FIGHTERS

NORTH AMERICAN SINGLE LINE SPORT KITES
THE NFKA JOURNAL 2000 PROJECT



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A Special Limited Edition Anthology published by the Northwest Fighter Kite Association

Special Projects Division

Mad Mary, Special Projects Coordinator Bruce Lambert, Assistant to Mary Dennis Crowley, Assistant to Bruce

On a wet and cold Saturday in December of 1997, 8 fighter kite enthusiasts got together in Tacoma, Washington to find a way of expanding the interest in fighter kites. We thought forming a Fighter Kite Specific kite club may be a good vehicle. Hence the Northwest Fighter Kite Association, NFKA. The mission of NFKA is the following: Encourage people to become involved with fighter kiting, through flying fighters, kite festivals, workshops, web site and email. Fly fighter kites more often, because it is sooo much fun! Share information among members and other fighter kite enthusiasts about flying, building and designing fighter kites. As the membership grew (at this time there are about 60 members) so did the communication among members about all aspects of fighter kiting. It became obvious we had a wealth of fighter kite information about an aspect of fighter kiting not much has been written about, the North American style of fighter kiting.

North American fighter kiting is different from fighter kiting in all other parts of the world.



Sometimes flying close quarter combat requires extra environmental precautions, Here Dennis prepares to fight Jeff mano-mano. Westport, 1998

Here we play many fighter kite games including line touch combat. We don't use cutting line. However, in virtually all other parts of the world, cutting line is synonymous with fighter kite flying.

As North American fighter kite games became more innovative and more competitive, it stimulated innovation and changes in the designs of the kites. In fact the kite designs are evolving and improving every year. Consequently, as you

may expect, quite often the kite employing the latest design innovation(s) emerges as the winning kite in the various competitions.

One day, a few of NFKA members were discussing their individual beginnings in fighter kiting with each other. We concluded how wonderful it would have been for each of us to have one book with virtually all the information we needed to successfully learn about the North American way of flying, competing, building and designing fighter kites. The birth of this book.

This book is a collection of fighter kite related knowledge, observations, ideas, plans and experiences of NFKA members and other fighter kite enthusiasts. NFKA is extremely fortunate that the contributors have been willing to share with the rest of us. None of the people involved with this project have received a penny for their efforts or for the information they contributed. It is strictly a volunteer effort. Northwest Fighter Kite Association sincerely thanks each person who gave so generously of their time and effort to share their knowledge and experiences in this book!

Many North American fighter kites are built by the flyers themselves. So, the mainstream kite enthusiast is not often exposed to high performance or competition style North American fighter kites. As a result they also never become exposed to the North American style of fighter kiting. NFKA is hoping this book will further encourage others to become fighter kite enthusiasts.

If the information contained in this book stimulates your interest in fighter kites, NFKA will feel this project is a success. However, if it gets you off your butt and into the flying field with a fighter kite on the end of your flying line and a big grin pasted to your face, YOU too will know this book is a success!

Welcome to the North American fighter kite world!

A STATEMENT TO ALL THOSE WHO CHOOSE TO COMPETE WITH US ON THE KITE FIGHTING FIELD.

When we compete, we each have the right to expect our opponent to be of the highest spirit, ability and integrity. It is the honorable way. We believe how we compete is a vital and clear definition of who we are.

AFFFELDS F

Flying in the third dimension is what sets flying fighter kites apart from flying most other kites. Perhaps it is also why our attitude is slightly different.

Added to the side-side/up-down flight patterns of multi-lined sport kites, the third dimension in flying fighter kites is the ever-changing distance between the flyer and the kite. This third dimensional element requires the flyer's constant attention and total concentration. Often frentic, sometimes chaotic and always exciting, it tends to make fighter kite flyers a bit more off-center than most other kiters.

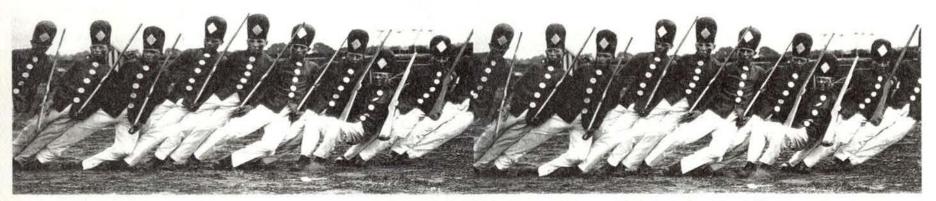
We have our share of heretics, geniuses, mavericks, anarchists just like other organized groups. The difference is that we fully honor and encourage their contrubution to keeping us awake, alive and a whole lot of fun to play with.

Playing on the edge of three dimensional space. We like it this way.

Just thought we'd let you know.

The contents of this book are not organized into convenient little pigeon holes. "Geez, the darn pages aren't even numbered." is a criticism we are willing to receive. We did not include a decoder ring. This is neither a "HOW TO" nor a coffee-table book. We wish this book be read as an anthology; as individual, often serendipitous, unedited presentations of exploration, philosophies, prejudices and errant thought covering many of the elements of flying and building fighter kites. As such, we have not enhanced the photographs and illustrations very much in an effort to make them look "prettier" nor have we seriously edited the text to be "proper English." We have chosen to be very low-tech in production and extremely high-tech with information. Although navigating this book may be challenging to more linear readers, we believe that learning about fighters is 90% unstructured experimentation...and flying fighters is 90% chaos. We hope this book provides the reader just such an adventurous experience. We know it's not much, but if it helps, here is a photograph and a list of contributors.

We sincerely hope you enjoy your journey.



NFKA's brave and hardy contributers to this anthology pictured I to r: Gary Goodenough, Andy Selzer, Steve Bateman, Jeff MacInnis, Chuck Lund, Mike Coons, Allen Stroh, Ed Alden, Brian Johnsen, Bruce Jarvie, Nelson Borelli, Neil Smedley, David Gomberg, Charlie M'Clary, Tom Humphery, Peter Stauffer, Randy Shannon, Gordon Schmidt, David Jam, Mad Mary Jot shown: Dennis Crowley and Bruce Labert who were too busy fighting kites to bother with such silliness. Ludo Petit, Karine Boitrelle, Philippe Gallot and Francois Gonnet stayed safely in France.



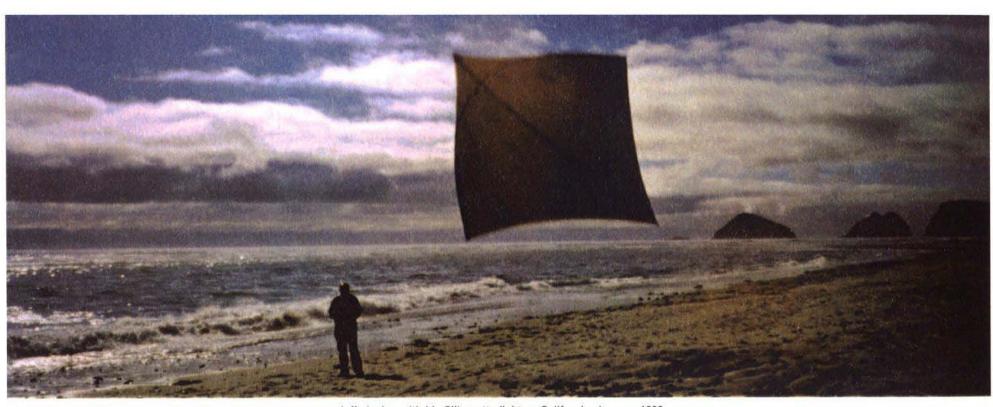


NFKA's Special Projects Coordinator, Mad Mary

Pssssst...

Feel free to copy any of the plans to make yourself a kite. But please do not use the plans to make kites commercially without getting written permission from the author of the plan. The plans are personal intellectual copyrighted property. To our knowledge, none of the contributors in this book are professional writers. They are fighter kite enthusiasts sharing aspects of fighter kiting they feel will be beneficial to anyone having an interest in flying these amazing little flying machines. This collection of ideas and experiences includes each person's unedited contribution. If you have an interest in discussing any fighter kite issue with any of the contributors, you can reach them via email. Their email addresses are listed on the NFKA web site at http://www.eskimo.com/-johnsen/nfka/index.html on he world wide web. Each of the chapters in this book represent the contribution(s) from the person whose name is the name of the chapter. A particular topic may be discussed by more than one contributor. In fact, in such a case, you may find inconsistencies and/or contradictions between different contributors about a particular issue. Each author has a different experience and a different point of view. Rarely does one's experiences or experimental ideas define the only "right and correct" way of looking at an issue or topic. This new sport is defining itself constantly. This is a work in progress. Everything we think we know could be very wrong or very easily change tomorrow...So we hope you can use the information contained in this book as a launching pad for your own exploration into the fun and exciting world of fighter kiting.

THANKS.



Jeff playing with his Silhouette fighter. California, January 1998

I once attended a "belt test" where Sanucas Go-Juru karate students vied for advancement to black belt. The rites of passage were delivered to the survivors in a ceremony and short speech by the She-Han. His parting words [to me at the time] were quite unexpected...

"TODAY YOU ARE BEGINNERS."

You do not need to have advanced skills to have fun flying fighter kites.

It's truly a blast at any level. I started out flying on my own for a year or more because I enjoyed it. Admittedly there were times when it became a little boring. One day a gentleman approached me in the park as I was flying and said: "Fighter kite, huh?" It took me off guard because he was the first person I had encountered who knew what a fighter kite was.

He explained that he at one time worked in a kite shop on the California coast. Adding that the owner of the shop was quite skilled with a fighter kite. He went on: "Yeah, my boss could draw geometric patterns in the sky like squares, triangles, circles, spirals, figure eights stuff like that.

He would do spins on one side, zip the kite all the way over to the other side and do some more spins. All within a foot 'er so off the ground." Boy! Can you say paradigm shift? I often fly at the very spot where I met the gentleman that used to work in the kite shop. Haven't seen him since.

If I ever do I'll be sure to thank him.

His related experience opened up new horizons for me.

Jeff returning home from NFKA fly at Westport, July 1999

FOR BETTER OR WORSE, THOSE HORIZONS ARE STREWN WITH TRASHED KITES.

[See sections on kite construction.]

When you push the performance envelope you crash a lot. You cut your fingers and kite eating trees appear from nowhere.

On one occasion I came up across a gang of prepubescent suburban bikers that peddled off to bigger and better crimes dragging a much cherished kite behind them. "Bummer'." You haven't lived until a bamboo and paper kite that took five hours to make becomes marked territory

by an untethered canine. "Oh it's O.K. he's friendly." If you ever become National Champion I can just about flat guarantee ya you won't appear on the "CNN-PLAY OF THE DAY" or get signed to a "NIKE" contract. No one really cares. No one except the fraternity of kiting elite like us that have been bitten by the bug. I sincerely hope the bite you have received becomes infectious. So, read on and may the Blue Skinned Gods smile upon you.



NFKA's first President - King Brian the Brave all dressed up for the big award ceremony. Fort Vancouver, June 1999

It is interesting to note that in discussions and articles about "traditional" fighter kites & "traditional" fighter kiting, North American kites are rarely included. We suppose that is saying fighter kiting is not considered a North American "tradition".

THE TRUTH IS, the so-called traditional way of flying fighter kites in the rest of the world simply does not apply to the way we fly them in North America.

Length of flying line during a "competition" is one of the primary differences.

In North America, the line length is usually shorter than 300′ – often less than 50′. Compared to fighting at 1,000′ to 6,000′ in the rest of the world, Part of the reason for this shorter line use is the fact that North Americans don't cut each other's flying line during a competition. Instead we TOUCH the opponents line with our own.

This is traditional in many of our indigenous people's ancient warrior system of "touching" the enemy rather than killing him...many believed touching an opponent from up close honors both warriors more than one killing the other from afar. North American kite fighting is also up close and personal.

In order to see if we have touched or been touched, we must fly close enough to see what is going on. And to untangle a possible line wreck.

When the length of the flying line is reduced, the flying range becomes an entire hemisphere. The flyer at the center, the ground the only limit below. Compared with long flying lines that limit flying within a narrow range either side of direct down wind.

Additionally, when a kite is only pulling 100' of flying line through the air, its forward speed is greatly increased and so is its maneuverability. Long lengths of flying line being pulled through the air by the kite, act like both a brake and a stabilizing tail to the kite, minimizing its speed & mobility.

Much of the time in shortline line touch competitions, the points are decided at or beyond the extreme edges of the wind window. Often reaching behind the flyers and in some cases flying a full 360* to win a point.

Since the shorter line allows for a complete hemisphere of flying range, kites to take advantage of this extended range needed to be created. And as it is with most sports, once one advancement is made, it simply spurs the creative juices of others to surpass it. And the result is a new kite for a new purpose.

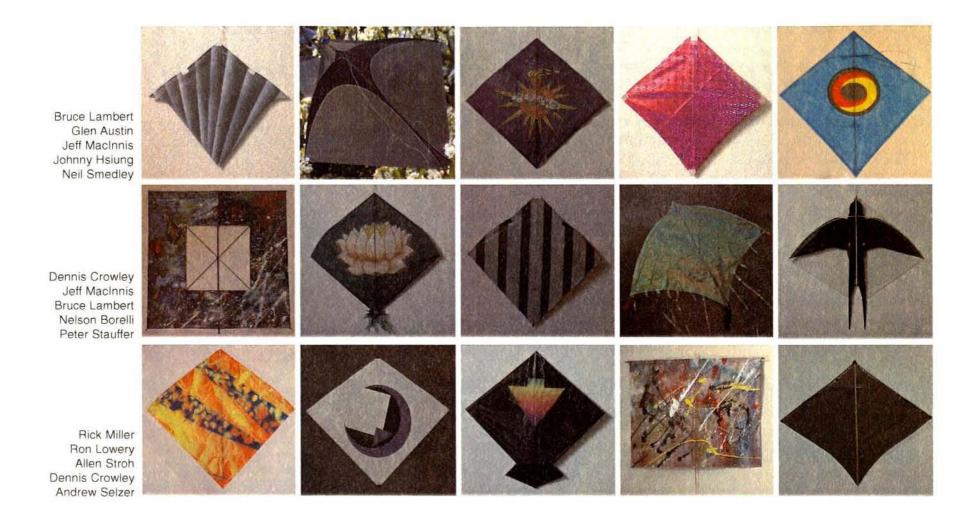


This book is about these kites and this style of flying.



CERF-VOLANTS TRADITIONNELS De Combat

PHOTOGRAPHS COURTESY OF LUDO PETIT & KARINE BOITRELLE and our compatriots - The Knights of the Manjha. Manjha club international



NORTH AMERICAN FIGHTER KITES FOR SHORT LINE COMPETITION

A SAMPLING

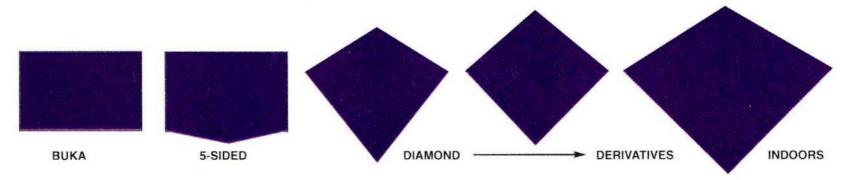
General description of fighter kite varieties used for short line flying.

Of the group of kites called fighter kites, there are many different shapes and styles. All have unique qualities that make them very desirable for short line ballet, precision, combat or just a great time.

BUKAS AND 5-SIDED:

A buka is a rectangular and/or trapezoidal shaped kite, originally from Japan. The leading edge is the long edge. A typical buka is about 16" wide by 11" high. It has a tension line on the back of the leading edge spar to provide the leading edge bowed-shape. These kites are fast and have an unusual spin that sort of allows the kite to roll and turn at the same time. They can "float" for long periods of time. Another aspect of a buka's flight characteristics is it seldom self launches after a grounding.

Five sided kites are variations of a buka. They fly and behave very much like a buka. The difference is they have a tail section that looks more like a diamond derivative tail, otherwise they essentially look like a buka.



DIAMOND DERIVATIVE:

Of the fighter kites used in the USA, the most popular shape is a diamond shape. Some are wider than tall, others very tall compared to the width of the wingtips. They are seen in virtually all sizes.

INDOOR KITES:

Flying fighter kites indoors offers lots of new possibilities! An indoor fighter kite has a fairly "soft" feel to it when you press on its face to imiate the wind. When flying, it looks like it "flaps" its wings! This "flapping" action is very helpful in propelling the kite when there is no wind!

Line Touch Rules

General description: Pairs of fliers compete in matches to see who can be the first to touch an opponent's line from either above or below. Winners advance to compete with winners of other matches until an overall winner emerges.

Governing 1999 Northwest Fighter Kite Association Sponsored Competitions

Rules, Guidelines and Definitions exist to promote a sense of fair play for the sport of competitive fighter kiting. It is our wish participants conduct themselves as ladies and gentlemen and that by example;

HONOR, INTEGRITY AND COMMON COURTESY BE THE STANDARD.

RULES

- Contestants must adhere to predetermined "pilot area" rulings and guidelines established for the event.
- 2. Grounding of kites is not allowed.
- 3. Kite adjustments are not allowed after initial contest launch.
- All points stand regardless of kite or line damage.
- 5. Contestants are not allowed to call time out during a tangle.
- Cutting line and/or devices such as manjha and kevlar are not allowed.

Please see the NFKA section at the back of this book for a restatement of these competition rules followed by supporting orgnizational Guidelines and terminology Definitions.



One of our many very friendly and willing, but quite crazy and blind, Head Judges ready for hard duty. Motel 6, Ocean Shores, 1998

FLYE STATES

A STATEMENT TO ALL THOSE WHO CHOOSE TO COMPETE WITH US ON THE KITE FIGHTING FIELD.

When we compete, we each have the right to expect our opponent to be of the highest spirit, ability and integrity. It is the honorable way. We believe how we compete is a vital and clear definition of who we are.

A Spectator's Guide to Short Line **Fighter Kite Competition**

You heard from a friend that a fighter kite competition was being held at a nearby park and you go to check it out. As you looked around the park you didn't notice any "real" kites anywhere, just quite a few little ones darting around.

Welcome!

You just saw fighter kites. They are small very maneuverable kites. No colorful tails streaming behind and not very fancy. In fact they are guite simple looking kites. Even the flying line is simple, thread-like.

How does the flyer control the kite?

The pilot or flyer controls the kite by pulling in his flying line hand over hand, dropping it on the ground all around him and by releasing the flying line and allowing the kite to take as much line as it needs. This pulling and releasing the flying line is what allows the pilot to control the precise movements of the kite.

When the flyer wants his kite to move in a straight path, you will see him pulling in line hand over hand. When the pilot wants his kite to change directions, spin, or hover, he will let out or release his flying line.

A combination of timing, sensitivity to the kite's behavior, recognizing the slightest changes in wind conditions and patience are the elements that make a good fighter kite flyer.

Competitions

There are many different forms of fighter kite competitions. All of the competitions have one thing in common. They are tests of the competitors' fighter kite flying skill!

The most common form of competition is called "line touch combat". It is just what the name implies, competitors try to touch each other's kite flying line.

Line touch combat competition is a head to head, one on one, competition. Two flyers or pilots, position themselves about 20 feet apart or so. The judge is usually in between the pilots calling the "points" and "starts".

The object of line touch combat is quite simple. Before the beginning of each point, the judge calls "over/ top" or "bottom/ under". This describes to the pilots how that particular point will be earned.

For example, if the judge says this point is an "over" point, this means the first pilot who can maneuver his kite's flying line to touch his opponent's flying line from on top of his opponent's fly-

The "under" point is just the opposite. The pilots "battle" to maneuver their kites so their flying line is the first to touch their opponent's flying line on the underneath part of the opponent's fly-

ing line. If one of the pilot's kite hits the ground that pilot looses that point.

A match between two pilots is usually consists of either 2 out of 3 or 3 out of 5 points.

Other typical fighter kite competitions are tests of flying skill against the clock.

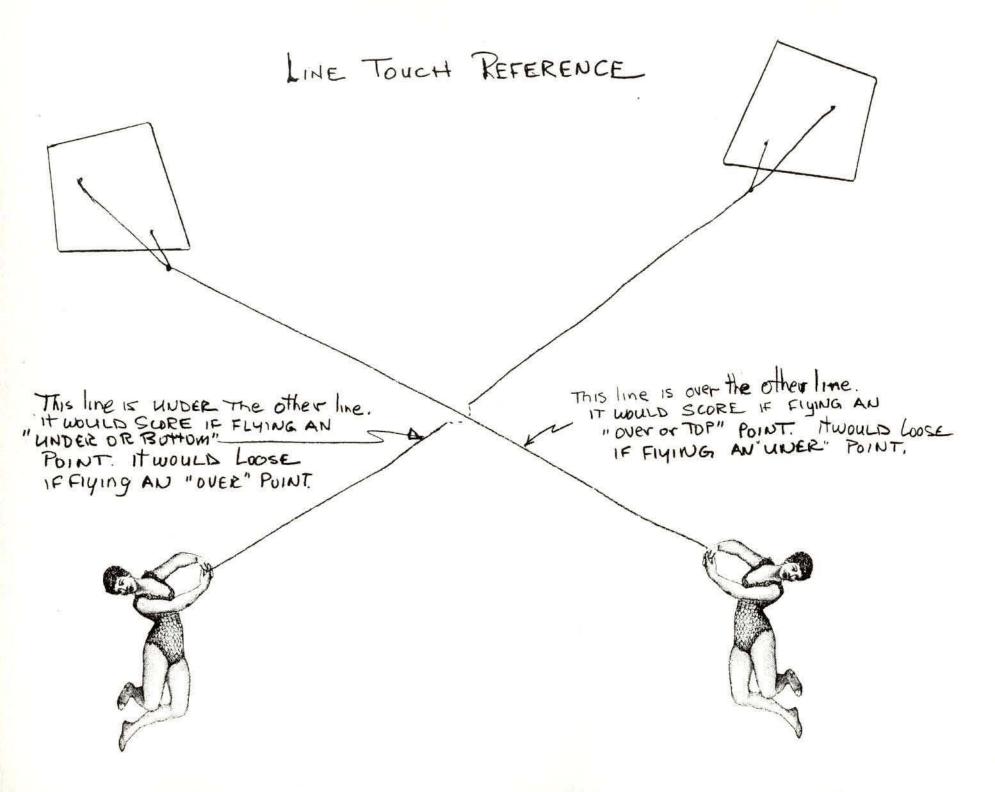
For example, a 100' away from the contestant, a 5' high pole will be placed. The pole will have a plastic cup upside down on top of it. The object is for the contestants to fly their kites in such a way as to knock the cup off the pole. One contestant flies at a time. Each contestant is timed, fastest time wins.

Another is to fly a kite through a 4' or 5' diameter hoop placed about 100' away from the contestant. The contestant who does it in the shortest time wins. There are countless other similar tests that could be used at any given event.

How do I learn more about these amazing kites?

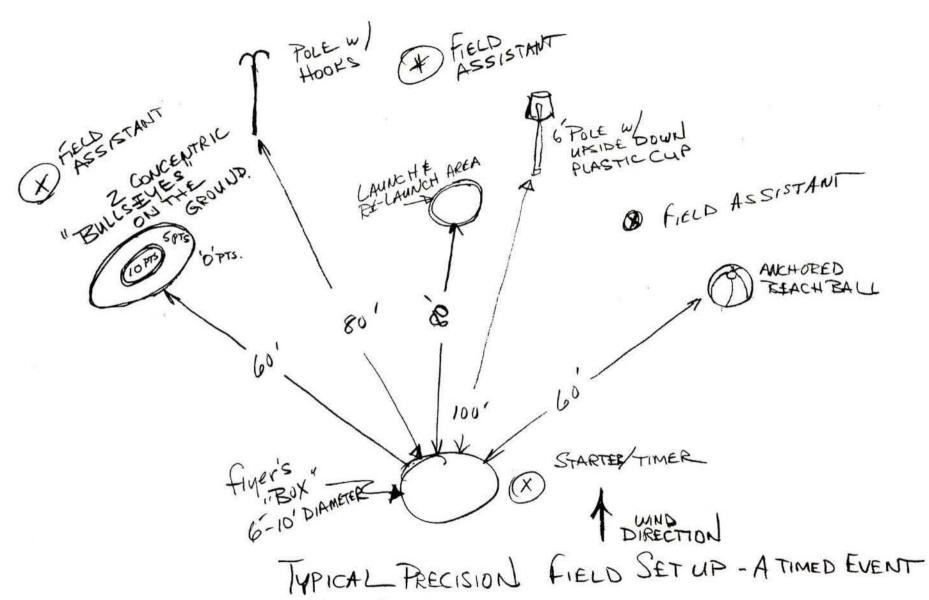
While you are watching the competitions, ask the flyers about the kites, how they work etc. Most fighter kite flyers I have met are very willing to share their experiences and knowledge with anyone who is sincerely interested!





FIELD ASSISTANT FOR PELAUNCHING

GROUNDED RITES, IS 200; 400 IS IDEAL LINE TOUCH LINE TOUCH SPOTTER "FLYERS" JUDGE/STARTER Score KEEPER 6-10 DIAMETER AREA WIND LINE TOUCH DIRECTION COMPETITION FIELD SET UP



OBJECT-with Kite and/or Kite Line:
A-TOUCH BALL, B-KNOCK CUP Of POLE, C-COTCH LINE IN HOOK
AND Fly out, D-LAND in CENTER OF BULLSEYE.

NOW FOR THE REAL MEATY PARTS. OF THIS BOOK.

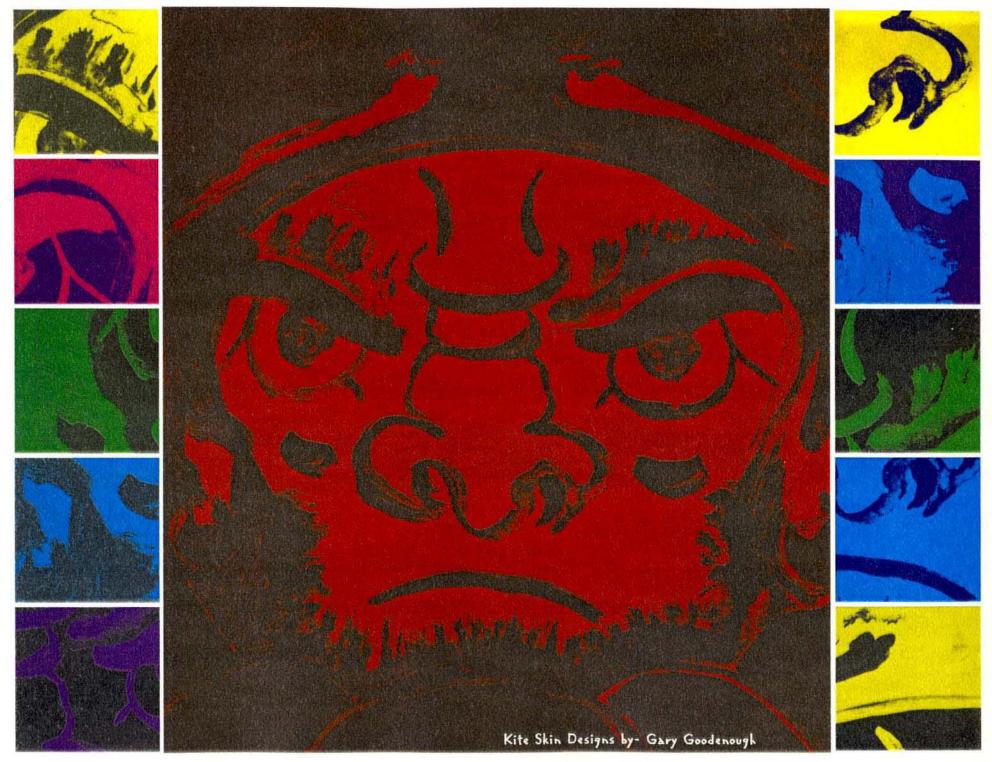
GODENOUGH

October 30, 1998, 75, sunny, wind 10k west ...

A beautiful day was yesterday! As I carved the sky with my fighter I fancied that the sail of the kite was slowing the Earth's motion-or perhaps it was just speeding it up. I also envisioned that the connection of line that i shared with the higher realm would transmit my desire for world peace throughout the atmosphere. My prayer for world peace would transmute itself from cork screws, figure eights, and roaring accelerations into a tangible force that once velocity abated would fall to Earth in a wind song. It would be accompanied by the sounds of Autumn leaves rattling and the tinkle and chime of wind bells,

Such are my thoughts about the wind.

- Gary Goodenough





If you're new to fighters,

palm of his hand. Wind pressure will keep it there. When you're ready pull the kite off the hand, keep pressure on the sail by pulling in line with an overhand motion. The kite should go straight up. Once the kite is in a vertical position, to initiate a turn, relax pressure on the sail by moving your hand forward quickly. If its windy you'll need to let some line slip thru your hand. The kite will spin, when the nose is pointing where you want. Put pressure on the sail again and keep it there; by overhand pulling in of line if necessary.

That is the basic idea of fighter kite flying.

FIGHTER KITE FLYING TECHNIQUES

Now that we've covered the basic idea of flying fighters, we need to cover a basic improvement most of us can make. Most of us stand facing the kite while flying as if facing a mirror. According to Mr. Gareau, we should be facing the kite on a diagonal. By putting your right foot forward if you're right handed. Now when you pull in line you're able to pull in 2 or 3 feet smoothly and quickly. Also as you're dumping line on the ground with your left hand, try to flick it away from you with a outward flip/twist of the wrist. Try it, it works. This method of standing and facing the kite on a diagonal is one of the most important improvements you can learn. For most of fighter kite flying is how fast you can get yourself into and out of trouble.

Next, what should you be practicing whilst flying. Try flying to points in the sky. Pick a cloud or a tree. The idea behind this is control of the kite; so that while in competition you'll be able to fly over or under your opponent. Also you can practice flying in and out of the wind window in a V form; trying to duplicate your angles in and out of the V. Finally, you need to learn to put the kite into a spin, and be able to control that spin.

Work or Play, You and your Fighter

Where I usually fly at is a little recreation park for the housing development I live in. It's pear shaped, facing south to north, with a basketball court, playground equipment and a ball field. I'm usually in shallow left field flying my fighter. Of course it's surrounded by houses and trees. So the wind down low stinks. It's full of pockets and turbulence, if there at all. But on a windy day, typically a westerly wind, there's a decent enough breeze down by first base. Trying to paste the kite on the fence or off on the right field foul pole. As noted in earlier articles, this is where you use your spin technique. To advance further, I've been working on gaining ground horizontally with every spin. Just four or five feet with each loop. With a slow loop and control of the spin. Make the kite fly left or right off the bottom of the turn, working your way in on the intended object. Being able to get within one arm pull of your opponent and then striking, works very well indeed.

The other week I got kinda lucky and had a south breeze blowing right up the center of the park. Off to the left of the

field is a thirty foot pine tree with a big gap in the branches, sorta like a big C. Well with a nice 5 to 8 mph. breeze, it was one of the best times I've had playing with the kite. Just rolling/spinning in and out of the gap in the branches. Also pasting on the right field foul pole. And with the wind blowing straight up the park, working the spin move, left to right and back, between the pole and the tree. This was at a distance of about 150'.

Also, I like trying to get in a large square. As a nice variation, and often necessary, is one with loops at the corners. In sport kiting, there's a maneuver called the rug. If you look at the end of a roll of carpet, it's a set of concentric rings. You can fly the by making the loops bigger or smaller. Now, with a fighter, this maneuver is practically impossible to do perfectly. So, if you pull it off, you better have the video camera rolling.

Enough of all this work. It's summer time, go out and play. Enjoy the warm air and breezes. And perhaps the company of another fighter pilot. And remember to keep those kites dancing in the wind.

THE FIGHTER AND THE SPIN

Now its time to discuss the more advance technique of the spin. First, though, it must be remembered, that a fighter is unstable and spins when there is no pressure on the bow. Which brings up the second point. The higher the wind speed, the harder it will be to induce a controlled spin. Assuming a light wind of 5 mph., diving the kite close to the ground; a quick movement of the arm forward, should snap the kite back upwards. This quick release of tension on the line should stall the kite in a upright position. If stalled, the kite should start to spin. I remember when I first attempted this maneuver. It took a double pump of the arm to get into a spin. The first to stall it; the second to spin it. Now that its spinning, your going to have to feed line thru your fingers to offset the pressure of the wind on the sail. Less pressure, a bigger and slower loop by the kite. If its too windy, you'll need to go to the edge of the wind window to induce your spin. After awhile you'll get this move down to a single movement of the arm. And when the wind's right, a continuous spin, by pumping your arm. As the kite rotates downward, relax tension on the kite, by moving your arm forward. As the nose of the kite passes the 6 o'clock position, pull your arm back, bringing the kite back to a vertical position. Repeating this timed pumping motion keeps the kite spinning.

Now that you can control a spin, you need to learn how to use it in competition. On bottom touches it is very useful as a delaying tacit. It keeps your kite low, creating opportunities to get under your opponent. Next to get a level pass off of the spin.

You'll need to pay attention to the direction of rotation. When you want to pull out of the spin, do so from the bottom. The kite should fly out in a straight pass. If you try to pull out of the spin from the top, the kite usually over rotates straight into the ground. So, if you're on the left side of the wind window, you'll need a counter clockwise spin to go right. And a clockwise spin from the right side to go left.

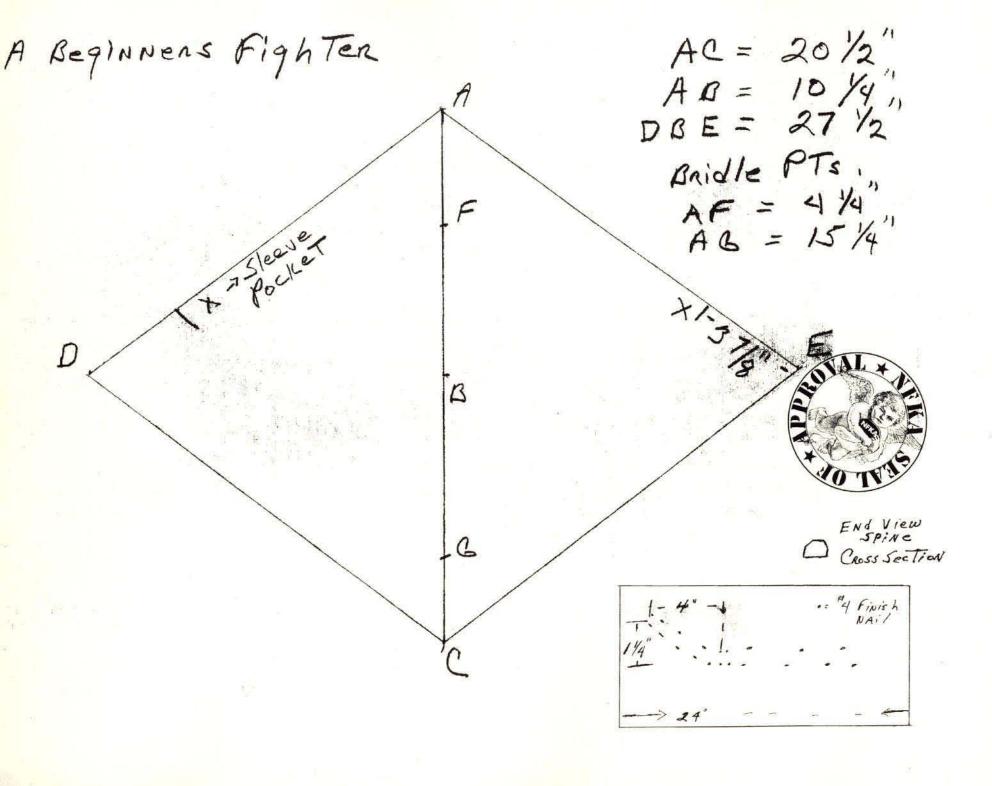
For a little fun with the spin, try pasting your kite against a light pole, fence post, or tree trunk. If your feeling gutsy (brave,) try picking a large opening, or space, in the tree branches. Rotate the kite into and out of the opening. Good luck; remember trees are our friends. What all this pasting and playing with trees does is sharpen your depth of field, making it possible to know how far your kite is away from you. Also, you should take notice of the amount of time it takes to close in on a object. In light winds, the number of arm pulls on the line to close in on a object. In a fight, having all this knowledge at your disposable, is indispensible.

Now you can see where all your practice comes into play. And, remember, when you see Mr. Richard Gareau, thank him for sharing his knowledge freely with all of us. For most of these articles ideas are inspired from his lectures this year at the Maryland Kite Retreat. Thank you, Richard.

A BEGINNER'S FIGHTER

Spine Material 3 /16"x3/8"x24" spruce or basswood...Sail Material 1/2yd of 1/2oz ripstop nylon or polyester 1 1/2"x 12" 1.5oz ripstop for pockets...Bow Material 2 - .080 graphite rods at 48" long & 4 end caps...Adhesive 3m 9460pc double sided tape or light spray adhesive...36" Line 20lb. Test braided line, cotton or nylon

- 1. MAKING SPINES: Usually the local modeling hobby store is a good source for the spine material. As noted spruce or basswood will do. In selecting the spruce, the tighter the grain the stiffer the spine. If stock is larger than above dimension, it will have to be trimmed at this time. Actual finished width dimension is light of 3/8" mark. A suitable container for soaking the wood is next. A 1 lb. coffee can will do; fill with hot water and put on medium heat. Keep it hot do not boil. It will take between 1 to 2 hrs. to soften the wood. When ready it should bend easily. Next the jig, using scrap lumber and finishing nails, make an offset of 11/4" with the bend beginning at 4". Allow to dry for 2 to 3 days. If available, finish sand with a belt or disc sander. Bring to final dimensions, also at this time sand a bevel on the top side of the spine. This is the side away from the fabric. To keep moisture away from the wood; spray coat with lacquer or polyurethane. Two coats works best. Because of labor involved I like to do this with multiple spines. Usually five or six at a time.
- 2. SAIL ASSEMBLY: Layout pattern for sail to dimensions as shown; hem allowances are included. I prefer to use a patternboard type of material, you can do either a full or half pattern. Hot cut the sail with a soldering iron or other suitable instrument. Next on back of sail, use ruler and make hash marks in at _" every three inches or so; also at this time mark for the sleeve pockets at 3&7/8". Now fold sail in half and make a center crease. Next mark the bridle points as noted. Fold edges of sail back to the 1/2" mark, creating a 1/4" hem. At this time the pocket material needs to be created. Cut two at 5/8" x 1 1/2", two at 1" x 1 3/8", two at 3/4" x 1", and one at 1 1/4" x 1 1/2". The 1 3/8" are the sleeve pockets and the 1" are the bow tip pockets. Take and fold pockets in half, now is when you should put on the 9460 pc tape pieces. A small piece will do, affix the bow and sleeve pockets to the edge of the sail at this time, under the 1/4" material. Now starting at the top, sew all the way around the kite. Back stitch over pocket materials and at outside corners of bow pockets; making sure loose end of pocket material stays in place, when being sewn. Next sew the sleeve pockets at the crease of pocket material; to affix it to the sail. At six stitches down from the spine side create a small J pocket, two by three stitches. This will hold the secondary bow. Spine pockets are next; fold the 1 1/2" material at 1/2" from end, creating pocket for spine. Center on sail at top and bottom of crease making sure they are straight and centered. Sew in place. Lastly, is the 1 1/4" x 1 1/2" center bow sleeve. Affix to sail just above the four inch bridle point, centering along the crease. Also, make an additional stitch line at 3/4" mark of sleeve making two parts. The bottom half for secondary bow.



- **3. SPINE:** You are now ready for the spine. Cut the tip of spine on a diagonal, the distance from the tip should place the curve of the bow at the top bridle point. Insert the spine in the top pocket, stretch sail tight until folds appear in sail; and mark the spine at just below the bottom pocket. Now cut the spine on the bottom mark also on a diagonal. Sand sharp tips lightly. With an extra pair of thumbs or hand clamp; hold bottom of sail on edge of table. Insert top of spine in pocket, with both hands; gently and slowly, bend spine just enough to allow you to insert it into bottom pocket. It may help to open the bottom pocket some before attempting this. Also make overlap of bottom pocket just enough to hold spine. Take one of the .08 graphite rods and slide it under the spine and through the sleeve. Insert into the tip pocket; next stretch sail at other pocket and mark bow at end of sail with thumb and forefinger. Cut bow with hacksaw or pruning shears. Install end caps, slide bow into all pockets. It should fit the center sleeve at the 4" bridle mark. Next, take the other rod and make the secondary bow. The distance between bows should be about 1/2".
- **4. BRIDLE:** Turn kite over on face and with large needle go through sail at top bridle point. Make sure it is close to top of bow, right next to it, and around spine. Pull line through and go to bottom bridle point, and go through sail and around spine. Tie off bottom bridle point securely with several overhand knots. Next, pull enough line out to go just past one of the wing tips; now tie off the top bridle point. Trim excess and secure knots with superglue. Tow point is determined by taking bridle to wing tip and sliding fingers to a point about 1 to 1 1/2" above the tip. This should be a good starting point. Using a small loop, larks head it on at this point, or if you prefer a small split ring from the fishing tackle shop.

WELL, YOU'VE DONE IT, now go and enjoy your new fighter. It should provide you with many hours of enjoyment. Use of secondary bow is recommended when you are more experienced and or in higher than 7mph winds.

And remember, keep those kites dancin' in the wind.



WOW, FIGHTER KITES. I NEVER THOUGHT THAT \$15 GA FIGHTER I BOUGHT AT WINDBORNE WOULD OPEN UP ANOTHER WORLD OF KITES FOR ME. BUT NOW IT...

encompasses most of my kite time.

I've been making fighters for a couple of years now, and the design has pretty much stayed the same. Plastic sail, wood or bamboo/reed spine, and graphite bow. I've never finished a fabric fighter; it just never seems as easy as a plastic one and gets put aside. Plastic ones seem to be faster in the sky. I like fast, straight tracking fighters.

This is written so that someone who is just getting started in fighters can expand his/her knowledge of how some people are making fighters, and what goes into designing one. It is not intended to explain everything there is; it is assumed that the reader will fill in any holes with the other contributions in this book.

THE SKIN

There are numerous plastics to make the skin out of; I'm constantly in search of and finding new ones. The weight of the plastic is very important; for the past year, instead of experimenting with different shapes, I've been experimenting with various placements of different weights of plastic on the kite. This distribution of material stiffness dramatically effects the way the kite flies. The following is a current (4/99) list of plastics I've used. All of these come in widths of about 24-30 inches, and can tear easily. None of these would correctly be called "Mylar", as Mylar is a brand name plastic that is very durable and comes in many different thicknesses.

Material	Relative weight	Nature of the material	Approx. Price	Where to get
Floral plastic	1-5	Clear, colored	\$9/100ft	Most floral supply stores
Prismatex	2-10	clear, prizmatic	See comments	Into the Wind
Prisim Bright	9	Clear, prizmatic	\$6.85/yd	Hang-em High Fabrics
Holiday envelopes	5	Colored, sliver backing	\$0.70-\$2 each	Gift wrap stores
Sparkles!	2	Sliver, prizmatic	\$1.50	Gift wrap stores
Translucent Lens	8	Clear, lens effect	\$21.00/yd	Plastic suppliers
Stumps plastic	7	Colored, prizmatic	\$40/50ft (w/ ship.)	Stumps
Holographic Laser Film	3	Silver, prizmatic	\$3.35/yd	Hang-em High Fabrics
Heat Transfer Ribbon	1	Colored	free	Trash

Floral plastic is the same stuff the florist uses to wrap the bottom of a bunch of flowers with. It is very cheap, comes in many different colors on long rolls. It has a good weight, but the kites come out with just a tad too much tension (ie: drum tight sails). It is a good material for experimenting with new designs.

Frisimetex comes in a very wide range of weights. I started with using the material from Prisimetex dragon kites sold in the kite stores. Into the Wind also sells 2 different weights; a heavy plastic version and a scrim reinforced version. I've seen samples of Prisimetex in many other different weights, mostly scrim reinforced versions that are used for wind-surfing salls and such. I haven't had much luck with making an entire kite out of the heavy plastic version. It's just to stiff, but it can be used in pieces on the kite (more on this later). Prisimatex is a neat material, giving flashes of brilliant

color when the sun is at the right angle. But if the angle isn't right, the material is clear which can make it difficult to see. The cost can be the cost of a dragon kite, up to about \$20 a yard for the scrim reinforced version. Frisim Bright is a heavy plastic with a rainbow glimmer to it; similar to an oil sheen on water. It is to heavy to make a fighter out of entirely, it too can be used in strategic places on the kite.

This past holiday season I found some large envelopes, used to stuff gifts in and such. These have turned into the best weight of plastic for fighter kites. The sail doesn't have that much tension, but the kite is still relatively quiet. They came in gold, red, and green. I picked up enough to last me a while, but I'm afraid I won't be able to find them again when I'm out.

When I first brought out a kite made out of Sparkles!, it was just dazzling. Charlie almost fell over it was so brillant. It

has the prizmatic effect of Frisimetex, but the silver backing enhances it 4 fold. Very light weight, I've mainly used it for light wind fighters.

The most recent addition of plastic is Translucent Lens. It is made by Coburn, a company that makes lots of different kinds of plastic (they probably make some of the other plastics discussed here). It has a lens effect, so when you look through it it looks similar to what a fly would see. Relatively heavy, it shouldn't be used for the entire kite

Stumps, a party supply store on the internet, sells 3 different colors of this plastic. The colored versions (blue and purple) are a tad heavier than the silver they sell. I bought a roll of blue and it looks fantastic in the sky. It is very sharp looking. It can be used for the entire kite, but the kite size should be relatively large to get good performance. What impressed me a lot with this material is its resistance to curl off the roll, making pattern placement easier.

Hang-em High Fabrics sells Holographic laser film which is good for fighters, though the holographic effect isn't as bright as other silver backed plastics. It has a good weight and is relatively cheap.

The first material I used was what I found at an old employer. They had a heat transfer printer, and would dispose of rolls of this plastic weekly. It is very light weight, tears very easily, and can be hard to tape. But it can be used to make a decent fighter.

There are two extremes in making the sail; a very flexible and light sail, and a very stiff and heavy sail. If it's flexible and light, it will be lighter and might fly well in very light winds (all other things being equal), but trailing edge rattle can destroy any speed you might get. The kite will track well as the sail will form around the spine, giving the kite a nice keel in the air. If the sail is heavy and stiff, the kite will have

incredible speed due to little or no trailing edge rattle. But with no forming around the spine, it will not track and will spin like a top out of control. This is more extreme than what happens when you use a bow spar that is too stiff.

I've also found out that the material around the nose should be flexible. I think this is due to the nose being the starting point of the kite turning; with out some give in the sail there, the kite just knife edges to much.

So lately I've been using the stiff materials on the trailing edge. This increases speed without compromising tracking ability. The exact amount of stiff material along the trailing edge I'm still experimenting with.

THE SPINE

I first started using wood dowels from the local hardware store. They worked ok, but aligning the bend of the spine when attaching it to the sail was difficult. I moved onto rectangular spruce, obtained from a local hobby store. Much better than dowels, aligning the bend was very easy. But I could not find a good way to keep the bend in the spine. I tried soaking the spine, heating the spine, letting the spine dry in a curved position, etc. The bend would still come out somewhat. Then I found Bamboo at a local import store (Pier 1 Imports). It feels similar to good bamboo, has no knots, is about 4 to 5 feet long, and is pre split in bundles of 40-50. The top 2 feet or so is curled for decoration, and a bundle is only \$10. So far I haven't found anything better. I do have to do some whittling to get the final shape, but the bend stays in the spine much better (bend over knee or forehead before flight like a traditional Indian fighter).

THE BOW SPAR

Most of my kites have a graphite bow spar. I've never used a fiberglass one. Graphite rods come in so many different sizes now, that there is bound to be one to fit the flight

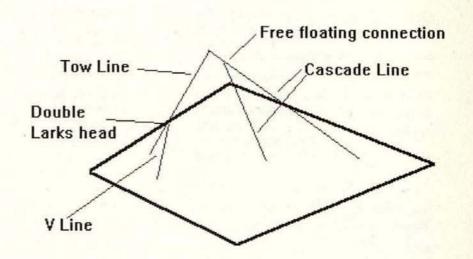
characteristics that you are looking for. I've used graphite rods in the range of 0.04" to 0.08", with most of my kites having 0.07" bow spars for a length of about 26.5". Occasionally I'll take a bow spar from a trashed Indian fighter, and make a kite out of it with a plastic sail. It works well, even without the triangular tails that the original kite had.

THE BRIDLE

The bridle is a very important part of the kite. Not only is the bridle used to set the angle of attack and tune the kite left and right, but it can be used to support the spine to provide straight-line tracking. I typically use a 4 point bridle, with 2 points on the bow spar set 2 inches apart (1 inch off the spine), and 2 points on the spine. Sometimes I put 3 points on the spine, sometimes even 4. The additional points on the spine keep it from deflecting under the wind, the same effect that using a heavier spine would do, but without adding significant weight to the kite. If the spine deflects, any irregularity in the bending of the spine will affect the kite by leaning the kite one way or the other. It is very annoying to have a kite that tracks well in light winds. but not in heavy winds. Heavy winds tend to bring out the slightest things that can cause the kite to not track straight, so it is better to tune kites in heavy winds. I use 20lb dacron for my bridles.

TUNING

If the kite leans to the left, move the point on the V line to the right in ever so slight increments (< 1mm), and vice versa. If the kite seems to turn to much, try lowering the bridle point on the tow line. If the kite doesn't turn enough, try raising the bridle point on the tow line. Weight can also be added to the tail to make the kite turn more, or added to the nose to make it turn less. I prefer to use a small piece of putty, the kind that is used to put up light posters on walls, It isn't wet or smelly, and it adheres nicely to the spine. I usually use a size of about 4mm cubed.



Some tools that I use to make a fighter kite: high quality packaging tape (clear, no scrim), soldiering iron, eraser guide, needle, scissors, Dremel (sanding and cutting wheel tips), metal ruler, ball point pen, Sharpie pen, seamstick double sided tape (1/4" wide), rubber end caps, poster board for patterns, glass to hot cut the plastic on, weights to hold the pattern down with, paraffin wax.

- Draw the kite out on poster board and cut out with scissors. Be very careful to cut very smooth, straight lines as you will be hot cutting along these edges. Any sudden cuts in the edge will end up on the kite, potentially being a weak spot for tearing.
- 2. On a glass surface, place the pattern on the material so that any curl is equalized across the kite. Weight it down to inhibit movement, and hotcut around the edges trying to go the same speed. Careful not to distort the tips of the pattern for further use.

CON STRUC TION

- 3. Draw a center line down the center of the kite with a ball point pen, where the spine will be.
- 4. Construct pockets on the tips for the bow spar using packaging tape. Try to not have any adhesive exposed, especially on the inside of the pocket. Press all edges of the tape down very well with your finger nail, to prevent sand and dirt from getting underneath the tape. If this is done well, the kite should survive occasional use at the beach unless it is dragged in the sand. Anticipate the direction of pull by the bow spar and place extra tape where you expect peeling to occur.
- 5. Cut and carve down the spine to size. Cut it a little short on the ends (2 mm or so) so that the skin will fold up along the side of the spine. Round the edges with sandpaper (or a Dremel). Practice bending the spine to see if it bends up or off to one side. If it bends off to one side, adjust by carving. Have the heavier end of the spine toward the tail, as this is best to allow the kite to cobra.
- 6. Tape the spine in place, starting with the nose. Cut a piece of packaging tape about 2.5 inches long, and 6 to 7 times as wide as the spine. Tape the spine in place by taping over the nose of the sail, and use the needle to press the tape into the corner of the spine/sail contact. Try to have all adhesive of the tape in contact with either the spine or the sail. Cut off the folded over corners that will

- extend out beyond the sail. When taping the tail, pull the sail taught a tiny bit along the spine.
- 7. Cut the bow spar so that it extends along the side of the kite a ways before it turns away from the edge. It shouldn't bow outside the sail, and it shouldn't bow completely inside the sail. Part of the spar should run along the edge. Use end caps on the ends.
- **8.** With the bow spar in the kite, tape the spine in two or three places using small strips of tape. Make sure the bow spar is centered along the centerline.
- 9. Fut a small dot on the sail along the bow spar 1 inch away from the spine with a Sharpie. Put a piece of tape here to reinforce what will be holes in the sail for the bridle. Hot cut, using the eraser guide, small vertical ovals here. Don't center vertically the ovals on the dots, but have them lower to allow for sail stretch and the angle the bridle makes with the kite.
- 10. Place small reinforcements along the spine on the front of the kite for the other two bridle points. I put the bottom point about 20-30% up from the tail, and the middle point halfway from the bottom point to the bow spar. On the backside of the kite, hotcut very small holes on either side of the spine in the middle of the reinforcements. If necessary

these holes can be made larger using a needle.

11. The bridle is mostly hit or miss, but most dimensions will work if you allow for it to be adjustable. The V line, the line that connects the two points on the bow spar, should be as small as possible. Too large, and adjustments along this line will dramatically affect the flight. But if it is too small, the two points might pull together and the knot might not stay put. If the points are 2 inches apart, I make the V line 6-7 inches long (total length). Tie small loops in the ends of this line. Wax the middle section of the line by melting wax on a lit desk lamp light bulb and running the line across the hot light bulb. Cut the very tip off of 2 end caps. Thread the small loops on the ends of the V line through the middle of the sidewall of the cut end cap using a needle, and then out through one end. Do this with the other end of the V line with another cut end cap. Remove the bow spar from the kite. Put one loop of the V line around the end of the bow spar and then put the cut end cap on. Wiggle and pull the V line so that the line sits in the middle of the end cap. It should look like heat-shrink tubing around the connection. From the back of the kite, run the other end of the V line through the holes going around the front and back out. Put the other end of the V line and cut end cap on the bow spar. Now slide the bridle points along the bow spar near the center and replace the end cap on the bow spar (that you needed to take off to get the cut end cap on). Replace the bow spar and center the bridle points in the holes. You can put a small drop of super glue to keep the cut end caps in place, but I only use it if I have problems with them moving.

- 12. The other two parts of the bridle should be sized with the size of the kite, so no dimensions are given here. The ratio of the cascade line and the tow line should be around 2.2:1 for the total length before they are on the kite. The cascade line has no knots until you tie it on the spine. The tow line has a one inch or so long loop at one end, and a very small loop at the other (< 0.5"). The large loop gets double-larks-headed around the middle of the V line, and the small loop has the cascade line run through it. The cascade line runs through that small loop after it is tied at one attachment point, and before the second attachment point. Use your choice of knots to attach the cascade line to the kite, but be sure to use a keeper knot on the end.
- **13.** Make a loop with a 0.5" tail for larks heading the flying line on the kite, and double-larks-head this loop onto the tow line. The tail on this loop will give you something to grab when untying the flying line.
- **14.** Tape the bow spar to the sail only where it runs along the edge of the sail. You can tape the entire length, or just tape it every inch or so. Use a needle to get the tape into the corner as best you can.

15. Practice bending the spine over you knee or head. I prefer the knee, as it allows me to see what's going on, and I don't leave a red mark on my head. It helps to hold the spine at the nose very firmly to keep it from rolling over in your hand.

LINE

I usually use the line Stafford Wallace imports from India. It has a nice smooth finish and is very light weight. It can easily be broken in you hands, which can be useful if you get wrapped up in someone else's nice single liner. It's much better to break your cheap line and let go than to bring down someone else's kite. I fly on asymmetrical hoop type reels that feed line off one side smoothly (Gator Yo-Yo spools). Since I fly with the line in my hands, these reels work well by letting line out while placed on the ground.

Cutting line is an option, but good cutting line can be hard to find. Making your own is an option, but very time consuming. The glass needs to be crushed very fine (face powder fine), and applying the glass/glue mixture to the line takes a while. I'm just getting experience in this, but I haven't had any luck yet.

FLYING

Practice doing ground passes. I feel that this alone has improved my flying ability tremendously. You will

get a feeling for what line tension does to the direction of travel, and how important it is for the kite to be balanced.

I try to use both hands equally when controlling the kite, but I tend to use one hand over the other. Having the dexterity to use your weaker hand comes in handy at times. I pull line in with both hands, toward my body. I've heard of other ways to pull line in, but this seems to work well for me.

THE FUTURE

I'm waiting for someone (or me when I have a good design) to come out with a fighter that will revolutionize fighters. Kinda like what the dart tail on a stunter did for 2 line kites. Something will pop-up in my head one of these days...

BRUCE LAMBERT

Bruce's Fighter Kite Flying Tips

1. Be sure you stand with your back to the wind.



BRUCE'S FIGHTER KITE FLYING TIPS...CONTINUED...

SLOW OR "TAME" THE FIGHTER KITE'S ERRATIC BEHAVIOR

Because of the unstable, erratic nature of fighter kites, if you are fairly new to fighter flying, slowing them may make it easier for you to have immediate success! The easiest method I know to do this is by adding a tail to the kite.

I use masking tape to temporarily tape a tail to the tail end of the kite's spine. The tail should be about 1" wide and about 4' - 6' long. It can be of crepe paper, survey tape or plastic bags cut in strips.

Once you have mastered the fighter kite with the attached tail, begin to reduce the length of the tail by about 1/2 its length each time you are ready for a livelier kite. Then, when you have removed the tail completely, you will already have a good idea of the kite's characteristics and will not be so surprised by its actions. This will keep you in better control of the kite! Fewer crashes!

FLYING A FIGHTER KITE

Launching

For a newcomer to fighter kites, launching is one of the more frustrating elements of flying fighters. Once you master launching, you are virtually "home free"!

Be sure you stand with your back to the wind!!

The launch technique that is the easiest is having a person help you by walking the kite down wind about 20'-30' or so, holding the kite with its nose pointed straight up and letting go when you apply tension to the flying line by pulling in the line. Hopefully at that moment, the nose of the kite was still pointed straight up so the kite would ascend! If not, it most

likely will crash, but don't worry, crashing is part of learning, even the most expert flyers crash. They just take it in stride. Remember, the worst thing that can happen in a crash is part of the kite may break and most of the time it is easily repaired.

More Advanced Launch

Hold the kite in the air, above your head but in front of you, kite nose up. Then, as you keep a very slight amount of tension on the flying line, release the kite and allow the wind to push it away from you, it will be pulling line through your fingers, so be sure to let the line go. Then, gently pull or tug on the flying line each time you notice the nose of the kite is pointed upward, and keep pulling line in until it has gained some altitude, release the flying line so the kite takes out more or the line. While the kite is moving away from you and spinning, notice when the nose of the kite is pointed upward. At that moment, tug or pull again on the line to gain more altitude and just repeat this pulling and releasing process until the kite is as far away from you and as high up as you want.

Two KEY points to remember about fighter kite flying:

- **1.** When the kite is in a nose dive headed for the ground, immediately release the flying line! Let the line run freely through your fingers!
- 2. After you have released the flying line and the kite is now more stable or spinning and moving away from you, begin retrieving or pulling in line ONLY when the nose of the kite is pointed up.

HOW DO YOU MAKE A FIGHTER KITE FLY IN A STRAIGHT PATH? HOW DO YOU GET IT TO CHANGE DIRECTIONS IN MID FLIGHT OR TO SPIN, ALL AT YOUR COMMAND AND IN YOUR CONTROL?

LETS START WITH THE BASIC CONCEPTS BEHIND THE FIGHTER KITE'S CONTROL.

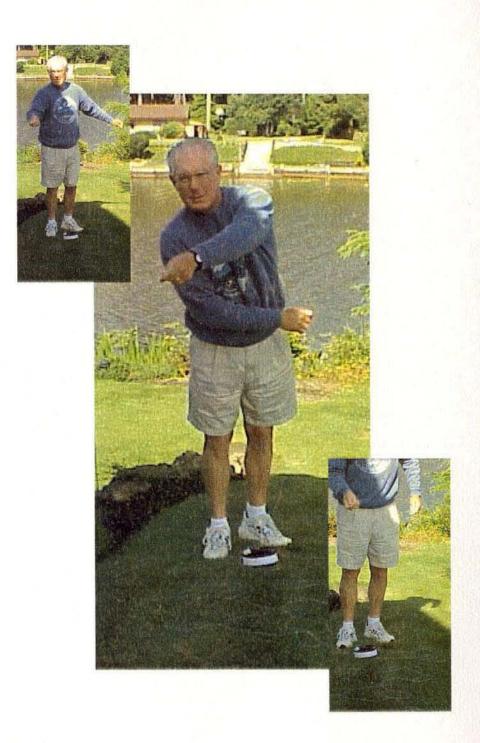
- **1.** Once you get the kite launched and in the air, you will notice that it will spin and fly in what appears to be an unpredictable manner and may even have a tendency to occasionally crash. Don't worry, this is normal until you get a feel for the way it responds to your control.
- 2. The way a fighter kite works is this. The direction the nose of the kite is pointing at the time you pull, tug or retrieve the flying line, is the direction in which the kite will travel. When fighter kite flyers are "pulling or tugging" on the flying line, they are almost always pulling line in, or retrieving line, hand over hand and dropping a "hand full" of flying line at a time on the ground. That is why the flying line ends up all over the ground around the flyer.
- **3.** As long as you continue to apply uniform and even tension by pulling in the flying line, the kite will continue on its straight path in the direction the nose of the kite is pointed. (This is assuming a properly tuned kite is what you are flying.)
- **4.** When you reduce or release the tension of the flying line and/or let the flying line be pulled through your hands by the kite, the kite will most likely be turning or spinning or at least change directions. Exactly what it does depends on the tuning of your kite and the precise tension on the flying line at that moment.

- **5.** When the kite is spinning or turning, watch the kite's nose. When the direction the nose is pointing is up, or the direction you want the kite to travel, apply line tension by pulling or retrieving the flying line and the kite will begin a straight path in that direction.
- **6.** The amount of tension you apply and how evenly or jerky you apply it, through pulling and releasing the flying line, are the only commands a fighter kite gets. Timing of the commands also plays a part in how the kite reacts.

FLYING LINE TIPS

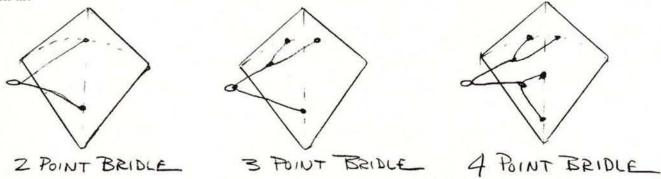
- **1.** Many flyers attach a snap swivel at the end of their flying line. This helps minimize the line twisting and makes it easy to attach your kite to the line. Other flyers prefer to attach the flying line directly to the kite's bridle using an easy to release knot.
- 2. After connecting the tow connection to the end of your flying line, place the flying line reel on the ground near your feet. From the reel in this position you pull line off of the reel to allow the kite to spin and to go farther away from you and when you pull line in or retrieve line, using a hand over hand pulling action, you simply drop it, one hand full at a time, and let it fall naturally on the ground.
- **3.** Sometimes, the wind may blow the loose line around on the ground and cause the line to get tangled and twisted. That is a normal part of fighter flying and is easy to deal with! Just break the line at the tangle, break the line again to remove the tangle, tie a knot to reconnect the 2 ends of the line and get back to flying!

- **4.** After flying for some time, your line will end up with lots of knots where you have broken and retied your line. If you want to get rid of those knots, just spool off all the line with knots, break it off and throw it away and start fresh. Thank goodness flying line is inexpensive!!
- **5.** Most flyers carry at least 2 spools of line with them. One for lighter winds, a thin light thread, for winds from about 1 to 5 mph and a heavier line, for higher winds, from 4 to 12+ mph. They also carry two or three kites for the same reason. For each wind range, there is a specific design, or kite, that performs at its optimum in that wind.
- **6.** Many fighter flyers prefer flying with line that is coated with wax. Some like a light wax, others prefer a heavier wax on the line and some prefer no wax. It is just personal preference. Your experience will guide you as you experiment with the various lines.
- **7.** The most common flying reel is called a Gator spool or reel. It is popular because it is inexpensive and allows the line to freely spool off of the reel as it is sitting on the ground and is easy to wind the line onto when you are finished flying. When you buy flying line, it usually comes on a small diameter core of plastic or cardboard. Just transfer the line from its original spool to the Gator Reel and you're ready to go!



FIGHTER KITE BRIDLES

There are several bridle systems common to fighter kites. They are generally described by the number of connection points they have to the kite frame. Such as:



In addition to the points of contact to the kite frame, each bridle has a tow connection. This is the place that the flying line is attached to the bridle of the kite.

The 2 point bridle is the most common among Indian and Indonesian bamboo and paper or mylar fighter kites and with most fighter kites throughout the world. The points of connection in the 2 point bridle are at the point where the bow and the central spine cross, near the nose of the kite, and at a point 8'' - 12'' toward the tail of the kite on the central spine.

To adjust the flight characteristics of a kite using a 2 point bridle, one moves the location of the tow point toward the nose of the kite to increase the spinning characteristics and move it toward the tail to reduce the spinning and create a more stable flight path. With a 2 point bridle it is imperative the kite is perfectly balanced from right to left, or from one wing tip to the other.

Kites using fiberglass or carbon fiber bows and/or spines often use a 3 point bridle. In this bridle system, the points of connection to the kite frame are: 2 points on the bow, each equidistant from the central spine. Usually about 1" - 2" either side of the central spine. The third connection to the kite is on the central spine around 4" - 6" noseward from the tail.

The way the bridle is made uses 3 pieces of bridle line. One piece attaches at each of its ends to the bow, we will call this the upper bridle. The second, we will call the lower bridle, connects to the center of the upper bridle with a movable locking knot, a larks head, and the other end is connected to the lower part of the central spine. By moving the knot attached to the upper bridle from right to left along the upper bridle it allows for balancing the kite from wing tip to wing tip or from right to left. The tow connection is the 3rd piece and is attached to the lower bridle. It is attached with an adjustable locking knot, also a larks head, so it to be moved up or down along the lower bridle to optimize performance.

A few kite makers use a 4 point bridle. In this type of bridle there are 3 separate bridle lines or legs. The upper bridle leg is the same as in the 3 point, its ends are each attached to the bow, equidistant from the spine. The second, is a piece connected at each of its ends to the central spine, forming a loop. One end is generally connected at a point that is approximately half way from the crossing of the bow and spine to the tail of the central spine with the other end connected about half the way from the there to the tail of the central spine.

The third leg connects these two by connecting to the upper bridle line with a moveable locking larks head knot and the at the lower end it is often looped around the 2nd bridle leg. This allows the lower end of the 3rd leg of the bridle to slide along the second leg as the attitude of the kite changes. The tow connection is attached to the 3rd bridle leg by a larks head knot and is adjustable.



Always an innovator, Bruce is shown in his shop experimenting with a new method for bending spines.

Flying Line

When you are transferring line from the original spool it comes on to your flying spool, here is something worth considering. Minimizing line twist. Virtually all line has twist built in it and it WILL twist during flying. However, you can minimize the twisting by the way you unwind the line from its original spool. Yup, something that simple can save you lots of frustration later!

See for yourself:

When you buy cotton flying line for exmple, it usually comes on a spool with a small diameter core of plastic or cardboard. Before you wind the line onto your Gator or other flying spool, try the following:

First, pull about 7-9 feet of line from one end of the original spool your line comes on. After you have the 7 feet or so of line off the spool, hold the end of the line in one hand and the spool in the other. Hold them up high enough from the floor so the line will droop toward the floor but not touch the floor. Then bring both hands next to each other and watch what happens to the line. Usually you will notice the two strands twisting around themselves. Break the line at the spool and do the same thing again, but by taking line from the other end of the original spool. And finally do it again but take the line from the original spool by naturally unspooling it by allowing the spool to turn in your hands.

From this experiment you will find one way of removing line from its original spool that will have the least twisting. That's the way to unspool it when you are loading your Gator reel.

I am often asked "how do you untangle line twists and tangles when you're flying?" My solution is quick and simple,

DON'T BOTHER!

Instead, I break the line on each end of the tangle to free the tangle, put the "bird's nest" or tangled line in my pocket, retie the line and most importantly, get back to flying!!

Many flyers attach a snap swivel at the end of their flying line. This may help minimize the line twisting and makes it easy to attach your kite to the line. Other flyers prefer to attach the flying line directly to the kite's bridle using an easy to release knot.

After connecting the tow connection to the end of your flying line, place the line reel on the ground near your feet. From the reel in this position you pull line off of the reel to allow the kite to spin and to go farther away from you. When you pull line in or retrieve line using a hand over hand pulling action, you simply drop the line, one hand full at a time, and let it fall naturally on the ground.

When flying fighter kites, you will always have flying line on the ground all around your feet! Sometimes, the wind may blow the loose line around on the ground and cause the line to get tangled and twisted. That is a normal part of fighter flying and is easy to deal with! Break the line and retie it!

After flying for some time, your line will end up with a few knots where you have broken and retied your line. If you want to get rid of those knots, just spool off all the line with knots, break it off, throw it away and start fresh. Thank goodness flying line is relatively inexpensive!!

Many flyers carry at least 2 spools of line with them to the flying field. One for lighter winds, a thin light thread, for winds from about 1 to 5 mph and a heavier line, for higher winds, from 4 to 12+ mph. They also carry two or three kites for the same reason. For each wind range, there is a specific kite that performs best in that wind. Many fighter flyers prefer flying with line that is coated

with wax. Some like a light wax, others prefer a heavier wax on the line and some prefer no wax. It is just personal preference. Your experience will guide you as you experiment with the various lines.

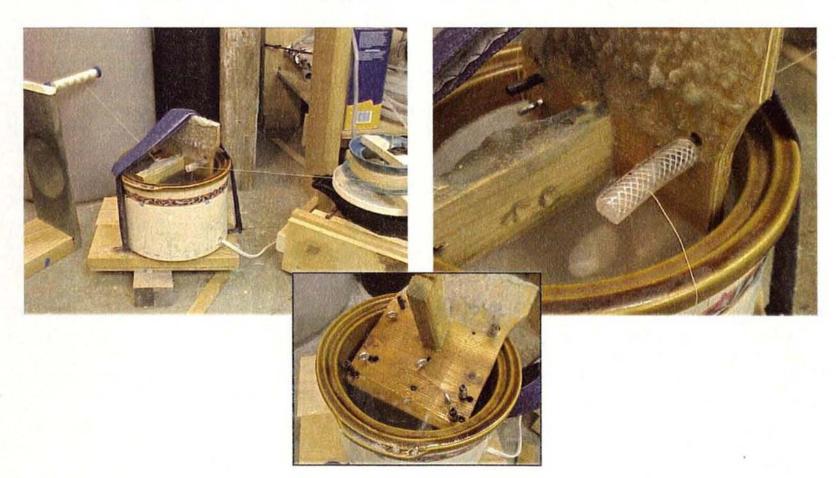
The most common flying reel is called a Gator spool or reel. It was originally designed as a hand held fishing reel. It is popular for fighter kite flying because it is compact in size, durable, inexpensive, allows the line to freely spool off of the reel as it is sitting on the ground and is easy to wind the line onto when you are finished flying.

Each flyer has his own preference for the amount of wax he likes or doesn't like on his fighter kite flying line. My preference is for a very thin coating of wax, and for it to be as uniform along the length of the line as possible.

I prefer using a "Gator" reel or spool to hold my flying line. So, I have to wind my line onto the Gator reel from the spool it comes on. I thought if I could combine both the waxing and the winding, I would have it made! My waxing/winding system works pretty well, but far from perfect.

So, Here it is...

Bruce's Semi-Automated, Almost Magical, Super-dooper Line Waxer and Winder



As you can see by the photos, I have assembled a conglomeration of second hand "treasures" to semi-automate the line waxing and winding process. What you see is a "crockpot" where I melt the wax. Next to it, the motorized workings or "guts" from an electric ice cream churn that winds the line onto my Gator reel.

I position the original spool of line so it will freely unspool or unwind in the direction I want it to. The winder rotates at about 50 rpm, not fast. As it rotates, it pulls the line off of its original spool, through the melted wax, then through a "wax squeegee" and onto the Gator reel.

The line is guided through the wax by a few screw "eyes" I screwed into a plywood board that is submerged into the wax. I secure the board into the crockpot with a strap. (what you see on the board in addition to the screw eyes are the remains of other unsuccessful methods I have used to guide the line through the wax)

When I begin to wax some line, I first melt the wax. Then lift out the board with the line guides and feed the line through the guides. Then I thread the line into the eye of a needle. The needle size is what determines the amount of wax that is squeezed off the line. I push the needle through a piece of vinyl tubing (this is the squeegee) and pull the line through it and tie the line onto the Gator reel that is on the winder. Start the winder rotating, and I have waxed line winding on my Gator reel.

Oh ya, the kind of wax. I use paraffin because of the way it coats the line and the way it feels in my hand when flying. It is readily available at the grocery store and is very inexpensive. I have tried beeswax and candle wax also. Beeswax makes the line too sticky. Beeswax is great for using on bridles, but, for my preference, is way too sticky for flying line. Candle wax is stickier than paraffin, but lots less sticky than beeswax.

SO, YOU ASK, WHY GO TO ALL THIS BOTHER?

Darned good question and one I'm not sure I can answer other than to say I am intrigued by contraptions and like flying fighter kites with a very thinly waxed flying line. In my search for the "perfect" flying line, I have not found a source for thinly waxed cotton or linen flying line that suited me, so I made my own. One idea and experiment led to another and this contraption is what I ended up with.

MANUHA

Manjha is the name of kite flying line that is glass coated. It is a cotton thread impregnated and coated with a concoction of a homemade rice based glue and finely ground powdered glass. The resulting line is called Manjha. It is cutting line.

Handling maniha needs special care and attention! The glass coated line can easily cut the flyer and anyone who accidentally gets in its way.

Manjha is designed to cut other kite lines that crosses its path! In most parts of the world, cutting line, or manjha, is automatically assumed to be the type of flying line used when fighter kite flying. In India for example, flying a kite means flying with manjha! The object of flying a kite is to cut anyone and everyone else's kite from the sky!

In the parts of the world where maniha is used, the fighting style is also quite different from the styles used in North America. Maniha "tangles" as they are called, usually occurs 1,500 feet to 5,000 feet away from the flyers! That is right, they have that much or more line out and are trying to cut each other's line at that distance. Often the kites are barely visible!

Once a kite is cut, the kite and a portion of the manjha lands somewhere. When it lands, the coating of powdered glass is dissolved with the first contact of dampness or rain. After it is wet, the cutting ability of the manjha is gone.

North America is one of the few places in the world where the use of manjha in fighter kite flying is prohibited from competitions. In fact, in North America, manjha's use is limited primarily to carefully controlled demonstrations.

The importance of having a properly tuned fighter kite can not be over emphasized. It makes a difference in the kite's behavior! When tuned it is in your control, when not tuned, it behaves as though it has a mind of its own! If you compete or plan to compete, precise tuning will probably mean the difference in your winning or not!

Bruce's Fighter Kite Basic TUNING Tips

KITE TUNING GOALS:

You will know when a fighter kite is properly tuned. It will do these two things:

- A. The kite quickly and easily spins or turns the moment the flying line tension is significantly reduced or released, and...
- B. The kite immediately flies along a straight path in the direction the nose of the kite is pointed when strong tension is applied and maintained by pulling in or retrieving the flying line.

Because the kite's tuning is directly related to wind speed you are flying in, once your kite is perfectly tuned, the next time you fly it, you will probably need to make one or more minor tuning adjustments.

THERE ARE THREE ELEMENTS TO CONSIDER WHEN TUNING A KITE.

- A. BRIDLE. The most important and often the only tuning that is needed are bridle adjustments.
- *B. SPINE.* The spine must have a slight bend. Most of the time the bend or curve in the spine of kite is not correctly set. The kite will not perform to its optimum without the proper amount of spine bend.
- C. ADDING WEIGHT. Adding weight to the nose or tail of the kite can also be very helpful in the tuning process.

BRIDLE

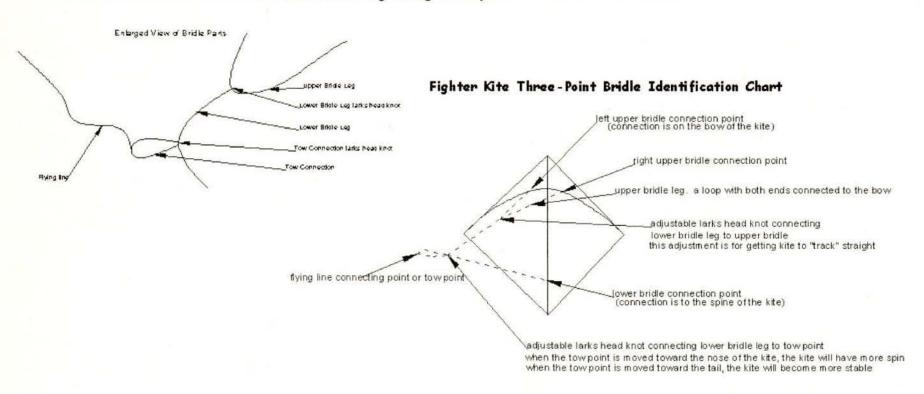
Bridle Description:

All of the kites I make use what is called a "3 point bridle". A 3 point bridle attaches to 3 separate points on the kite. And, coincidentally, consists of 3 bridle parts or legs, see the diagrams:

The upper bridle leg; each end of the upper bridle leg is tied to the kite bow about an inch or so, depending on the kite, on either side of the central spine.

The lower bridle leg; one end of the lower bridle leg is connected to the center of the upper bridle leg using an adjustable "larks head" knot and the other end is tied to the kite's central spine near the tail of the kite.

The 3rd leg of the bridle is the tow connection. This is where you connect your flying line to the kite. The tow connection is attached to the lower bridle leg using an adjustable "larks head" knot.

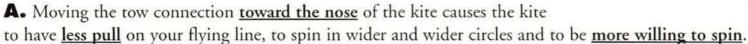


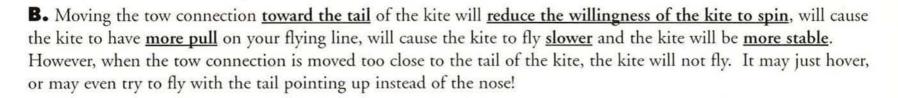
THE FIRST ADJUSTMENT

is to get the kite to spin when you release tension on the line.

Adjusting the bridle requires an understanding of "opening" and "closing" a larks head knot and I assume you already know this.

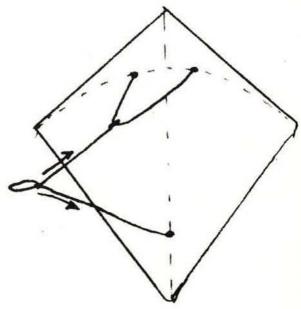
Let's start with the adjustment that allows you to move the tow connection along the lower bridle leg, this controls the willingness of the kite to spin.





C. A balance between the extremes is what normally works best.

D. This adjustment is quite sensitive. I recommend moving the tow connection about 1/8"-1/4", then fly the kite and see if it is as you want it to be. If not, make another adjustment and re-test. Repeat this until you have the kite flying as you want it to.

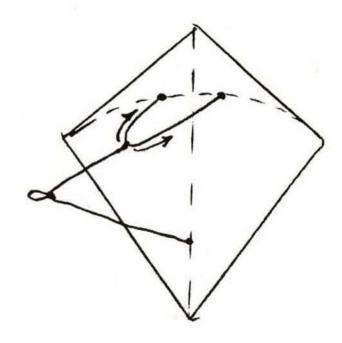


THE SECOND ADJUSTMENT

is to get the kite to fly or "track" straight when you are applying tension to the flying line.

This occurs by moving the lower bridle leg "larks head" knot along the upper bridle leg until it is at the aerodynamic center of the upper bridle leg. You will know when it is at the aerodynamic center because the kite will track in a straight path.

- A. For example, if your kite is turning, veering or pulling consistently to the right and is not flying or "tracking" in a straight path when you are pulling in your flying line, you would move the lower bridle leg "larks head" knot to the left along the upper bridle leg. If the kite is veering to the left, you would move the "larks head" knot to the right.
- **B.** This is a very sensitive adjustment. I suggest moving the "larks head" knot 1/64" and fly the kite to see if it is flying straight. If not, then move it again about 1/64" and fly again. Repeat this until the kite is flying straight.



THE SPINE

Spine Bend

In order for a fighter kite to properly perform, the spine must have a slight curve or bend in it. The spines in kites I make are made of bamboo. Bamboo, changes with temperature and humidity may change the amount of spine bend originally put in it.

The <u>more bend</u> in the spine means the kite will turn and <u>spin more</u> readily and when spinning, will spin faster. So if more spin is what you want, increase the amount of bend, just a little. If you want a kite that spins less quickly, remove some of the bend in the spine by bending it a little in the opposite direction of the original bend.

Checking to see if the kite spine has the proper bend is easy.

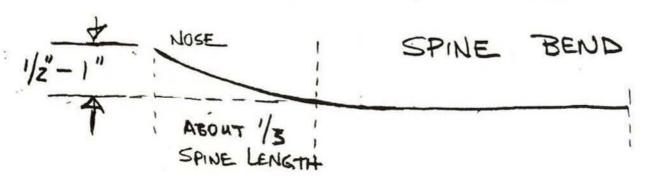
A. Place the kite on a flat surface with the front face of the kite laying on the surface.

B. Press the spine of the kite near the tail so it is pressed to the surface.

C. If the bend in the spine is correct, the nose of the kite will be elevated above the surface approximately 1/2" to 1". It depends somewhat on the kite.

D. If the bend is insufficient, add a small amount of additional bend in the spine. Any method of bending the spine that works without damaging the spine is fine.

The most common method is by placing the spine, backside of the kite, directly on the crown of your head near the crossing of the bow and spine and gently pull the nose and tail ends of the spine down an inch or so, hold that position for a few seconds, then release it. Recheck for the correct bend. Then repeat, until bend is correct. I know, it sounds a little silly, but "using your head" is the best way to increase the spine bend and minimize accidentally breaking the spine by over bending.



ADDING WEIGHT

Tuning by Adding Weight

You may find that even with the spine and bridle adjustments, the kite is still not flying as you want it to. Adding a small amount of weight may do the trick.

Window glazing putty that comes in a roll, or "tacky" stuff used for sticking pictures to walls, or any other semi sticky putty-like material will work fine.

Here is what to do:

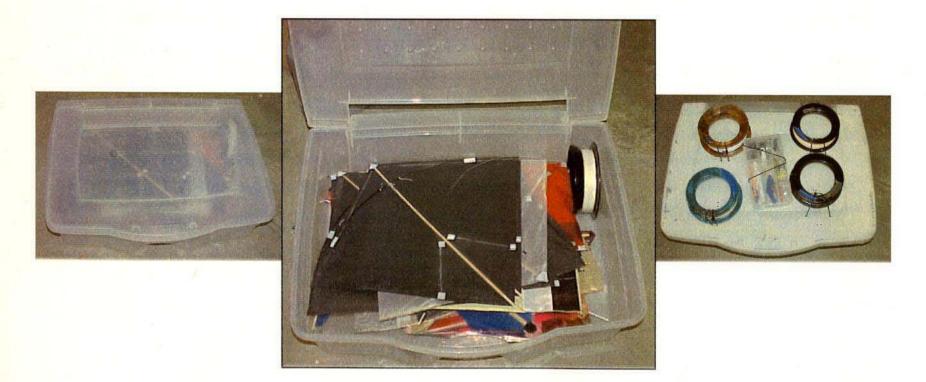
A. If you would like to <u>increase the tendency to spin</u>, and/or the rate and speed of your kite's spinning, add a small amount of putty to the tail of the kite. Just press some onto the spine near the tail end of the kite, on the backside of the kite. Use a small amount, about the size of a pea, fly the kite and notice the changes in the flight. Then either take some off if you have too much spin, or add a small additional amount until you have the kite "tuned" to your liking. This may take a few test flights to get the flight characteristics you want.

B. If the kite is spinning too much and you want to <u>reduce</u> the spinning and increase the stability, add a small amount of putty to the nose of the kite. Press a small amount of putty on to the back of the spine near or <u>at the nose</u> of the kite. Continue to add small amounts until you have the kite performing as you want.

ADD PUTTY
ADD PUTTY
TO TAIL TO INCRESE
SPIN

EXPERIENCES WITH FIGHTER KITE CARRYING BAGS, BOXES, ETC.

Since fighter kites are small, they are reasonably easy to pack around, even though the kites do not always disassemble. There are many variations of boxes and containers to carry fighter kites. For me, the two most important aspects for a kite box are: 1) it must protect the kites from damage and 2) it must allow easy access to your kites when you are on the flying field. I have used plastic bags of various types and although they are cheap and plentiful, they don't do a good job of protecting the kites. And they don't provide easy access to the kites when on the flying field. I've designed and made a couple of carrying bags made from ripstop nylon and although they were better than the plastic bags, they weren't very acceptable either. Since I am not a woodworker, and can't do an adequate job of making a nice custom wooden box, the most practical kite carrying containers for me are commercially available plastic ones. A word of caution about kite containers. If left in the sun for any length of time or sitting in hot car, the plastic, if clear or translucent, acts like a greenhouse. Some of the plastic films used to make kites can become distorted or worse in such heat. Also, the carbon fiber rods that are under tension, such as the bows in kites, can break with exposure to heat. Both occurrences are heartbreakers! The box I use most is a Rubbermaid product available at Wal-mart, Kmart, Target, etc. for about \$10. It holds lots of kites as long as the kite dimensions are less than approximately 22"x25". Plus it also will hold a couple of Gator type spools. The box dimensions are about 17.5"x24"x6.5" deep and has a large hinged top opening lid. This box I bang around and abuse quite a bit and it has not failed me yet!! These boxes are available in a few colors. Mine is milky clear. To help minimize the greenhouse effect, I have painted it with reflective paint. Since I enjoy experimenting with various small changes in kite designs, I end up making lots of kites and like to carry about 60 or more kites with me when I go flying. I now pack the box so full with kites that I have had to put my flying line filled Gator spools and my repair kit on the outside of the box! Although my "quick and dirty" way of attaching the spools makes it look pretty "funky", it is extremely convenient. The other box I use is one I found at Staples office supply store. It is made of a corrugated polypropylene and is very compact, lightweight and reasonably priced at about \$10. Its dimensions are about 22"x17"x1.5" deep. It is a very nicely made, a clever design and sleek looking, but doesn't hold many kites and isn't deep enough to carry a Gator type spool inside. Some fighter kiters adapt and/or convert old suitcases to serve as kite boxes. Although some of them are ugly, they work very well! Others make their own kite boxes, usually of wood. They are customized to hold the size and quantity of kites and flying line they want to carry. I have seen one that doubles as a portable kite making workshop! It included a kite making work surface, toolbox, material storage and workbench! There are no limits!



COMPETITION FIGHTER KITE FLYING

Many times throughout this book, references are made to competitions of various kinds. Although flying fighter kites for the sake of flying, is great fun and offers many meditative qualities as well. However, for many fighter kite flyers, the way to measure their growth in developing flying skills and/or kite designs comes during a competition. This is the time you can measure your flying skill against the clock and/or against other flyers. In competition, the challenge and test is whether you can control your kite's behavior at the precise moment you "must" control it. You can count on your opponent forcing you to maneuver your kite at exactly the worst possible moment for you to do it! That is the nature of competition! When you are practicing fighter kite flying, it is easy to fool yourself into believing you have the kite completely under your control. Often what happens is you decide what the kite should be doing at the exact moment you maneuver your kite to do just what you were thinking it should be doing. This seems like you are truly in control of your kite. And you are . . . sort of. It is like you are flying to fulfill your kite's own tendencies mixed with some true control, by you. The way to find out how much of your practice was your control and how much was following the kite's tendencies is to compete in one or more types of flying competition. With the precision competitions you are flying against the clock. In line touch combat competition you will discover the reality and "truth" about your control of your kite. This is because, the moment your kite "must" maneuver is not any longer determined only by you. It is often dependent upon and determined by your opponent's kite position, speed and direction and your estimate of his next position, speed and direction! Quite different from flying by yourself in practice!!

Line Touch Competition

When you begin flying in line touch combat competitions you will probably wonder what should your kite really be doing to increase your chances of winning. And, what general strategies are known to be successful, if any?

Strategies

These are scenarios to show how some of the maneuvers can be used to assist your gaining an advantage in your battle for a point. As with many aspects of fighter kiting, when you discuss these strategies with other flyers, you may hear other opinions about the validity of some of these strategies. Pay attention, try the other ideas, this is a great way to learn! With fighter kite flying, there is no "one way" to do things; do what works best for you. The primary purpose of this discussion is to give you a place to start.

Often flyers discuss the relative difficulty or ease of winning a bottom point compared to a top point. The truth is, both are easy if you know the right things to do and you have adequate control of your kite. And, of course, your kite has to have the ability to fly at least equally as well as your opponent's kite.

First, do not fly your kite in a competition if your kite is not tracking perfectly straight in both directions! This means your kite is not precisely tuned. Take the time to adjust the bridle and other tuning options to assure your kite is tracking perfectly. This is very, very important. Without attention to proper tuning, you will not have the ability to control your kite, it will control you and limit your available maneuvers.

One of the images a competition flyer must grasp is that he and his opponent are each the center of a 360* hemisphere described by their flying line and the ground. That's right, 360*. So the first thing is to practice flying a kite in 360* circles around you. This is something that is possible only on light wind days, generally when the wind is blowing less than 5 mph.

Competition line touch flying is all about accurately timing and predicting the speed and direction of your kite relative to your opponent's kite. And then being able to control the direction and speed of your kite at will. This is it in a nutshell. It is simple in theory, but as with many things, quite difficult in practice.

One of the most successful winning strategies that I have used is to attack immediately upon the head judge starting the tangle. As soon as the point begins, if my opponent is not already on the attack, and many are just trying to get set up for an attack, I attack. The fact that I am in their face quickly seems to confuse them momentarily and gives me the advantage. I don't always win using this method, but I do win much more that 50% of the times I use it. This applies to either a top or bottom point. In fact the earlier you can catch an opponent, the better chances he will be in a very vulnerable position and will be an easy and quick "kill".

In most competitions I have seen, the ground takes more points than all flyers combined! Grounding is a more threatening enemy than the opponent. When flyers discuss grounding, most of the time it is assumed the grounding occurred in the pursuit of a bottom point. My experience has shown that the ground takes more of both top and bottom points almost equally. Hard to believe? Pay close attention to the next few competitions you watch or participate in and see for yourself.

For winning a bottom touch point you don't always have to be close to the ground. Many flyers believe that you can only win the point if you can keep your kite inches off the ground. It is true that will make it easier, but most bottom touch points are won at much higher altitudes.

Here are a couple of reasons. One is that the flyers are often afraid of grounding their kites and avoid getting too close to the ground. Another reason is, even though both opponents' kites are kept near the ground, one of the flyer's kites eventually becomes high enough to lure the opponent in to believing he can come underneath and win. This is often done on purpose as a winning strategy. So, up the opponent comes to attack. As he is heading to get under your line, you dive toward the ground just ahead of him, cut back and come under his line. All of this will usually occur at an elevation well above the ground.

PRECISION FIGHTER KITE FLYING

In precision flying of fighter kites, you try to accomplish specific tasks or tricks with the kite and/or kite line. In precision flying competitions you are accomplishing the tasks against the clock.

Tricks or tasks such as:

knocking a cup off of a post located 100' away from the flyer.

Flying the kite through a 5' diameter hoop and back out. The opening of the hoop is facing the flyer or for variations, it can be oriented in any direction. Again, the flyer is about 100' from the hoop.

Cutting a crepe paper tail from a single line static kite or from a 8' post

Pasting your kite on an object such as a post, tree, building, tennis racket mounted on a pole, etc

Taping a pin or needle to the nose of the kite and pop balloons that are on 5 foot lines tied to a 10' pole located about 100' downwind of the flyer.

As you can see, almost any task could be a valid challenge and could be part of precision flying competitions. Precision flying is virtually limitless in the challenges that can be created and the fun that can had!

The flying skills required to be competitive in precision competitions are similar to the skills needed in line touch combat games, but instead of doing a head to head battle with another flyer, you are pitting your skills against the clock.

Although kite speed can be beneficial in precision competitions, the most important element is to have precise control of your kite!

One nice aspect of precision flying is it can be easily practiced alone. Each of the flying skills you need to be a top precision flyer can be practiced every time you fly!

FASTEST TIME WINS.

So you want to fly a fighter kite, but there is virtually no wind or no wind. Hmmm, what to do? Go home and call it a day? NOPE -- FLY, FLY FLY! Dig out your "ultra-lightwind fighter kite". What does it look like you ask? This is a fighter that has a very "soft", flexible action when you press on it to simulate wind pressure. Some may call it floppy or loose. The kite's wingtips easily move so when flying it looks a little like a bird's wing action. Also these ultra light wind kites have more surface area and are larger than kites normally used in stronger winds. But despite there larger size, they are extremely lightweight. They float like a feather. Attach your lightest weight, smallest diameter flying line to the kite. This flying line should be similar in size to normal sewing thread or maybe a bit heavier. I prefer using 100% cotton, hand

feet or so, I tug on the line. This action causes the kite to turn and/or spin. As the nose rotates upward, I tug again making the kite climb and then release the line allowing a small amount of line to be pulled with the kite, taking the kite farther away and/or higher. At the end of the glide from that tug, I repeat the above step. Tugging and releasing. As this happens I am letting a little line out with each release. And as the kite rises in elevation it usually will find a few small pockets of air movement along the way. If it doesn't, then you just have to work that much harder to keep the kite flying by creating your own wind by continually working the kite. The action of the kite during this process looks sort of like wing flapping. Its flexible wingtips flap like a bird with each tug and release of the line. This "flapping" action is what

FLYING IN VIRTUAL WIND or VIRTUALLY NO WIND

quilting thread. It has a very smooth outer finish called "glace". At any rate, a very small diameter and very light weight flying line. Now comes the fun part, getting the kite to fly in virtually no wind. The object is to get the kite to a higher elevation in hopes of finding some pockets or layers of moving air. Plus, once the kite is higher, you can dive the kite and pick up speed and provide lots of apparent wind for the kite. What I do is launch the kite in a special way. Any way that works for you is the way to do it, but here is how I do it. I hold the kite by the spine, in the area just forward of the tail, the sail wrapped a little bit around the spine, my index finger over the end of the tail of the spine, the kite's face is facing toward the ground and about parallel with the ground. I toss or throw the kite like a dart or glider, downwind, or, where downwind would be if there was some wind. As the kite comes near the end of the loose line I have provided for it, about 10-15

propels the kite and helps to create forward motion. Once you get the drift of the technique, you will find that you will be able to fly the kite in ways you couldn't with normal wind. For example you will be able to easily fly the kite behind you and in 360* circles around you. It opens up a whole additional range of flying possibilities for fun flying and for competition too!! Just adds a new dimension and a ton of extra fun to fighter flying! PS: Another launching method I use is to lay the kite on the ground with the face of the kite facing up and the nose of the kite pointed away from me. I step back a few feet and tug on the flying line. When I do that, the kite jumps up and begins to climb. As the kite reaches the end of the amount of line that is available, I tug on it again and quickly release the line letting some line go with the kite. Then I follow the rest of the descriptions above relating to getting the kite to gain altitude.

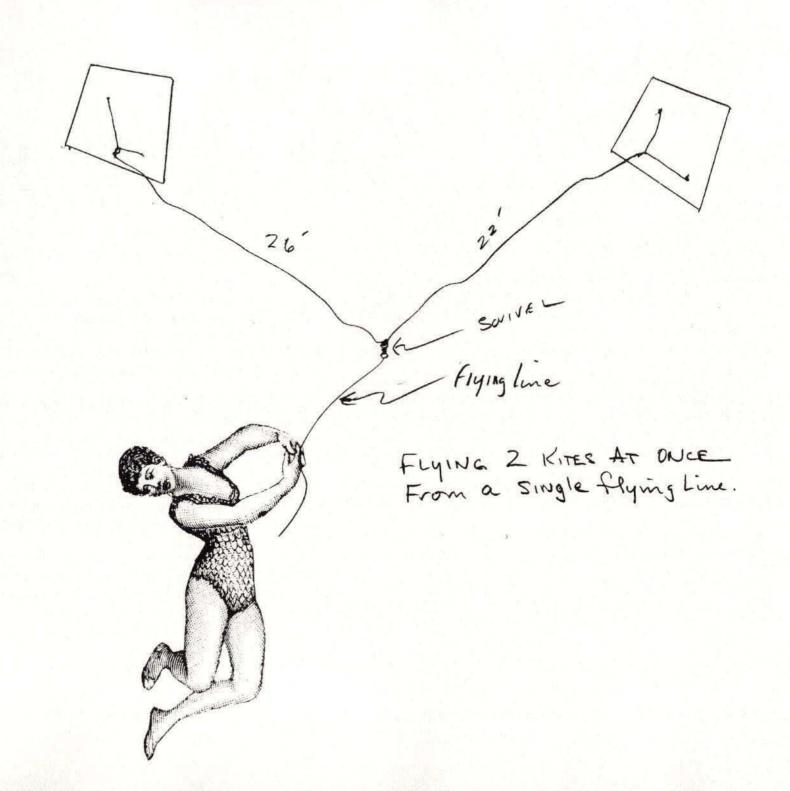
So you want to fly a fighter kite, but there is virtually no wind or no wind. Hmmm, what to do? Go home and call it a day? NOPE -- FLY, FLY FLY! Dig out your "ultra-lightwind fighter kite". What does it look like you ask? This is a fighter that has a very "soft", flexible action when you press on it to simulate wind pressure. Some may call it floppy or loose. The kite's wingtips easily move so when flying it looks a little like a bird's wing action. Also these ultra light wind kites have more surface area and are larger than kites normally used in stronger winds. But despite there larger size, they are extremely lightweight. They float like a feather. Attach your lightest weight, smallest diameter flying line to the kite. This flying line should be similar in size to normal sewing thread or maybe a bit heavier. I prefer using 100% cotton, hand

feet or so, I tug on the line. This action causes the kite to turn and/or spin. As the nose rotates upward, I tug again making the kite climb and then release the line allowing a small amount of line to be pulled with the kite, taking the kite farther away and/or higher. At the end of the glide from that tug, I repeat the above step. Tugging and releasing. As this happens I am letting a little line out with each release. And as the kite rises in elevation it usually will find a few small pockets of air movement along the way. If it doesn't, then you just have to work that much harder to keep the kite flying by creating your own wind by continually working the kite. The action of the kite during this process looks sort of like wing flapping. Its flexible wingtips flap like a bird with each tug and release of the line. This "flapping" action is what

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Thing Multiple fighters It's easy. I am sure there are many variations to doing it, but this is what I do.

I measure and cut a 30' to 60' length of flying line. The longer lengths provide for more independent travel for each kite. Just choose a length and give it a try and go from there.

On each end I tie a small snap swivel. I also I tie, using a larks head knot, a swivel at a point that is about 2'-5' from the center of the line. The important thing is to place the swivel so it allows for each leg of the line measured from the central swivel to be a few feet different in length. This allows a few feet of separation between the kites.

What I end up with is a 30' to 60' line with a swivel about 4' from the center of it and a snap swivel on each end. I call it a "2 kite yoke".

I attached my flying line to the open side of the central swivel that I larks headed to the "2 kite yoke" .

To each end of the 2 kite yoke, I attach a fighter kite, each kite can be similar in size and performance or quite different. The closer they are in performance the easier it is to fly them, so begin with similar kites and later experiment.

Most important is the issue of the kites' flying behavior in the wind speed you have at hand. They should fly easily, sort of slow, not fast and erratic.

Now you are ready for the only tricky part, launching.

First, I launch the kite on the longest leg of the line, once it is flying, I let line out and when I get to the second kite I launch it while keeping the 1st kite above ground! It takes a little practice, but is worth the effort once they are airborne!

Another way to launch. Once one kite is launched, if you can work it high enough in elevation, it will drag the second kite into the air with it. Once the second kite is airborne, it usually will begin to fly in a normal manner very soon.

When flying 2 kites on one line, each kite flies independently but with some order and control from you, it is fun to watch and a blast to fly! Sort of like doing pairs kite ballet all by yourself. Or, like doing a line touch battle by yourself!

I have seen as many as 10 fighters on one line using this same idea repeated 5 times along the flying line. It is a beautifully active spectacle to watch!

You have heard it all before. But, it doesn't hurt to rethink it.

When making a kite you will come in contact with many different materials, some you may not be familiar with. A few have fumes that are very toxic others can cause other types of injuries.

Work in a well-ventilated area. Have protective eyewear and a air filter mask handy, it is best if you actually use them! Wear protective eyewear when cutting and sanding wood, carbon fiber and fiberglass materials, you never know what direction some of the cut pieces will shoot.

Wear an air filter mask. The dust from carbon fiber and fiberglass is very fine and dangerous to have in your respiratory system. You don't want to breathe it!

KITE MAKING SAFETY AND HEALTH CONCERNS

Contact cement, super glue and other adhesives have toxic fumes. As do many of the paints and markers that you may use for decorating your kites.

When you hot-cut mylar, tyvek, ripstop nylon, ripstop polyester, polypropylene or any plastic film or other synthetic, you will be creating toxic fumes.

When working with bamboo, you are subject to several potential injuries. The edges of split bamboo are razor sharp and easily make a cut like a paper cut, but much deeper. A small sliver of bamboo is like a needle, it is strong and sharp. In addition to these hazards, another common injury comes from the knife being used to shape the bamboo. It will slip just when you don't expect it, jabbing itself into your flesh. Be very conscientious about the way you use a knife when working with bamboo!

Obviously, when using sharp scissors, razor or utility knives, you must use caution and pay close attention to what you are doing.

And of course, When flying kites, keep the kite away from power lines, electric lights, electric signs, and people.

So, you're thinking about making a fighter kite and want some basic information about the commonly used materials for making them.

Fortunately, fighter kites are fairly small, so even if you choose the more expensive materials, you only need a small amount for making a kite. The total cost for the materials to make 1 fighter can range from \$1.00 to \$8.00, depending on the materials you choose. The performance of the kite is not necessarily determined by the price of the materials selected.

Sail materials

The most obvious component of a kite is the sail. For fighter kite sails, Mylar and Mylar-like plastic films are very popular. They are available at most craft stores are inexpensive, are reasonably easy to work with and the finished kites fly well!

Other popular sail materials include Orcon, Icarex, ripstop nylon, ripstop polyester, Toray, Tyvek, papers of various types and plastic bags.

The sail material you choose will in large part determine the type of construction you must use for your kite. For example, if you choose to use ripstop nylon, Icarex (a polyester ripstop), or Toray (also a polyester) you would have the choice of constructing the kite by sewing it, gluing or using a special double-sided tape.

Each construction technique can produce a comparable quality kite, it is a choice of builder preference or convenience. Maybe, for example, you don't have a sewing machine so gluing or taping is a more suitable method of construction.

MATERIALS commonly used to make fighter kites

If you choose for the fabric of a kite, Mylar, Tyvek, Orcon, paper, plastic bags, or any thin plastic film then the construction can be by gluing or taping. Again, the quality of the finished kite and its performance is comparable regardless of which method you use.

Spar material

For the sticks or spars of a fighter kite bamboo, spruce, wooden dowels, carbon fiber or fiberglass rods are the most commonly used materials.

Fiberglass and carbon fiber rods are readily available from most kite stores in a variety of diameters. Each kite design will use a particular diameter of carbon fiber or fiberglass rod. The most common diameters used are 0.05", 0.06", 0.07" and 0.08".

Since carbon fiber is stiffer and lighter weight than fiberglass, it is preferred and the most commonly used material. However, it is more expensive than the comparable diameter fiberglass.

Bamboo is the material I prefer for the spine of kites I make. It is very strong for its weight, easy to work with, and inexpensive. It isn't always easy to find "virtually ready to use" bamboo spars, so many plans suggest using spruce or a wooden dowel for the kite's spine. Still other plans use carbon fiber rods.

Tapes

When a kite sail is made of a plastic film, and taping is the construction method used, regular 2" wide packing tape is often used to assemble the kite. It is readily available, inexpensive and it works really well!

Many other tapes could be used for reinforcing stress points. The plans usually will identify any specific tape needed.

Glues

Contact cement is the glue most commonly used for assembling kites. It works well when using plastic films, nylon or polyester ripstop, Tyvek, Mylar & Orcon.

When gluing papers, rubber cement is often used.

Super glue is used for attaching various small parts onto the bow or spine.

Tubing

For stops on the bow and/or spine for the bridle or other attachment points, a short piece of vinyl tubing is used. The tubing must fit snuggly around the spar, it is usually super glued in place.

Heat shrink tubing and vinyl end caps are also used for bridle stops.

Bridle line

Bridles are usually made from braided Dacron line of 12# test to 20# test. However, any low or no stretch small diameter line with similar breaking strength will work fine.

USING GLUE to assemble a fighter kite

Of all the different glues I have tried, i have found only one glue that I can count on and it is Weldwood contact cement. It is available in the original formula and also in a neoprene base, that has less toxic fumes. It is available in tubes, small bottles and in a quart can. I buy it by the quart for about \$7 or so at Home Depot, Wal mart, etc. I have used it successfully on Orcon, ripstop (both nylon and polyester), Clearphane, Mylar, Mylar like films and Tyvek. It is the only adhesive I use and I have used it for over 2 years and 300+ kites.

There are a couple of problems with the original formula. The color of the glue is sort of yellowish/tan and if you use a clear, translucent, white or light colored skin material, the glue color may show through the skin, and the other is the glue has toxic fumes, so use in a well ventilated area!!.

Most of the time I use it straight out of the can, but I have also used it after slightly (about 10%) thinned with contact cement thinner.

HERE IS HOW I USE IT: I pour some glue out of the quart can into a smaller container that has an airtight removable lid and has a wide enough mouth to get easy access to the glue. This is the container I open and close all the time to get glue into my application device which is a 3cc syringe with the needle pulled out.

I suck up the glue into the syringe and then apply a small bead of glue on the kite skin in an area I want to glue. Then I spread the glue with a small piece of closed cell foam. I spread the glue so it is as even as possible, but I don't think it is too critical. I put glue on the hem areas of the skin and on the parts of the bow and spine that will be glued.

I don't worry too much about spreading the glue into areas outside of the intended glue area. I take care of that after I am finished.

When I have all the desired areas of the skin covered with glue, I put a bead of glue on the spine and smooth it with the foam and the same

with the bow, toward the ends, where they will be encased in the kite skin leading edge.

After everything has dried for about 10 minutes or so or until they are slightly tacky to the touch, I begin to stick the pieces together. Once they touch, that is about it, so you have to be careful from this point on!

I grab the bow in both hands and flex it to find its "natural curve or bend" and place the tips of the bow at the point on the skin where the wingtips are to be located. I have already marked them from my template. The bow is bent and almost 90* to the surface of the skin except for the tips, which are touching the skin. Once I have both tips of the bow touching the skin, I then allow the bow to swing or rotate down toward the nose

of the kite and onto the skin. When that happens I press the bow to the skin to secure the bond. Be careful not to distort the natural shape of the bow when you are pressing it to the skin.

Then I begin folding the leading edge hem area over the bow and burnishing them lightly.

After the bow is installed, I mount the spine. Lifting the bow, I slide the spine under it so the nose of the spine is in contact with the nose of the skin, the rest of the spine is still above the surface of the skin. Then, I slowly lower the spine onto the skin along the spine center line. Sometimes I will also pull the skin snug from the tail as I lower the spine.

It is sort of a long explanation, but it is really very quick and quite easy once you have done it a couple of times.

Recently I have made a jig to help get the bow tips in repeatable positions so I no longer use just my hands to place the bow tips, but I have done it both ways with equal success. I call my jig a "Bow Setter".

Once the kite is finished, I take talcum powder or cornstarch and brush it on the areas where the excess glue is still exposed. This seems to kill the adhesion of the glue so it doesn't pick up sand and other stuff on the flying field. A very quick and easy solution to my sloppy gluing.

INSTALLING A BOW USING BRUCE'S

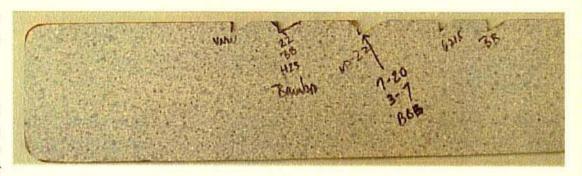
Bow Setter

When making a kite, I prefer to use contact cement to hold the kite parts together. After I have applied the contact cement to the bow, spine and the kite sail in the appropriate places, I wait for 15 minutes for the glue to dry.

After the glue is dry on all the parts, including any leading edge stiffeners, the FIRST part I install on to the kite sail is the bow.

When I am ready to install the bow of a kite, this is how I go about it.

First of all, I have to tell you about the device I use to assist me. I call it "Bruce's Bow Setter". All it is, is a piece of



formica about 24" long and 2" wide with notches in it. I had some scrap formica, so I used it. A yardstick would work just as well.

I cut notches into the Bow Setter precisely where I want the bow tips to be located on the trailing edge of the kite. I do this by laying the Bow Setter on the kite template and marking the location where the notches need to be. The notches in the bow setter are aligned with the exact location I want the tips of the bow to be located.

At the point in the kite making process when I want to install the bow, the kite sail is lying flat on the worktable with contact cement already applied and dry. Next, I lay the Bow Setter across the kite sail and align the Bow Setter so the notches in the bow setter line up with the right and left bow tip positions marked on the sail, (I mark them using an ultra fine tip marker through a small hole drilled in the template at the location where the bow tip is to be). Then I secure the bow setter to the worktable using masking tape.

I use carbon fiber rods for the bows in my kites. Carbon fiber, is not as uniform around its circumference or along its length as it may appear. For example, if you hold a 24" length of carbon fiber rod with one of the ends in each hand and try to compress or bend the piece, you will notice the carbon fiber will rotate around its axis like it is trying to find its "natural" bend or position. This is the way I want the bow to be oriented, so it has "found" its natural bend.

After the Bow Setter is taped in place, I bend the bow so it can find its natural bend and place the tips of the bow in the appropriate notches of the Bow Setter with the arch of the bow pretty much vertical or perpendicular to the worktable. Next, I hold the bow tips in position in the bow setter and allow the bow to slowly rotate toward the kite sail so the arched part of the bow ends up laying on the sail.

Next, I fold the hem of the fabric over the bow from the wing tip to the point where the bow and the leading edge form 2 different and separate angles. Then I remove the bow setter. My next piece to install is the spine.

I really like the performance of kites that have bows with more flexible wingtips than the rest of the bow. Most of the kites I have flown that have such a bow use bamboo for the bow.

I have tried to find a way of making the tips of a carbon fiber fighter kite bow more flexible than the rest of the bow. It is something that keeps coming to me as an idea to explore.

The first idea I tried was to add a second piece of bow material Idouble bow) in the center.
This second bow was about 6"-10" long and centered over the center of the spine. It works pretty well, but I thought there must be a better way.

The next thing I tried was to taper the carbon fiber rod I used for the bow. Sanding them beginning from about 6" from each wingtip.

The goal was to taper the bow so it was about 1/2" of its original diameter at the wingtip.

This method didn't produce as even or uniform a taper on the right and left wingtip as I wanted and I wasn't patient enough to keep working at it.

An acquaintance of mine in Brighton, England, lan Dunford, came up with the idea of sanding the main bow rod and a smaller diameter tip section so each had a very long angled surface area or scarf. In other words, he sanded the ends at an angle so the length of the sanded portion of each end was about 1" long. He then glued the two pieces together by joining the flat sanded angled areas. I have never tried this method, but it does work for lan.

Then I had a different idea.

"Just glue a section of smaller diameter carbon fiber rod to the ends of the bow." I did it and it worked pretty well and was relatively easy and quick to do.

Here's what I did:

Ramblings

about

more flexible

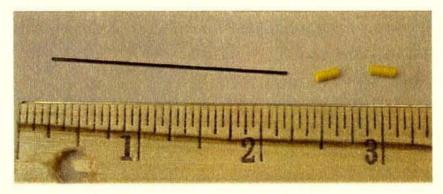
bow tibs

Cut the original 0.06" diameter carbon fiber rod I was using for the bow 5" shorter than it called for in the kite plan.

Cut 2 - 3" lengths of 0.04" diameter carbon fiber rod

Cut 4 - 1/8" - 3/16" long pieces of heat shrink

tubing that would snuggly fit over both the 0.06" diameter bow rod and the 0.04" diameter end sections.



Slide 2 of the heat shrink pieces on to each end of the 0.06" rod.

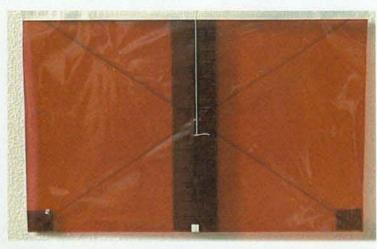
Slide each of the 0.04" sections into the heat shrink so they overlap the 0.06" rod by about 1/16".

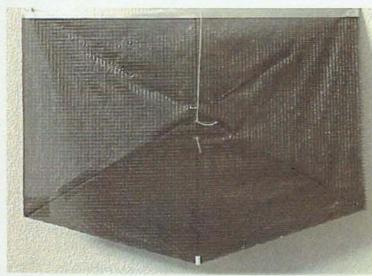
Align the heat shrink tubing so about 1/2 of the piece at the end of the 0.06" rod is hanging over the end of the 0.06" rod, and the other piece of tubing is overhanging the end of the 0.04" rod section.



Heat the tubing, shrinking it around the bow and the smaller wingtip section, holding them firmly together. Once the tubing is shrunk, the 2 pieces stay positioned. Align the two ends so they are straight and true with each other and with the main bow rod and put super glue on the exposed area between the 2 pieces of shrink tubing. That's it, the bow is ready to be installed in a kite.

THESE INSTRUCTIONS WORK
EQUALLY WELL FOR MAKING
A FIVE SIDED FIGHTER OR
A BUKA (FOUR SIDED)
FIGHTER KITE.



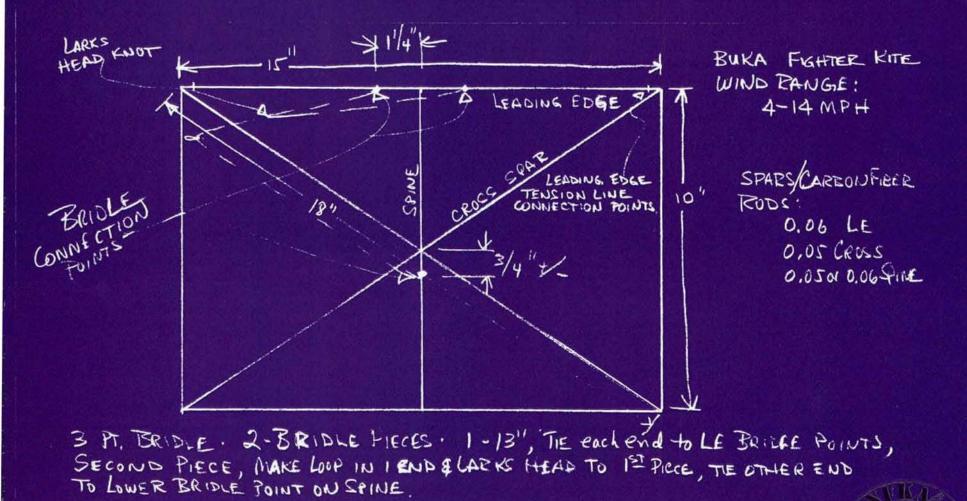


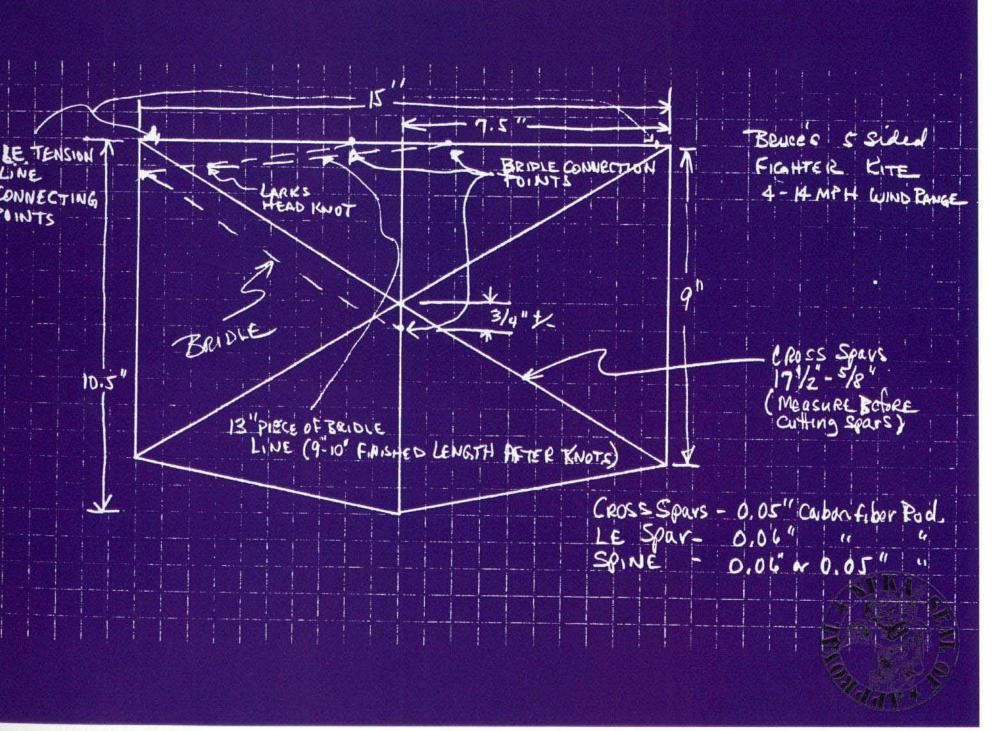
THE BRV(E'S VE SIDED FIGHTER

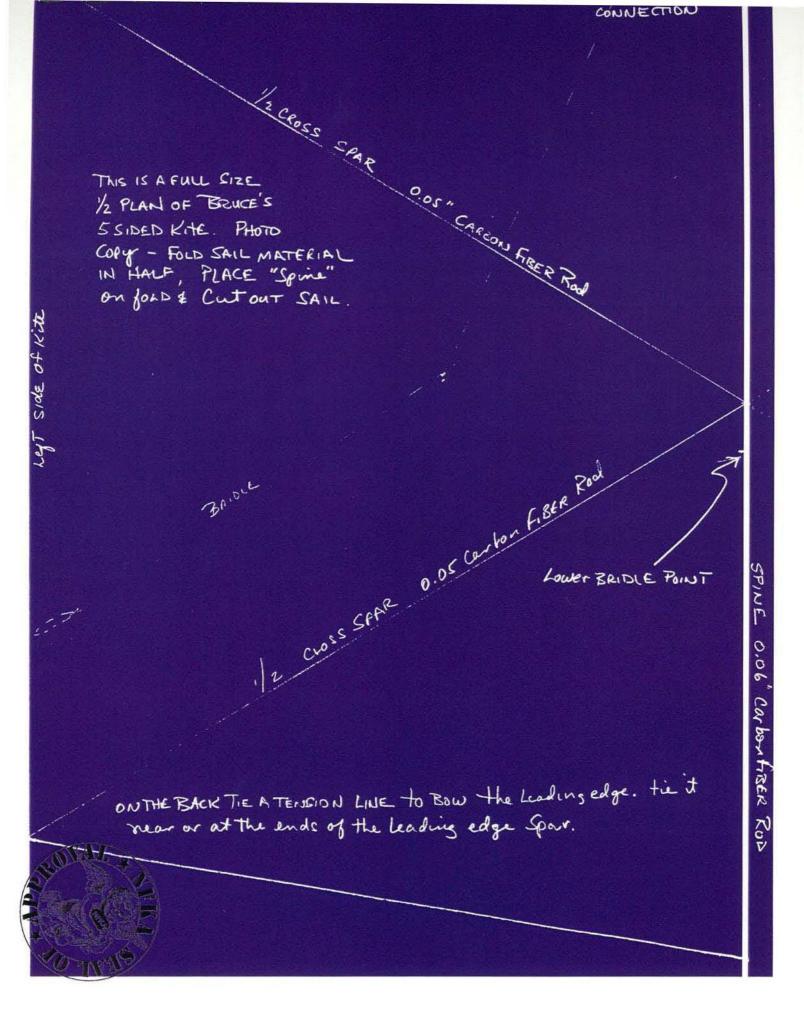
The kite described in the construction instructions performs best if flown in winds of 5 mph to 14 mph. Here are dimensions of both a buka (4 sided) and the 5 sided kite for other wind ranges. Choose the wind speed that is common to your flying area and use the dimensions to make a kite best suited to those winds.

# of Sides	LE length"	Spine length"	Side length"	Wind, mph
5	15	10.5	9	5 -14
4	15	10	10	5- 14
5	17	12.75	10.25	3 - 8
4	17	11.25	11.25	3 - 8
5	18	14	11	0.5 - 4
4	18	12	12	0.5 - 4

For all sizes listed above, use 0.05" diameter carbon fiber rods for all spars except the spines and leading edge spars. All the spines should be 0.06" diameter carbon fiber rod. The leading edge spare can be either 0.05" or 0.06" carbon. I prefer 0.06".







For this kite I am using a plastic mylar-like film called Clearphane or Celane. I buy it at Michael's Craft supply stores. It is used for wrapping baskets and flowers and is available in transparent colors and some patterns. Any mylar-like plastic film or any thin, lightweight material that will stick securely to packing tape will work using this technique.

The following material list is for building a 5 sided kite to fly in 5mph – 14mph wind. For other wind ranges, the lengths of the spars will vary as will the size of the sail.

Kite sail material, 16"x11" Clearphane or mylar like plastic film

- 2 17.5" long, 0.05" diameter, carbon fiber rods for cross spars
- 1 15" long, 0.06" diameter, carbon fiber rod, for leading edge
- 1 10.5" long, 0.06" diameter, carbon fiber rod for central spine
- 6' of 15# 20# bridle line
- 36" of 2" clear packing tape
- 3" length of flexible tubing with an inside diameter no larger than 1/16"
- 3" length of smallest heat shrink tubing you can find, 0.06" or 0.07" inside diameter is ideal.

A few drops of superglue.

BEFORE YOU BEGIN.

Before you actually begin the construction, I suggest reading through the instructions and look at the photos so you have an idea of the flow of the process. MaterialS list for the Buka and the 5-sided fighters

THE TEMPLATE

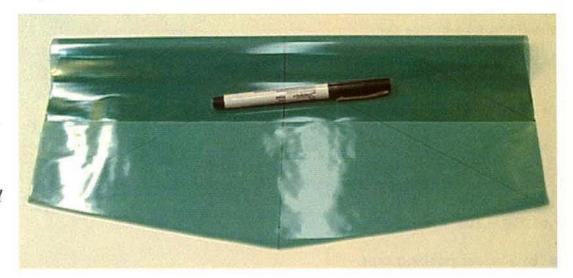
If you plan to make more than one of these kites, it would be a good idea to make a template to speed the sail cutting process. A heavy posterboard, matt board, or formica all work well. If you plan to make only one kite, then just draw the pattern on the sail material using a fine tip Sharpie type marker.

CUTTING OUT THE SAIL.

Once you have the template cut out, lay it on the sail material and cut around it with either a hot knife or a very sharp (new blade) xacto

knife. If you drew the plan on the sail material, use a straight edge for guiding your knife during the cutting out of the sail.

caution note: Before you actually cut out the sail, there is a characteristic of mylar and other plastic films that I want to share with you. It is this; once an edge is nicked, it easily tears at that point. And once it starts to tear, it doesn't want to stop!



HERE IS HOW TO MINIMIZE THIS POTENTIAL PROBLEM.

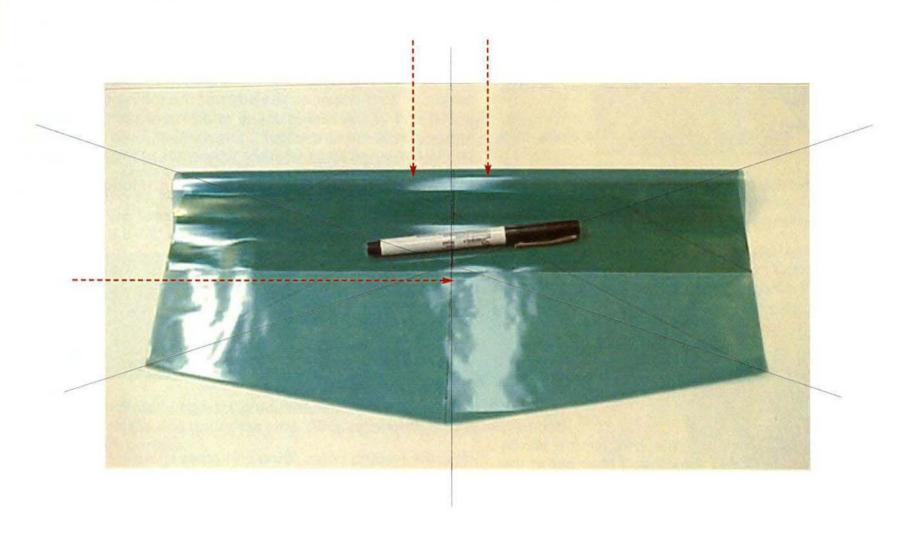
When cutting out the kite sail with an xacto type knife, use a new blade and do not stop the knife along the cut. Make each cut with one uninterrupted pass of the knife. If you are using a template or straightedge, make one pass with the knife along each edge. The only place you can stop the knife is at the corners.

It is very disappointing to finish the kite and during its first flight, the sail tears for no apparent reason! The reason is the "nic" made either by a dull knife or the knife stopping and starting along a cut. Fortunately, a piece of clear packing tape can usually repair the tear.

Now that you have the kite sail cut out,

draw a line from corner to corner where the cross spars will be located and a line from the center of the leading edge to the tail point marking the location of the spine.

Also mark the location of the bridle connection points. On the leading edge it would be 1.25" either side of the center and on the spine about 5.5" toward the tail from the leading edge.



SPARS

Make sure you have the carbon fiber rods cut to the proper lengths. Check them by laying them on the sail just to be certain of their correct length.

Getting the leading edge spar prepared to install onto the kite sail requires a little bit of thinking ahead.

Cut from the shrink tubing 4 pieces, each about 1/8" long.

Cut 1 piece of the flexible tubing about 3/4" long

Mark the center, the bridle points and the tension line points on the leading edge spar. Use a metallic marker or a Sharpie.

Select 2 of the heat shrink pieces and slide them onto the leading edge spar.

Using a large needle, make a hole in one wall of the 3/4" length of small diameter flexible tubing about in the center, 3/8" from the end.

Slide the flexible tubing piece onto the leading edge spar in such a way that the spar enters one end of the tubing, but exits through the hole you made near the center of the tubing.

Slide 2 more of the shrink tubing pieces onto the same end of the leading edge spar as you put the flexible tubing. You should now have 2 pieces of heat shrink, 1 piece of flexible tubing and 2 more heat shrink pieces on the leading edge spar.

Once they are on, push 2 of the heat shrink pieces together near one end and the other 2 together at the other end of the leading edge spar.

Hold each end over a heated soldering iron or other heat source, **NOT AN OPEN FLAME**, to shrink the tubing so it is snug around the spar. If the tubing you are using is already snug, forget this step.

Move the pieces that are closest to the ends inward toward the center about one inch.

Place a drop of super glue on the spar at the tension line connection point and slide the shrink tubing piece back toward the end of the spar so it is glued into place at that point. The edge of the tubing closest to the end of the spar should be on the tension line connection point mark you made on the spar.

Mark the location of the 2 bridle attachment points on the leading edge spar and super glue the heat shrink tubing on to the spar so the edge of the tubing closest to the end of the spar is at the attachment point location. The most important thing is that both bridle points are equal distance from the center of the spar.

Cut two pieces of the flexible tubing about 1" long each.

Slide one of the flexible tubing pieces about 3/8" on to each end of the leading edge spar.

Slide the cross spars into each of the pieces of flexible tubing on the ends of the leading edge spar.

Slide the spine into the open end of the flexible tubing located in the center of the leading edge spar.

Now the leading edge, spine and cross spars are ready to be installed onto the kite sail.

Putting it together

(In the photos, you will notice I am using a colored packing tape. This is only so it would show up in the photos. The clear tape would not.)

Draw a line about 17" long on your work surface.

Cut 3 pieces of clear packing tape; 1- 22", 2- 2" long. I just attach the corner of each piece to my work table so they are handy to reach.

To each end of the 22" piece attach one of the 2 – 2" pieces (sticky side to sticky side) so that when the 2" pieces are stuck down onto your work surface, the 20" piece has its sticky side facing up.

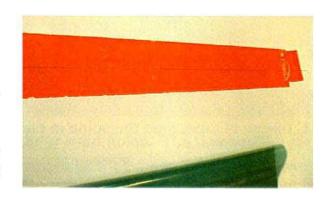
Align the tape so the line you have drawn on your work surface is running along the center of the tape's width, then pull it snug, but not tight, and stick the 2 – 2" pieces down to your work surface.

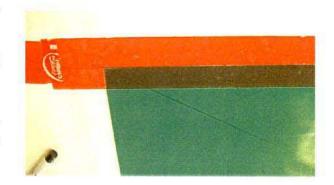
You should end up with a 22" piece of tape with its sticky side up on your work surface and the line visible through it and running along its center. It is stuck to your work surface at each end with the 2" pieces of tape.

Without touching the sail to the tape, align the leading edge of the sail with the line under the tape.

Slowly and carefully attach the sail's leading edge to the tape so the leading edge is on the line under the tape. The sail should lay flat and smooth on your work surface.

About 1/2 of the width of the tape is stuck to and under the sail, the other half is exposed beyond the leading edge of the sail.





Cut a piece of tape about 1/2" to 1" wide x 11" long. Place this piece of tape on the sail so its center is aligned with the center line you drew for the spine. It will overlap at the tail of the kite. After the spine is installed, trim the extra with your xacto knife.

Align the leading edge spar along the leading edge of the sail and carefully place it on the sail so it is also barely on the tape.

Cut 6 - 1" wide x 2" long pieces of clear packing tape.

Locate the flexible tubing in the center of the leading edge spar so the spine end is aligned with the center line and the spine, using one of the 1" x 2" pieces of tape, tape the spine in place near the tail.

Fold one of the cross spars so it is aligned with the cross corner of the sail along the line you drew, using one of the 1" x2" pieces of tape, tape it in position about 2" below the leading edge.

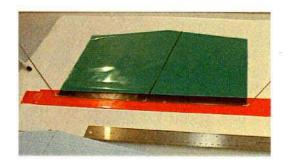
Using another of the 1"x2" tape pieces the same cross spar at the bottom corner. And then again about half way from the center to the bottom corner.

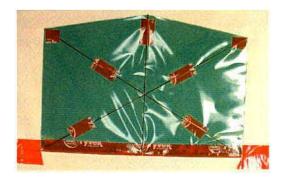
Do the same with the other cross spar.

Using your xacto knife, make a cut in the leading edge tape from the corners of the sail outward to the edge of the tape and also do the same in the center, at the location of the spine.

Carefully fold over the tape so it encases the leading edge and smooth it out and burnish it so it sticks well.

Cut the remaining tape on each end of the leading edge spar so there is about a 1" \times 1" tab. Fold it over each side edge of the kite. This will also overlap the cross spars.

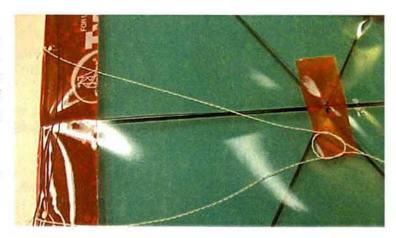




MAKING HOLES FOR BRIDLE ATTACHMENT.

Using a pointed soldering iron or a heated nail, melt a small, (approx. 1/8" diam. or a little smaller), hole in the sail at the location of the bridle connections on the leading edge and on the lower part of the spine and either side of the center crossing of the spars and at the tension line connection point near the ends of the leading edge spar.

Your kite is now ready for the bridle and tension line to be attached.



BRIDLE

Cut a 12" piece of bridle line and tie each end to the leading edge through the melted holes. The finished length is not critical, it should end up about 9"-10" after making the knots and trimming the ends.

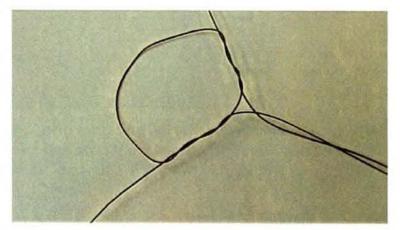
Cut a 10" piece of bridle line and tie the cross spars together with the spine at the center of the kite.

Cut a 24" piece of bridle line and tie a 2 1/2" - 3" long loop in one end.

Using the loop end, form a larks head or double larks head knot around the bridle line you tied to the leading edge. You want the bridle to be on the front face of the kite.

Tie the remaining end of the bridle line to the spine below the crossing of the spars. But before you do, make sure the finished bridle length is not long enough to wrap around one of the leading edge corners.

Cut an 8" piece of bridle line, fold it in half and tie a knot in the loose ends so you end up with a 3" loop or there abouts.



Using a double larks head knot, connect the loop to the lower part of the bridle line. This is where you will be connecting your flying line.

TENSION LINE

Cut a 24" and a 12" piece of bridle line.

Make the 12" piece into a 5" long loop and tie an overhand knot and secure it.

With the loop, tie a double larks head knot (Prussik knot) onto the 24" piece.

Put the loop through one of the holes near the end of the leading edge spar. Once you have part of the loop through the hole, pull the rest of the line through the loop and pull it snug so the loop locks around the leading edge spar.

Tie one end of the 24" line through the hole at the other end of the leading edge spar.

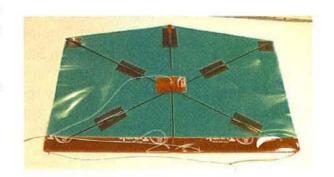
Snug the Prussik knot and while holding the knot between you fingers, pull the loose end of the 24" line so it is snug.

Tie a knot in the loose end close to the Prussik knot to prevent it from accidentally being pulled through the Prussik knot. And then trim off the extra line.

Your kite is complete, go fly, fly, fly, and grin, grin, grin! You now have a fighter kite that is one of the more enjoyable and intriguing to fly!!





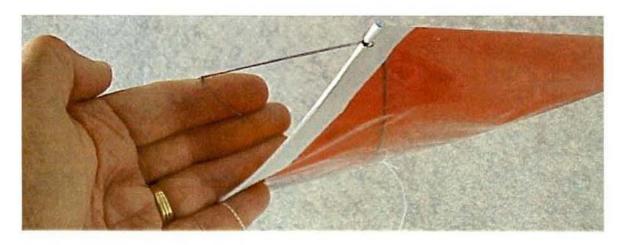


BEFORE YOU FLY IT

Before flying, put a bow in the leading edge. To do it, tension the tension line by holding the Prussik knot between your fingers and slowly and carefully pulling on the loose end of the line, using the knot in the end of the line to grab on to.

When the desired amount of bow is achieved, (usually about equal to the distance of 3 fingers between the leading edge and the tension line), give a tug to the line in a direction parallel with the tension line and toward the opposite end of leading edge spar.

To loosen, hold the Prussik knot in your fingers and pull the tensioned portion of the tension line through the Prussik knot, shortening the tension line loose end.



If you've never flown a Buka or Buka-like kite, it may be useful to read the article about tuning and flying Buka's. This 5 sided kite acts very much like a Buka and responds in the same way as a Buka to bridle adjustments, amount of bow put in leading edge, etc. I think of it as a Buka and fly and adjust it like one.

Have Fun!

BUKA BUKA!

BRUCE'S TUNING TIPS FOR 4-SIDED BUKAS AND 5-SIDED FIGHTER KITES

If you have never flown or even seen a 5-sided or Buka style kite, you have really missed one of the most interesting and amazing high performance fighter kites!

A Buka is a rectangular or trapezoidal 4-sided kite. A 5-sided kite has very similar characteristics to a Buka and similar in appearance.

In this article I use them interchangeably. Where I mention a Buka, the same suggestion and/or tip applies to a 5-sided fighter as well, and visa versa.

On a buka, one of the long sides of the rectangle is the kite's leading edge, on a five sided kite, the longest edge is the leading edge.

In the air they have a very unusual, if not awkward, appearance. Their flight is highlighted by their odd way of spinning, hovering, and their superb tracking ability! In the hands of a skilled flyer, a Buka should not be under estimated in a line touch competition, despite its odd and slightly awkward appearance!! Bukas are fierce fighters and can hold their own with any other style fighter!!

Here are a few points that may assist you in tuning and flying a Buka.

1. The leading edge spar is supposed to be bowed during flight. It has a leading edge tension line on the backside of the kite to bow the leading edge.

To bow the leading edge, tighten the tension line. Hold the adjustable knot (at the end of the short loop) with one hand and gently pull the short loose end of the tension line with the other hand. Once you have the amount of bow you want in the leading edge, tug a couple of times on the loose end of the tension line to lock the adjustable knot in place.

2. A good way to determine an initial amount of bow in the leading edge is to have enough distance from the taut ten-

sion line and the leading edge spar so you can fit 3 fingers between them. Once you are familiar with the characteristics of the buka, you may want to change the amount of bow in the leading edge to better match the wind conditions, but to begin with, 3 fingers is a good starting place.

3. If your kite has not been partially tuned and you are starting from scratch try this. After bowing the kite, set the tow point on the bridle so the kite is almost at a stall. This means that when you try to fly it, the kite just seems to stay in one place, not wanting to climb or to descend. To achieve this, the tow point is fairly low on the bridle, toward the tail of the kite.

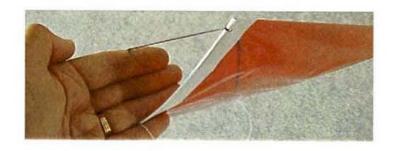
The reason for this starting position is it gives you an opportunity to fly the kite slowly.

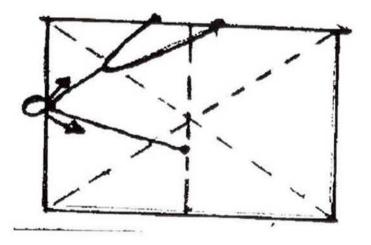
The closer the tow point is to the stall point, (kite in equilibrium), the slower the kite will move. As you move the tow point toward the leading edge, the kite will speed up its forward motion and will be more willing to spin and will spin faster. Initially this behavior may be more difficult to control if you are not prepared for its actions. Starting at a stall will slowly bring you to the spunky action of the kite.

Begin to move the tow point toward the leading edge in 1/8" to 1/4" increments. Test fly the kite after each change in the tow point position until you have the kite in a slow flying condition.

4. Bukas have a 3 point bridle. A 3 point bridle means the bridle is connected to the kite in 3 places. This style of bridle has 2 adjustments. The tow point adjustment mentioned above, and a lateral or yaw adjustment to control the straightness of the kite's tracking.

Once you have the tow point positioned, the kite may be veering to one side or the other. If so, the lateral or yaw





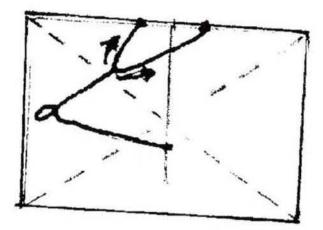
adjustment is what will allow you to correct this situation and get the kite to a straight flight path or straight track.

5. For example, if the kite is veering or turning consistently to the right, you will move the adjustable knot on the upper bridle leg to the left. This adjustment is extremely sensitive, so only move it a 1/64" ,or less, at a time and test fly the kite after each change in the bridle position until you have the kite flying or tracking straight.

6. As you become more familiar with the Buka and its unique characteristics, you will want to begin experimenting with changing the tension on the leading edge spar to increase and/or decrease the bowing in the leading edge. Also you will want to play with the setting of the tow point. So the kite will fly to your preferences.

7. One aspect of a Buka is it is very difficult, read virtually impossible, to launch it from the ground after a crash or a landing. So, flying a Buka provides a little more exercise than flying a diamond derivative fighter that will "self launch" after a grounding!! Buka's are worth a little bit more exercise! They are a "Hoot" to fly!

Have Fun! Flying 5-sided kites and Buka's Makes Me Grin Really Big! Hope they do the same for you!!





"Blue Boy"

BLUE BOY IS A FUN KITE TO FLY. IT IS QUICK, FAST AND HAS A RELATIVELY LIGHT PULL. THE IDEAL WIND RANGE FOR THIS KITE IS 4 - 12 MPH.

Use a mylar-like plastic film for the sail, bamboo for the spine, 0.05" diameter carbon fiber rod for the bow and 0.03" diameter carbon rod for the battens.

Contact cement and packing tape are the construction adhesives that are used.

Packing tape is for reinforcing the leading edge, nose, batten ends and the point of shape change on the leading edge.

Contact cement is used for the hem area that encloses the bow from the wingtip to the point where the leading edge changes shape and also to install the spine and battens.

ASSEMBLING THE KITE:

Using the full size half plan in the book, fold your sail material in half and align the spine of the pattern with the fold of the sail material. Using a razor knife or xacto, cut out the sail.

Apply packing tape to the nose area of the leading edge so about 3/4" of the tape is on the kite sail. Since the packing tape is 2" wide, it will extend beyond the kite. Re-cut that portion of the leading edge to get rid of the extra tape that is outside of the leading edge. This reinforcement is optional, the kite will fly well without it, but it will perform better in higher winds with it.

Prepare spars, including sliding the bridle stops onto the bow, leaving them loose for the moment. The bow is 20" long and is 0.05" diameter carbon fiber rod. Cut the bamboo to length to fit the spine or fold line on the sail.

Apply contact cement to the bow hem area, spine and batten lines and to the spars themselves

After the glue has dried for about 10 minutes or so, I use my bow setter to install the bow. Then install the spine and battens. Apply reinforcing tape to the nose, and the point where the leading edge shape changes, where it meets the bow. Using a small diameter tipped soldering iron, melt holes in the

sail for the bridle connections and a hole on either side of the spine at the cross point of the bow and spine. You will tie the two together.

Using super glue attach the bridle stops on the bow to their precise locations so that the outside edges of the stops are 1" either side of the spine center.

Using a 12" piece of bridle line, tie one end to each of the bridle points on the bow, this is the upper bridle line. The finished length is not critical, about 9"-10".

Tie a 2" to 3" long loop in one end of a 24" piece of bridle line. Using the loop, make a larks head or double larks head knot around the upper bridle line. Tie the loose end to the spine at the lower bridle connection point so that the completed stretched out bridle will be about 1" inboard of the wing tip.

Tie a 2" to 3" loop in a 6" piece of bridle line. Larks head or double larks head this loop to the lower bridle line. This is where you will attach your flying line.

Tie the bow and spine together at the point they cross near the nose of the kite. Put the knot on the backside of the kite.

The last step is to dust the exposed glued areas with cornstarch. I use a small paint brush. This is an idea I was given by Kevin MacInnis of Seattle.

Now go to the flying field to test fly it and make any bridle and other tuning adjustments needed for optimum flight.

Fly it a lot! Grin a lot! Bruce

1/2 PLAN FULL SIZE. (WIND RANGE 4MPH - 13 MPH) PACKING TAPE REINFORCEMENT (OPTIONAL) LEADING EDGE (NO HEM) REINFORCE WITH PACKING TAPE BRIDLE POINTS BOW 12 0.05" LEADING FOGE CARBON FIBER ROD ZO" LONG BOW TIP

BAMBAD Long OPTIONAL BATTENS BRUCE'S BLUE BOY" USE MYLAR OR SIMILAR THIN PLASTIC FILM FOR SAIL MATERIAL.

Bruce's ALMOST SQUARE Fighter Kite

A GREAT WORKSHOP FIGHTER

This kite is fairly easy, inexpensive, quick to make and flies very well. Its performance will allow you to learn virtually all fighter kite flying skills, plus will be very effective in fighter kite competitions. And, if you just want to enjoy the fun of flying a fighter kite, flying the BASF will give you hours of pure kite flying enjoyment!

You can use many different materials for this kite, such as Tyvek, ripstop nylon, ripstop polyester, Orcon, paper, a plastic bag, or mylar or mylar-like plastic gift wrap films. The technique described here is the way I make kites using a plastic film type of material for the kite sail or skin.

These instructions are based on using a mylar or mylar-like film for the kite's skin. This material is lightweight, strong, waterproof, inexpensive and fairly easy to work with.

The particular gift wrap or floral wrap film I use is readily available at Michael's Craft Stores for less than \$3 for a roll. It is called Clearphane, Cellane or other names and is available in solid transparent colors as well as some patterns. Any gift wrap mylarlike film will work just fine. A roll has enough material on it to make many kites! So buy a roll with a couple of friends and share your fighter kite making experience!

These instructions use 2 different types of tape to hold the kite parts together. You can apply this construction technique to any kite plan you want to make.

Please read the entire instruction before you begin. This will give you an overview of what is involved.

MATERIALS LIST

A 17"x17" piece of mylar-like film. Position the kite pattern diagonally on the material if you are using this minimum 17"x17" size, or if your material has a grain or pattern in it, you may need it to use a 19"x21" piece in order to properly orient the pattern.

Clear packing tape that is approximately 2" wide by about 36".

About 12" of double-sided carpet tape.

Bamboo spine 19" long. Bamboo is the best material to use for the spine of the kite.

Bow material. If you want your kite to fly in light winds, 2mph-6mph, then use a 23 7/8" bow of 0.05" diameter carbon fiber rod, if you want your kite to fly in winds from 4 mph-10mph then use a 23 7/8" bow of 0.06" diameter carbon fiber rod.

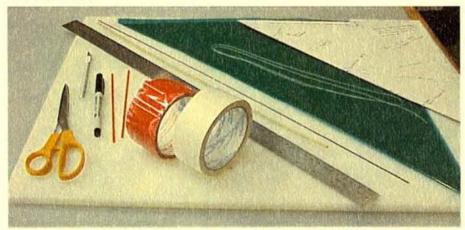
A couple of drops of Super Glue

About a 1/2" length of the smallest diameter vinyl tubing or shrink tubing you can find. These are used as stops for the bridle connections on the bow.

Optional Batten material. You will need 2 pieces each about 6 1/2" long. You can use small diameter drinking straws, I ike is used for stirring coffee. The ones I use are red.

Approximately 50" of 15# - 20# test dacron line for the bridle. Any strong small diameter, low stretch line will work just fine, including cotton, linen or spectra.

THE TOOLS



A 24"x 20" work surface that will allow you to cut with a razor or xacto knife.

A very sharp breakoff utility knife or xacto with new blade

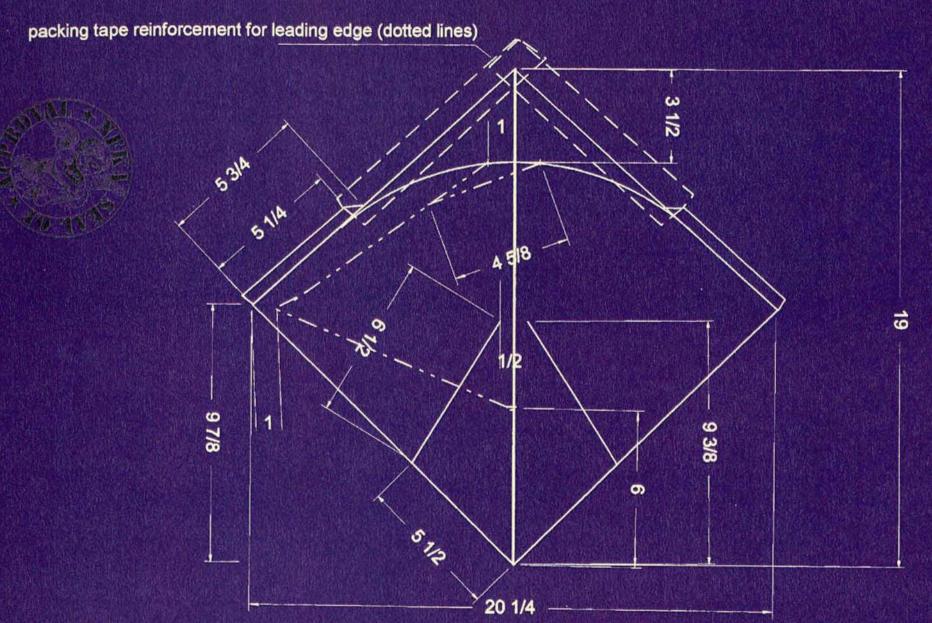
24" straight edge ruler

A Sharpie extra fine point marker

Sharp scissors

Construction nail, about 8 penny size, and a cigarette lighter or a pencil point soldering iron

Bruce's Almost Square Fighter (BASF)



Bow 23 7/8" long. Use 0.05 carbon fiber for winds 0.5 - 5 mph.

Use 0.06 carbon fiber for winds 3 - 9 mph.

MAKING THE TEMPLATE. You only need a template for half the kite. The included drawing of the BASF is to scale. So the easiest way to make it full size is to enlarge it on a copy machine to the size that the spine length on the finished enlarge version is 19" long. Transfer the half size template to a matt board or heavy poster board or other hard material you will use as a cutting template. Of course, you can also draw the half kite pattern directly onto the template material.

I put small holes in the template at the points where the bow tips will be located at the wing tips, the lower bridle connection point, the point where the bow and spine cross, and the points where the bridle attaches to the bow and the location of the battens.

CAUTION NOTE: Before you actually cut out the skin, there is one characteristic of mylar and other plastic films that I want to share with you. It is this; once an edge is nicked, it easily tears at that point.

HERE IS HOW TO MINIMIZE THIS POTENTIAL PROBLEM.

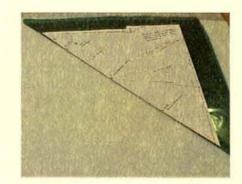
When cutting out the kite skin with a knife, do not stop the knife along the cut. Make each cut with one uninterrupted pass of the knife. If you are using a template, make one pass with the knife

on each edge. The only place you can stop the knife is at the corners. It is very disappointing to finish the kite and during its first flight, the skin tears for no apparent reason! The reason is the "nic" made by the knife stopping and starting. Fortunately with

a piece of packing tape it can usually be fixed.

MAKING THE SKIN. Fold the material so you have at least 19" along the fold. Align the half kite template so the spine of the template is on the crease. Now use the Sharpie pen to put dots on the material in all the holes in the template. Use an xacto knife and cut around the template. Now turn over the material and using your Sharpie, put dots on top of the existing dots so both sides will have them.

Open the material and lay it flat on your work surface.



LET'S GET STARTED!

If you plan to make only one BASF, then you can draw or transfer the full size pattern directly onto the mylar kite skin. But, if you think you would like to make more than one, or if friends want to make one or more, you should make a template to speed cutting out the kite skins.



OPTIONAL STEP

Now we are going to reinforce the leading edge with packing tape. This is an optional step. The kite will fly just fine in light wind without it, but the kite, even in light wind is more durable with the reinforcement. Cut about a 12" or so length of tape. When you look at the included plan, you will see the dotted lines showing where the reinforcement tape is to be applied.

Using your eye as a guide, it doesn't need to be exact, place one end of the tape on the kite skin about 1/2" beyond the intersection of the left tab and the leading edge. Place it so that when you extend the tape to the nose of the kite skin, about from 3/4" to 1" of the tape will be on the inside of the leading edge line. This is the part of the tape that will remain on the skin of the kite as reinforcement.

After completing the left side, do the same for the right side. Trim away the packing tape along the leading edge.

CARPET TAPE

Now apply double-sided carpet tape to the kite tabs. Mark on the roll of tape about eight 7/16" - 3/8" wide strips. Cut pieces of carpet tape so they are about 7/16" - 3/8" wide. Apply the tape to the tab area on each wing tip aligning the tape with the outside edge of the tap.

PREPARING THE BOW.

Now you need to get the bow ready to put onto the kite skin. First, cut the carbon fiber to the correct length and sand the ends so they are rounded. Next place two 1/8" wide slices of small diameter vinyl tubing onto the bow. Leave them loose. The bow is now ready for installing, which we will deal with a bit later.

PREPARING THE SPINE.

Cut your bamboo spine to 19" long.

The shinny or skin side of the bamboo is the side to put onto the kite sail. Now the spine is ready to be attached to the skin.









PREPARING THE BATTENS.

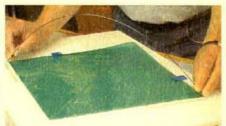
Cut the material you have chosen to use for the battens so you have 2 - 6 1/2" pieces. The battens are now ready for taping to the skin.

INSTALLING THE BOW.

Next, peel off the carpet tape protective paper covering on the tape you just put on the tabs.

Pick up the bow, make sure the 2 slices of vinyl tubing are near the center. Flex the bow and touch the tips at the edge of the trailing edge on both sides so that they are just barely on the carpet tape, keeping the bow above the kite skin except for the tips. Holding the tips in place, allow the bow to rotate down to the kite skin. As it touches the kite skin, it will also be touching the carpet tape. Press the bow onto the carpet tape where it is naturally touching it. Then, while holding down one side of the bow onto the kite skin, fold over the carpet taped tab around the bow and onto the kite skin. Burnish the tape and do the same for the other side.





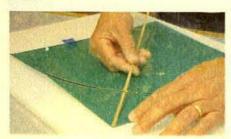




INSTALLING THE SPINE.

Cut 2 small pieces of carpet tape, about 1/8"x 1", and apply to the nose and tail of the spine.

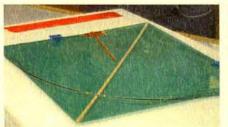
Install the spine so it is attached to kite skin at the nose and tail of the kite and the spine runs along the centerline of the kite. Place the curved portion of the spine so it is trying to force the nose up off the work surface.

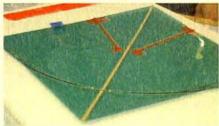


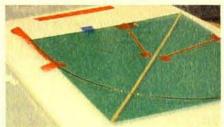


INSTALLING THE BATTENS.

Cut 4 small pieces of packing tape, about 3/8"x 3/4". These will be used to hold the battens in place on the back side of the kite skin. Place the left batten in its position. While holding it there, place one of the pieces of tape on the end of the batten that is nearest the trailing edge. Be sure the tape is not extending over the trailing edge. Next, apply a piece of the tape to the end of the batten closest to the spine. Do the same with the other batten.







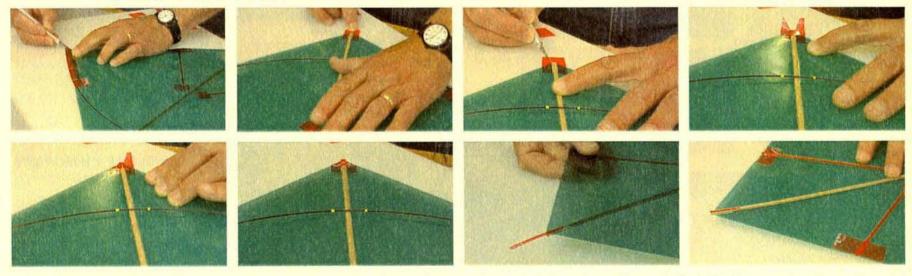


PACKING TAPE REINFORCEMENT.

Reinforce the wing tip area where the tabs have been folded over with packing tape. Cut 2 pieces of packing tape about 1" wide by about 6" long. Apply the tape so it wraps around the point where the tab that is holding the bow in place, joins the leading edge of the kite. Do the same to both sides. The reinforcing tape should be about 1/3 on the front face of the kite and 2/3 on the back side.

NOSE TAPE.

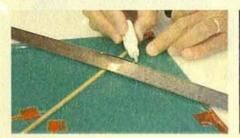
Now, reinforce the nose of the kite with tape. Place the kite on the work surface so it is lying on its face with the nose pointed toward you. Cut a piece of tape about 1"x1 1/2" and lay it sticky side up on your work surface so that half or so of the length of the tape is under the nose of the kite. Press the nose of the kite down onto the tape. With your xacto knife, cut two slits in the tape aligned so the cuts are extensions of each side of the spine. Fold the center portion of the tape over the spine. Then, fold over one side of the remaining tape onto and around the back of the kite skin and onto the spine. Do the same with the other side.



TAIL TAPE. Cut a 1/8" wide piece of packing tape and apply it around the end of the spine. About half of the 2" long piece is on the front of the kite sail and the other half on the back of the spine.

SECURING THE BRIDLE POINTS. With the kite lying on its front face with the nose pointing toward you, move the loose vinyl tubing pieces so that one is on either side of the spine, but within 1/2" of the spine. Lay a ruler across the spine just below the bow so you can accurately measure 1-1/8" on either side of the spine center. Put a drop of super glue on the bow about 1" either side of the spine. Slide the vinyl pieces to the glue so that the outside (wingtip) edge of the vinyl is 1" from the spine center. Once the vinyl touches the glue it should hold it.

Now with your Sharpie pen, mark on the kite skin the location of the outer edge of each of the vinyl pieces.





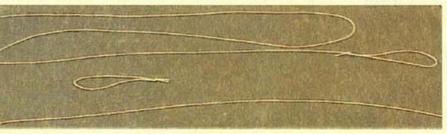




MAKING HOLES FOR THE BRIDLE.

Using a small diameter soldering iron, touch the hot soldering iron to the kite sail at the dots on the lower part of the spine, at the points were the bridle stops are located on the bow, and at the point where the bow and spine cross. You could also use a lighter or candle flame to heat a nail hot enough so it will melt the kite skin material.





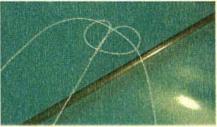


BRIDLING THE KITE. For the bridle cut 3 pieces of bridle line, one 12" –13" long, another about 20" long and the third about 6" long. Take the 6" piece and fold it in half and tie an overhand knot and trim the ends, set it aside. This will be the "tow connection".

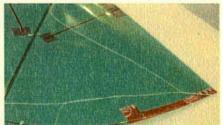
Next tie one end of the 12" piece to the bow through one of the holes in the front face of the skin. Use any knot that will hold well and is easy for you to tie. When I tie the knots, I usually have about an inch or so of line that is a tail that I later trim off. Then tie the other end of the 12" line to the other bow bridle point. Trim the tails so they are only about 1/4" or so. The finished length isn't critical, it should be about 9"-10".

With the 20" piece, loop one end over on itself and form about a 4" long overlap. Tie an overhand knot there to form a loop that is approximately 3"-4" long. Attach the looped end to the 12" bridle line you just tied to the bow. To do this, use a larks head knot. Center it and tighten. Tie the loose end through the lower bridle attachment point holes in the skin and around the back of the spine. Before you tie it, pull the bridle line toward one wingtip of the kite. When tied, the bridle should not be long enough to extend over or outside of the wingtip.









Tie the lower bridle point and trim the tail of the line.

Using a larks head knot to attach the two parts of the bridle allows for adjustment of the kite's bridle.

Attach the 3"-4" loop you made earlier to the lower bridle line using a larks head knot. This is the point where you will attach your flying line, it is called the tow point. Using a larks head knot allows the tow point to be adjusted up or down to suit the wind and your flying style.

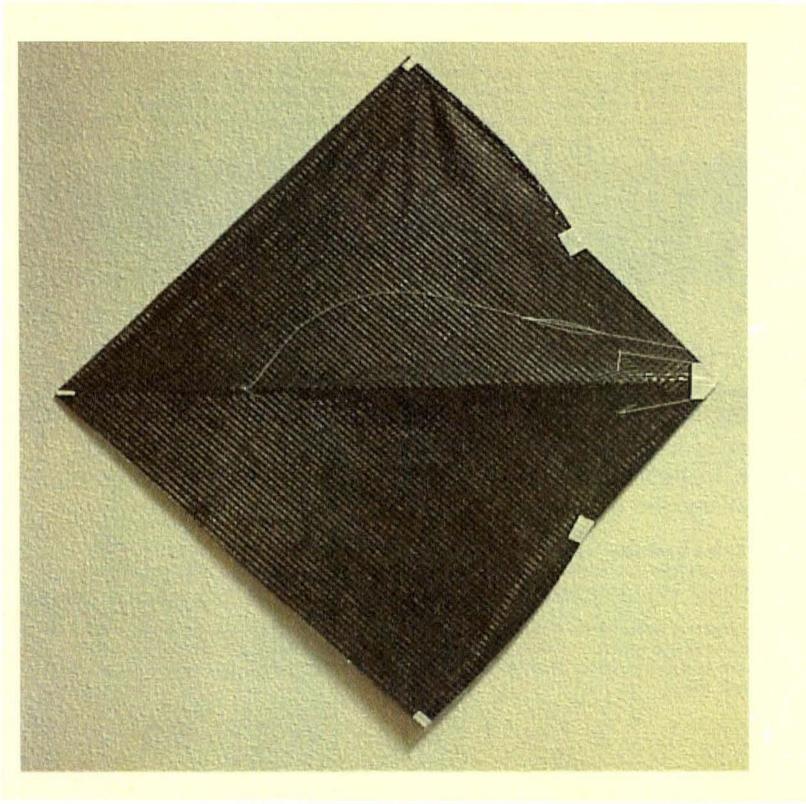
CONGRATULATIONS!!
YOU HAVE MADE A GREAT FLYING KITE!
GO HAVE FUN WITH IT!

MAKING BRUCE'S 4-2-12 FIGHTER KITE

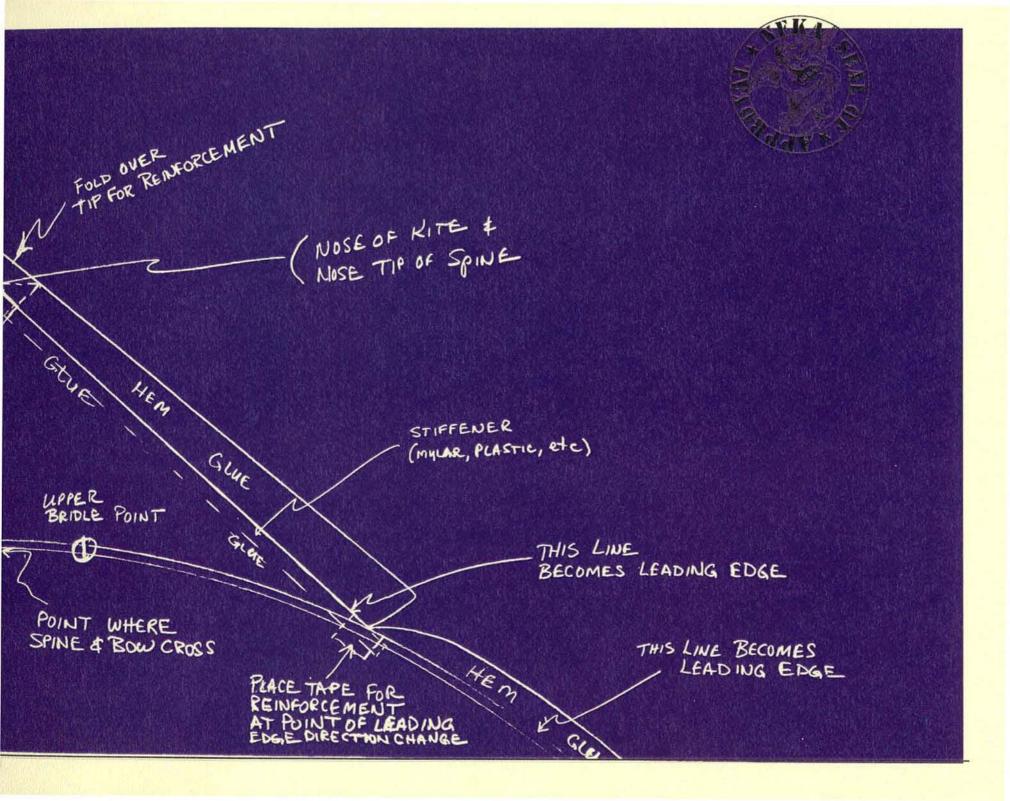
This kite plan and building project will produce a successful, highly competitive, flyer! I have made many kites of this exact plan in the exact way I will describe. Each one has been a successful and competitive kite. In fact this particular kite I used in virtually all the line touch competitions I entered in 1998, including the AKA Nationals. In those competitions, this kite won first, second or third each time except one.

The name 4-2-12, is the optimum wind range, 4mph - 12mph, for this kite, when using a 0.06" diameter carbon fiber bow. Using a 0.05" diameter carbon fiber rod for the bow will create a high performance lighter wind kite, I call it the 1.5-2-5 (1.5mph-5mph).

There are several techniques that work well for building kites. Such as sewing, taping and gluing, or any combination of them. The process I'll use here is my favorite because it produces a kite quickly, is fairly simple and requires no special tools or sewing machines. This kite can be made in about 2 hours if you have all of the equipment and materials at hand.



4-2-12



GLUE Bow 22 15/16" LONG USE 0.06" DIRMETER CARRON FOR 4-12 MPH WINDS BEGIN D. DS" DIAMETER CARBON SPINE BEND FOR 1.5-5 MPH WINDS. 95/8" BAMBOO SPINE 171/2" LONG LOCATION OF BOW TIP 0.03, 0.04" CARBON, BAMBOO, DRINK STRAW) BATTEN 5/2")

LOWER BRIDLE ATTACHMENT POINT BRUCE'S AMPH-IZMPH OR ORCON 1.5 MPH-5 MPH FULL SIZE 1/2 PLAN

MATERIALS LIST

Spine - Bamboo approximately 1/8" x 3/16" x 19"

Bow - Carbon fiber 0.06 x 23" for the 4-2-12, or 23"x 0.05" for the 1.5-2-5.

Skin - Orcon, ultra lightweight, 20" x 20".

Ultra lightweight Orcon has become my favorite fighter kite sail material. However, you can use you favorite material for the kite skin and use this construction technique. I have used Tyvek, ripstop nylon, lcarex, mylar, polypropylene film, and other plastic films and they all fine with this construction method.

Glue - Contact cement, regular hardware store stuff. Weldwood, or any other contact cement. It comes in small bottles, tubes and large cans.

Bridle - 4 feet of 12# - 20# test dacron, spectra, linen, or any other small diameter line with comparable strength

Battens – 2 pieces of 0.03" diameter carbon rod each about 5 1/2" long. I have also used small 1/16"x1/8"x51/2" bamboo or a 5!/2" length of small diameter red colored coffee stirring straws for successful battens.

Leading edge stiffeners – thin, but stiff, plastic, ie drafting mylar, acetate or similar. 2 pieces each about 7" long and 3/16" wide.

Orcon tape - about 12" of a 1" wide Orcon tape or any tape that will adhere well to Orcon, that is, if you are using Orcon. Otherwise use reinforcement tape that will adhere well to the fabric you are using for the sail.

Cornstarch and small paint brush

TOOL LIST

Soldering iron with hot cutting blade, or a hot cutter of some sort Scissors
Ruler, accurate to 1/16"
Hack saw, wire cutters (to cut carbon fiber and the bamboo)
Candle or propane torch

Soldering iron with small diameter pointed tip Straight edge Glass cutting surface Utility knife to shape bamboo

FIRST STEP

Read carefully through all of the instructions so you have a general idea about the process and what to expect. As I was writing this, it became clear, building a kite is quicker and simpler than trying to write a description about building one! Please don't let the length of the description lead you to think it is difficult. Once you understand it, it is quite simple.

MAKING THE SAIL TEMPLATE.

I use a full size template made of formica-like plastic laminate. I draw the kite plan on it, including allowances for hems etc and cut it out with a large (12") pair of tin snips. These cutters work well for cutting formica quickly and accurately. You may want to practice a little because the formica is brittle and by improperly stressing it, you can splinter and crack it during the cutting process.

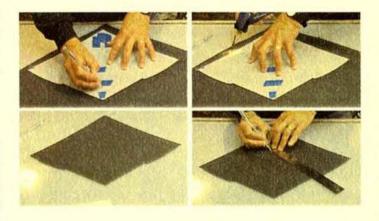
On my template I drill small holes large enough for the tip of a ultra fine tipped Sharpie pen to fit through, at the locations of the tips of the bow near the trailing edge at the wing tips, location of the battens, location of the stiffeners for the leading edge and for identifying the hem areas.

CUTTING OUT THE SAIL.

I lay out the Orcon, it is black in color, on my glass work table and smooth it down. Then I place the template on the Orcon and orient it so the ripstop grid lines are aligned as parallel as possible with the trailing edges of the template. Then I mark through the template holes, using a metallic silver pen or, if the sail material is not black, I use a Sharpie. Using my hot knife, I cut around the template.

Because the hot cutting process melts the Orcon, a small bead of melted Orcon is created that adheres the kite sail to the glass work surface so it doesn't have a tendency to move around.

After the sail is cut, using a straight edge, I draw lines connecting the small dots I marked on the sail through the holes in the template. These lines identify the location of the battens, leading edge stiffeners and spine, etc.



PREPARING THE SPARS.

Next I cut the exact length of carbon fiber 0.06" diameter rod for the bow. In this case it is 22 15/16". After smoothing the ends, I slide 2 – 1/8" long pieces of small diameter tubing or heat shrink tubing on the bow. I use a heat shrink tubing. These will be used for the bridle stops.

I measure a piece of bamboo for the spine and cut it to length. I use prepared spines I import from Indonesia and India. These spines have no knots or nodes and are virtually ready to use. This makes the job of shaping the spine very quick and easy. After the spine is cut to length, I make sure it is straight and true by eyeing it along its length. If it has a curve in it, I gently heat it over the low flame of a small propane torch and straighten it out.

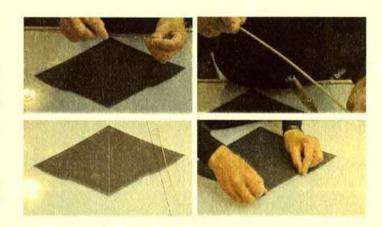
After the spine is straight, I mark the location where I want a specific bend and gently heat it there and bend it to the amount I want. It is usually a very slight "rocker" shaped bend so when the tail portion of the spine is held flat on a table the nose will rise above the table be about 5/8" to 7/8".

Cut 2 battens to length. For batten material I use 0.03" diameter carbon fiber rod, a small diameter piece of bamboo or a small diameter drinking straw, the straws I use are red.

STIFFENING THE NOSE AREA OF THE LEADING EDGE.

I have noticed a kite's performance is improved when the leading edge is stiffened. I am talking about the leading edge beginning at the nose of the kite and running to the point where it meets the bow.

To stiffen the leading edge I use a thin but stiff piece of mylar, acetate, or any other plastic that will be light weight, thin and stiff. I often use a drafting mylar. I cut a piece about 3/16" wide and long enough so the stiffener reaches from the nose and lays under the bow at the point where the leading edge meets the bow.



APPLYING THE GLUE.

With the parts all cut to size, I begin gluing them together. I first load my glue syringe with contact cement from a small bottle of it I keep on my worktable.

I place a "bead" of glue along the hem area along the leading edges, from wingtip to nose. Then I smear the "bead" of glue into a light, fairly uniform coating using a small piece of closed cell foam as a brush. The closed cell foam I use is cut from a piece of foam pipe insulation.

Next I lay a small "bead" of glue along the spine and batten lines I drew on the sail.

While I am waiting for the glue to dry, I apply glue to the bow, spine, leading edge stiffeners and battens. On the bow I apply glue from each wingtip inward about 8".

After about 10 minutes or so, the glue is dry to the touch, a little tacky, but dry.

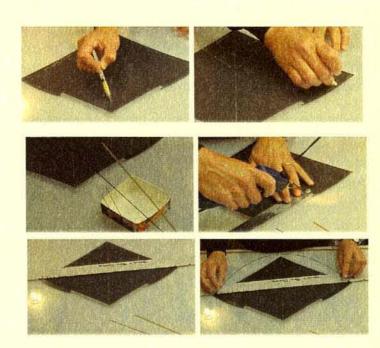
LEADING EDGE STIFFENERS

First I lay the leading edge stiffeners along the line I drew on the sail from about 1/8" from the nose to about 1/4" beyond where the bow intersects it. Remember, once you touch the 2 glued surfaces together, that's it, they are stuck!

I don't fold over the hem to cover the stiffeners until after I install the bow.

BOW SETTER

From 2 laminated pieces of formica, I made what I call a bow setter. A yardstick would work just as well. It holds the proper shape and tension in the bow during the assembly of the kite. A notch is cut in the bow setter that corresponds to the precise location of the bow tips.



INSTALLING THE BOW

I align my "Bow Setter" with the wingtip location dots marked on the trailing edge, using masking tape, tape the bow setter to my glass work surface. The bow setter is laying across the kite sail, including the "dry" glue for the spine and battens. It doesn't seem to stick to them.

Once the bow setter is positioned, I take the bow and make sure the 2 pieces of heat shrink tubing are near the center, then I hold the bow tips between my hands and apply a gentle pressure to begin to flex the bow. Once the bow flexes it will automatically rotate in your hands to find its "natural" shape.

Then I insert the bow tips into the notches in the bow setter. At this point, the bend of the bow is basically perpendicular to the sail. Now that the bow tips are secured in the bow setter notches, I carefully allow the bow to naturally rotate toward the nose of the kite sail until it touches the sail.

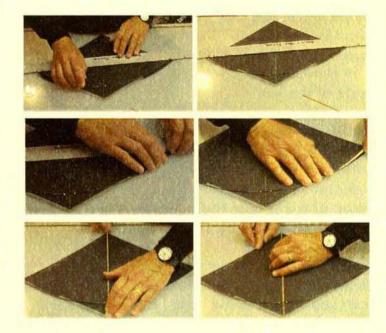
Once the bow is on the sail I press down the glued areas just to be sure there is good contact. Then I begin at the nose and fold over all the hems of the leading edges. This secures both the stiffeners and the bow. Once the hem has secured the bow, I remove the bow setter and finish folding over the very tips of the wings that the bow setter interfered with.

INSTALLING THE SPINE.

Being careful not to touch the glued surface of the spine to anything, slide the spine under the bow and raise the tail portion above the work surface so only the nose of the spine touches the very nose of the sail. Then slowly lower the spine onto the glued spine line on the sail. Sometimes, while lowering the spine, it is also necessary to push the spine toward the nose to create a little more tension in the sail, making it free of wrinkles.

BATTENS

Lay the battens on the glued batten lines on the sail.



REINFORCING TAPE

Without moving the kite from the table, I begin to apply small pieces of Orcon tape for reinforcing. Each end of the battens get a piece. Then for the rest of the reinforcement pieces, I will fold the tape over the edge of the kite so about half of it is on the face and half on the back side. Each wingtip gets one, the point were the bow changes shapes on the leading edge gets one and the very tail of the spine gets one.

I then pick up the kite and fold over all the tape that needs folding to the face of the kite and apply the nose reinforcement tape. For the nose I lay the tape, sticky side up on the work surface and push the nose of the kite face onto it, then with an xacto knife, I cut 2 slits at an angle of about 45* from the spine outward to the edge of the nose tape. Then I fold over the center portion onto the spine and each of the remaining portions I fold over the leading edge, spine and backside of the kite.

BRIDLE STOPS

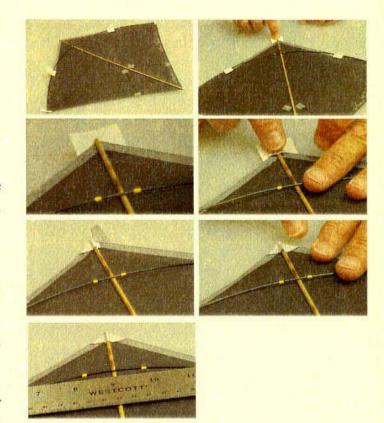
With the kite lying on the worktable on its face, I lay a ruler across the kite near where the spine and bow cross. I line up the ruler so it can accurately measure 1" either side of the center of the spine. I place a drop of super glue there and slide the heat shrink tubing onto the glue so the edge of the tubing closest to its wingtip is at the 1" mark.

Then I mark on the sail, the location of the bridle stops with a silver marker as well as the location of the lower bridle point. I do this so I can see where to melt the holes for the bridle line.

MELTING HOLES FOR THE BRIDLE.

Using a small diameter tipped soldering iron or heated nail, I melt a hole about 3/16" diameter at the points I marked on the sail. These are at the outside edges of the bridle stops. Be careful not to touch the bow with the hot soldering iron as it will very likely melt or seriously weaken it.

I also melt a hole in the sail either side of the spine at the lower bridle connection point and at the cross point of the spine and the bow.



BRIDLE

I use a 3 point bridle. For it I cut 4 pieces of line. 1 - 12", 1 - 24", 1 - 6", 1 - 8". In one end of the 24" piece, make a loop about 3" long. I tie an overhand or figure 8 knot.

Fold the 6" piece in half and tie an overhand or figure 8 knot in the ends forming a loop about 2 1/2" long.

Through the bridle holes on the front face of the kite, tie each end of the 12" piece, this is the "upper bridle leg". Use any knot that will secure them. The upper bridle attachment knots should be pulled snug against the outside edge of the bridle stops. The finished length of this piece is not critical, it will probably be about 9"-10". Allow the upper bridle leg or loop to lay on the front face of the kite.

With the loop in the end of the 24" piece of bridle line, make a larks head or double larks knot around the upper bridle loop or yoke and while holding the 2 connection points on the bow, pull the larks head tight. This is the "lower bridle leg". The larks head knot should be in the center of the upper bridle leg and be located over the spine.

Secure the remaining end of the 24" lower bridle leg, to the lower bridle connection point, through the holes in the sail and around the spine. Before you tie the knot, stretch the entire bridle toward one wingtip. The total bridle length should be short enough so the bridle will not wrap around a wing tip. I usually make mine so it is about 1" inboard from the wingtip.

With the 6" piece that is now a 2 1/2" loop, attach it using a single or double larks head knot to the lower bridle leg. This is the tow point, the place you tie your flying line to the kite.

Tie the bow and spine together using the 8" piece of bridle line. I tie them at the point where they cross. The knot is on the back side of the kite.



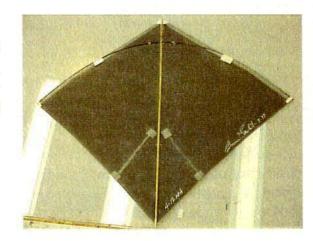




LAST STEP

The last thing I do is on the backside of the kite. I dust the areas of exposed glue with cornstarch by brushing it over the glued areas. This virtually eliminates the exposed glue from picking up sand or sticking to other things it comes in contact with. I learned this trick from Kevin MacInnis of Seattle.

Now is the fun part, fly, fly, fly, fly!!!





Who says my kites are kites? My kites are not kites. After you understand that, We can discuss kites. After a particularly great fly I often attempt to capture it conceptually using paint and written notes. The art is applied quickly and chaotically to match what is for me the very soul of flying fighter kites.

HERE ARE 3 EXAMPLES.

A LONELY WINTER'S DAY. CLEAR, THEN CLOUDY.

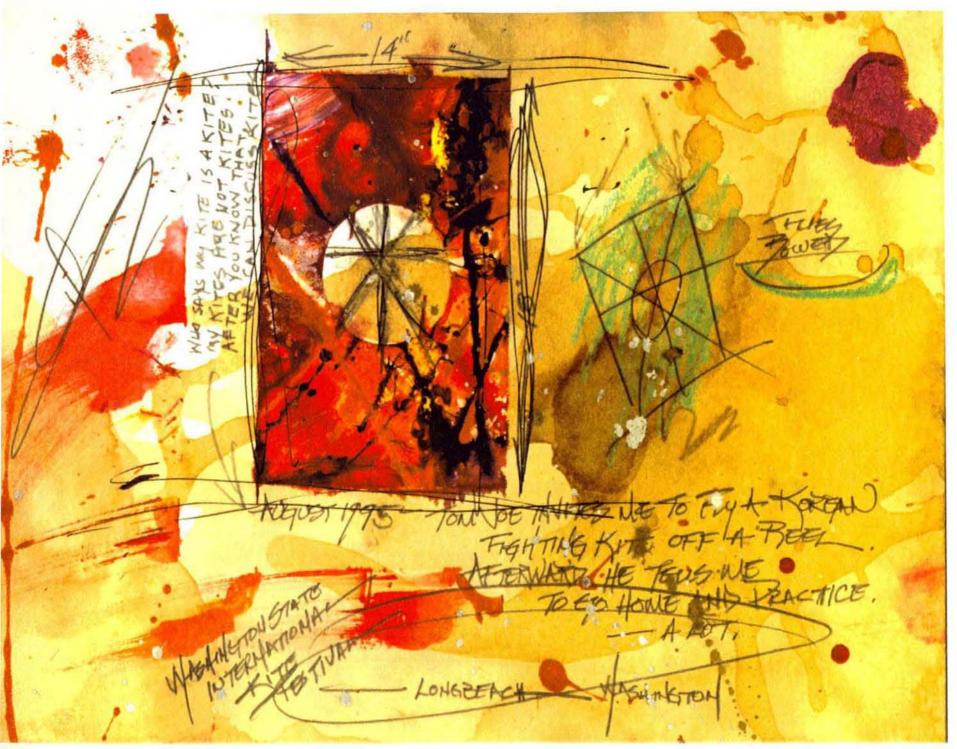
UNEXPECTEDLY AN OLD FRIEND COMES AND URGES ME TO FLY WITH HIM. JOYFUL NOW, I TAKE UP MY BUKA AND FLY.

THANKS, BRUCE.



Concept Buka for Ocean Shores 1998

REMEMBERING TO THANK TOM JOE



Remembering to thank Tom Joe 1995





Whatever would result if, while having triple lattes at Starbuck's with Sun Tsu and Mao Tse-Tung, they used a couple paper napkins to describe the art of war as it relates directly to fighting kites.

THE FOUR TACTICS OF CONSTANT NOVEMENT THE THE TO KITE HEAVING. HOTES FROM A CONVERCAMON ON

As water has no constant form, there are no constant conditions in kite battles.

There is only change.

Therefore avoid all possible passive and inflexible methods.



Tactic #1 When the enemy attacks - Retreat

Know your opponent. Be totally present. Become constant movement.



Tactic #2 When the enemy halts - Harass

Deception and Surprise.

These two essential elements come from constant movement.

This way the opponents are deceived by illusions, become confused, tired, and unable to rest.



Tactic #3 When the enemy avoids battle - Attack

Appear in places to which your opponent must hasten.

Move swiftly to where you are not expected.

Be at once brave and wise.

Control developments.



Tactic #4 When the enemy retreats - Persue

Remember, because there is no constant except change, don't <u>ever</u> give up. Fly hard until you can fly no more forever.



My home in the mountain meadow
is cool in winter
Often flocks of swallows
playful and curious
frolic with the kite
This is my church

CAESAR DEL SABIO

Hying the fighter kite

It has been said, "Flying a fighter kite takes ten minutes to learn and a life-time to master". Fortunately, learning to master the kite is a joy rather than an arduous task.

There are two basic methods of instruction for the beginning fighter kite pilot. The method of being guided by a more experienced kiter' or the method of being self taught. The decision of seeking instruction is self determining and left to the individual. If the novice plays kites for any length of time they will take a lesson soon enough.

The advantage of having a guide available to the student appears in many forms. The teacher can put their experience to work in setting up a positive first encounter with the fighter kite. If the perspective fighter kiter' elects to go it on their own the following may be helpful.

Assuming the kite chosen is in tune and suited for the winds, do self assisted launches using a lawn chair or other object to prop the kite against prior to each flight.

Lean the kite against the prop nose up and walk up wind approximately 75 ft. When ready, pull in line until the kite flies into the air. Congratulations! You have just completed lesson one.

If you are still flying the kite you have completed lesson two. If the kite crashed worry not. Everybody crashes. The art of flying the fighter kite is directly attributed to line handling. Its all about pulling, holding on and letting go. When and how much is learned through practice. Just remember, whenever you lose control of the kite especially in proximity to the ground, let go of the line. Drop it to the ground. This will instill a sense of control in a "yikes" situation by setting up for a much softer crash. Now lets try something new.

Repeat the self assisted launch Technique. Each time attempting To haul the kite from its perch straight up to as high over head as 75 ft. of line will allow. At this juncture the kite may assume any one Of a number of maneuvers depending on the kites angle to the wind, total air speed or line tension.

one thing for sure, the kite will not lie to you.

It will react to input received via the line. Our aim is to keep the kite in a "general area" of the sky high over head. If the kite sits and spins, well enough If the kite floats away down wind try a few line pulling experiments. Every time the nose of the kite points up or in the direction of the on coming wind to the rear of you pull the line. The technique may vary anywhere from holding tight to the line, to pumping up and down like a rope on a church bell, or hauling in yards of line like pulling down the chain on a big garage door. Some of the time it is only necessary to hold the line still while the kite finds its balance point in the sky.

By now it should be apparent that the kite moves in the direction the nose is pointing when line tension is applied. The ultimate goal up to now being to launch and keep the kite off the ground for as long as possible. When you are a beginner that is challenge enough. The most profound insider advice I am able to offer is to "play and have fun!"



EXPLORING THE RUDIMENTS OF LINE HANDLING AND THREE BASIC MANEUVERS.

Generally speaking, "short line" fighter kiting` takes place within the range of 30 to 200ft. During a "fly", the kites distance from the pilot is perpetually changing. With the constant hauling in and paying out of line the beginning pilot will notice two things.

The performance of the kite varies with distance and a lot of line laying on the ground. Nearly all of the fighter kite people I know use the "Halo" or "Gator Yo-Yo" spool to store their line on. At the start of each flight the line is fed from the spool laying just forward of the feet. When the line is hauled in it is deposited near the spool on the ground falling onto a pile. This pile or better yet piles, are managed to avoid twisting and knotting up of the line. [i.e. string wrecks]. At the end of the session haul in the kite line walking in big circles 30ft. to 50ft. Lay the line on the ground as you go. When you "spool up" the line will be less inclined to birds-nest. Avoid spooling up the line feeding from the bottom of a pile.

Much to do with the avoidance of "string wrecks" has to do with the quality of line. The rest is line management. The basic technique is to lay a small pile of line on the ground consisting of 40ft. or so.

Side step one pace to lay the second pile and so on. When line is paid out stand just to the rear of the last pile laid. When it is used up side step the reverse direction and feed off of the previous pile. Always avoid paying out from steep angles or long distances from a pile of line. Stay near the line reservoir. Good line management takes concentration. In time the technique becomes second nature. It should go without saying that to stand on the flying line will definitely alter your flight plan. Shoes with laces, heavy seams or lace hooks can also be troublesome. Clothing with "Velcro", draw strings or buttons can spell an agonizing re-appraisal of circumstances. You would not believe the power of a clover flower or blade of grass.

THREE BASIC KITE MANEUVERS.

The right - left spin hover, the right-left sweep and the assent & dive. With the exception of the stationary hover, [cobra] the three basic maneuvers and combinations thereof constitute the prerequisites for everything you can do with a fighter kite.

Perform a launch the best way you know how and warm-up flying high over head. We will venture to lower altitudes during this session but lets keep it to 20ft and above when possible. Stand in the practice field facing straight down wind and play with these lower altitudes. Assuming the kite chosen is in tune and suited to the wind, sooner or later it will spin.

Notice that when the kite is flying to the left of straight down wind it has a natural tendency to spin in a clockwise direction. On the right side of the

envelope the kite has a natural tendency to spin in a counter clockwise direction. Generally speaking the kite has a tendency to spin when there is a slight amount of tension on the line. A little less tension than it takes to send the kite off on a track. Now, when the kite is spinning, notice when the nose of the kite approaches twelve o'clock. At this time [ten o'clock on a clock-wise spin / two o'clock on a counter clock-wise spin] give the slightly tensioned line a little tug-and-release. Repeat this on every revolution. The momentum boost helps the kite get all the way around until the next tug-and-release. With this technique the pilot is able to continue spinning the kite on command.

There are two ways to stop the spin.

The first method is a matter of quickly increasing the line tension. The kite will stabilize and take off on a

track in whatever direction the nose is pointing at the time tension is applied. Usually there is 1/8th to 1/6th of

a revolution delay between the time the line is tensioned and the kite locking on track. The other method for stopping spin is to relax line tension. Experiment with this technique. After a while you

will acquire a feel for it. It is only a matter of practice before the pilot can reverse direction of spin on command. When you can do this try counting the rev's' and reverse direction for an equal number of spins. Practice this maneuver straight down wind and off to both sides of straight down wind.

Oooh, Yer' gettin' good!

Up to now the pilot has had the opportunity to steer the kite around to kinda' where he or she wants. Lets articulate. With the kite on the left side of down wind, break out of a reverse spin [counter clock-wise] using the increased line tension technique. Practice anticipating the timing of this maneuver so the spine of the kite is parallel with the horizon [flat-straight and level] when the kite locks on track.

At this juncture the balance of wind conditions and equipment is critical. The concentration required is akin to what is needed to walk a tight rope. In bumpy air a horizontal track is difficult to perform. In smooth even wind the tight rope becomes a nice wide bridge.

The key to flying straight and level is to concentrate on the nose of the kite. Watch it very, very closely.

It is almost always necessary to vary the speed at which the pilot handles the line. If the nose of the kite begins to rise from straight and level, haul the line in faster. If the nose of the kite begins to fall, from straight and level, haul the line in slower.

As if that is not enough, the nose of the kite will have a tendency to rise or fall on extreme sides [right and left] of the envelope and a tendency to stabilize straight down wind. This is due to the kites angle to the wind. A sudden drop in wind velocity will cause the nose of the kite to rise. It is sometimes necessary to quickly induce spin and re-assume the horizontal track. The angle to the wind also affects the speed of a fighter kite. The tendencies are slower speeds on the sides and faster speeds in the middle. As mentioned earlier, there is a direct correlation between the length of line paid out and kite performance. It is easier to perform maneuvers with 50ft. or 80ft. of line out than it is to perform them with 250ft. Including the sweep.

Say for example the pilot breaks from the spin to a right sweep and the kite assumes a slight down hill track. The kite will increase its velocity as it approaches the point straight down wind. Gradually

slow the rate of line pull until the desired track is achieved. The kite by this time is into the right side of the envelope and is at a steeper angle to the wind. To keep the kite on track it will be necessary to pull in line at a faster rate.

One more thing; the lower the altitude the flatter the track. When the sweep is executed at higher and higher altitudes the track is more and more arc shaped. This is due to the nearly "quarter sphere" shaped operating envelope. Try to perform right and left sweeps one after the other, straight back and forth. Try lining up with a horizontal object in the distance. The roof line of a building or land mass. Practice tracing the object with your kite to develop your technique.

The assent and dive maneuvers are much simpler to execute than line handling, spins or sweeps. For one thing they are best performed at a point straight down wind which translates to less variables.

Another reason is that we already covered the assent in the first ten minutes. So we will Concentrate on the dive. The fastest speeds achieved with a fighter kite occur during the power dive. This is possible due to the kite being at its flattest angle to the wind generating the most power. Gravity also lends a helping hand. Remember the 20ft. altitude restriction? I know your going to want to fudge.

Bear in mind the miscalculated power dive has laid many a kite to waste. It might afford one the dubious distinction of performing the most oft executed and least flattering of all the trick moves in fighter kiting; The "Lawn Dart".

Stand in the practice field facing straight down wind and fly the kite at zenith. When the nose of the kite points down wind haul in the line at a rate just fast enough to allow the kite to track in the direction of the ground. To stop the dive release line tension. The kite will halt, rotate 1/2 revolution setting up for the assent. Try to perform assent and dive maneuvers back to back, straight up and down, straight down wind. Try lining up with a vertical object in the distance. A pole or tall structure. Practice tracing the object with the your kite to develop your technique.

The ultimate goal of this session is to familiarize the novice fighter kite pilot with a sense of "feel", "anticipation" and "timing". Fortunately it is easier to do than it is to study. Flying a fighter kite comes naturally. The beauty of it is that you can become quite skilled without having the attributes of a professional athlete.

Show up at a kite festival in your area and look around for the fighter kite people. If there are any present, they won't be hard to find.

Oh yeah'. Don't forget to bring your kite box.

The human condition spawns two forms of competition.

Survival of the fittest and the spirit of assisting one another in the pursuit of excellence. These examples are not polar opposites. Comparisons are only interesting to corralate ideas and to try and reach better understanding. Preference for the visceral or spiritual is more indicative of immediate circumstances or make up of the individual than a value judgement.

Games competition often bring to the surface fascinating examples of what individuals have to offer in both performance and temperament. At any level of competition, quality of performance is very closely linked to temperament. Talent, skills, knowledge, and the desire to win account for fifteen percent of the play. The rest of the equipment between the ears. **The mental game "is"**

... Let's go into the garden and see what we can see.

(OMPETITION AND THE MENTAL GAME

Look. Over there. A cat stalks prev. She is the image of "Relaxed Concentration". Poise, focus and readiness illuminate her being. Hunger fuels the instinct to hunt but she does not long for gratification. Her cunning is aware of percentages but she thinks not of winning. There is no fear. She does not worry about looking foolish if she makes a mistake. Nor is she concerned with what the other cats will say if she looses. She is focused only on the task at hand. A sharp twig causes discomfort to her abdomen. It will be dealt with when she is ready. A hornet momentarily hovers to inspect her. The senses take in everything without thought. The heat from the late afternoon sun, haze, the smell of moist soil and grass. The sounds of frogs in the peripheral. Its all there. Add nothing, take nothing away. Just the here and now. There is no opponent. There is no score. There is no time. Only the task at hand.

Get the bird.

"Relaxed Concentration" is a state of being that enables a focused mindset working in harmony with the body at ease. It is somehow ironic that the level of relaxation required for a "Giggle Game" is often difficult to grasp and maintain in a "Sanctioned Event". Why is it that in the big show, just when we need it, concentration slips away. Perhaps if we let go the grip, the mind won't slip.

The only difference between a neighborhood kite fight and the big game are the amount of chances we have and what is at stake.

Performing "only the task at hand" is made more difficult when we think of making the finals, how many tangles are left or anything else. A big fight is a great teacher. Consider for a moment the results are a self grading system based on a curve. We cannot do it on our own. There would be no contest without the help of others.

So if you come in first or dead last, go to your opponent and shake their hand. Thank them. Thank them for the opportunity. Thank them for the game. Thank them for the lesson.

ADVAN(ED FIGHTER KITE FLYING

In our sport like most others, execution of proper technique begins with a solid foundation. For most of us that means the feet.

The best stance is to place the feet at a forty five-degree angle to straight down wind. It is important to be able to strike a stance with either foot forward. If you favor one side it may take a little getting used to.

Once the feet are in position the body will naturally follow.

The finesse hand controls the micro movements of the kite. It also remains at the ready in anticipation of any abrupt changes necessary. When it comes time to get the kite moving fast it is often necessary to haul in as much line as fast as possible. The stance is such that it allows the hands to cross in front of the body. The front hand reaches out, grabs the line and pulls in, to past the belt area of the body. The back hand crosses over the top of the front hand just past the shoulder and grabs the line.

For a split second the arms are crossed with both hands holding the line. At this moment the line is flicked out and away from the front hand and then it reaches out for another scoop of line. Simultaneously the back hand pulls in to past the belt area. For a split second the arms are wide open with both hands on the line. At this moment the line is flicked out and away from the back hand. This is one complete cycle. The cycle is repeated until the desired results are achieved.

It is important that the line is thrown out and away from the hands to avoid becoming entangled. Fighter kite people facetiously call hand/line entanglement "jewelry". Bracelets and rings appropriately. Develop good technique first and incorporate the speed later. Always keep a mental note of where your line piles are. Paying out of line can sometimes be achieved by allowing the kite to be blown down wind while letting line slip through the fingers. An even better method is the old Indian trick. Hold the finesse hand up slightly over the head with the elbow bent. Quickly motion the hand back and fourth in the direction of

The front hand

[right hand when the right foot is forward, left hand when the left foot is forward] is the finesse hand.

down wind to up wind. It will look like you are pretending to shake a can of spray paint. [Aquanet?] Now; With the line held between the thumb and index finger, pull on the back strokes and slack off on the forward strokes.

With all this quick pulling and slacking the kite will flit about like a butterfly. If the kite takes an errant path, slack off a couple of strokes until you can make the adjustment. The beauty of the old Indian trick is that it allows the pilot to lengthen the amount of flying line while still maintaining tension. Never allow excess slack in the line. In advanced line manipulation the trick is in the tension and acceleration.

Think what it would be like if an automobile had only two speed settings. Full brakes or full throttle. Cars were never meant to operate that way for obvious reasons. Like the car the fighter kite can be operated full brakes, full throttle and all speeds in between. It is often desirable to use abrupt heavy-handed inputs on the flying line to achieve a particular result.

The thing is, our flying line is not only an accelerator and a break pedal, but a "steering wheel" as well.

This is an important concept. For the steering wheel speeds [in-between on and off] require smooth, liquid, flowing motion of the hands. Quick starts and stops

allow the kite to yaw or pivot sharply inducing a square cut corner. A slower hydraulic style line manipulation enables the kite to turn gradually. Once in a while the winds are such they allow the pilot to sweep the kite without hauling in line.

All that is necessary is to pinch the line tight and hold it there. Say for example the kite takes a slight down hill track.

"Estimated terrain impact three seconds."

In this situation if the hand is held perpendicular to the direction of the wind it gives the option to micro adjust. With the line held tight move the arm forward the appropriate speed and distance. This slows the total air speed slightly allowing the nose of the kite to gradually rise. Your kite is back on track. Not only does the kite have to be in tune and suited for the winds, ya' gotta' have a pretty good kite to execute the following maneuvers. The following is enough material to keep you busy for years. If you can even do a fraction of this stuff you'll be ready to go up against the best of them.

You'll even give yourself a chance to win.

...AT ONCE WE ARE TRANSFORMED
THE KITE A LARK,
I A LOTUS
STILLNESS AND CAPRICE CO-HABITATE

THE COBRA

The cobra is a maneuver that sort-of emulates static kite flight characteristics. The fighter kites capacity to maneuver is contingent on air speed. When the weight, thrust and drag are close to an equilibrium the kite seeks a balance. A constant altitude is the basic criteria for the cobra.

There are three types of cobra. **The "perfect" cobra** is when the kite is stationary at a point in space. This maneuver is performed at almost any altitude straight down wind. **The "creep"** is when the cobra is established off wind and then the kite slowly seeks equilibrium or creeps to straight down wind. **The "crawler"** is when the kite moves toward or away from the pilot.

This maneuver is difficult to perform in strong wind and next to impossible to do in bumpy conditions. Assuming the kite chosen is tuned and suited to the wind find the altitude straight down wind the kite is most inclined to remain stationary. Practice holding it there. The kites wing tips will slowly rock to and fro`. The flying line will assume a serpentine series of waves from the hand to the kite.

A cobra maneuver is very much dependent on the tuning of the bridle even in the right conditions. It may be necessary to make fine adjustments to the pitch attitude. Try this. Adjust the pitch attitude low enough on the bridle so the kite will not fly. In small increments [maybe 1/16in. more or less] raise this setting. Test fly the kite between each adjustment. At the lowest adjustment point the kite is able to fly will be the point the kite cobras at the lowest altitude. The trade off is that this is also the same tuning that allows the kite to fly its slowest speeds. The other effect is that the kite is less capable of flying off wind. After you play around with this adjustment for a while look for a happy medium somewhere between "mild" and "wild" tunings.

When you feel confident with the cobra, experiment with assuming the maneuver at different points in the sky. Dash the kite quickly from one position to the next, stop dead and establish the cobra between sprints.



- **#1** If you have had experience with **altitude loss** during the spin, time the tug so the kite climbs as much as it falls on every twirl.this should be a matter of only a few inches.
- **#2** Beginning with the cobra position **initiate right-left spins** one revolution at a time. Cobra, one spin to the right, reassume the cobra. One spin to the left, reassume the cobra etc. Straight down wind and on both sides of the envelope.
- #3 Break from **right-left spins to right-left sweeps**. This time sweep only four to eight feet. Keep the spine of the kite horizontal. [parallel with the ground] This should be a matter of only one arm pull. Quickly snap the kite into the sweep and reassume the spin. Do right-left spin breaks near the straight down wind zone and on both sides of the envelope. Try starting out on one side and continue the move all the way to the other side.
- **#4** Right-left **spin breaks vertically / diagonally**. Only a few feet up and down. Straight down wind and on both sides of the envelope.
- **#5 The wheel.** Same as above but find a point in space to station the kite. This station is the hub of the wheel. Spin and break short equal distances to the vertical, horizontal and diagonal. These are the spokes of the wheel. Eight in all. Assume the spoke by snapping the kite from the hub to the desired direction,

reverse direction [one hundred eighty degrees] returning to the hub and assume the adjoining spoke. Do this in sequence all the way around right or left.

- #6 Zig zags. Draw this pattern in the sky moving toward the vertical or horizontal either direction. Use short slack times in comparison to the tension times. Execute sharp corners. Practice the turns until you can perform then without inducing spin.
- **#7 Do loop the loops** all the way across. Initiate spin, tug the line just before you normally would and lengthen the duration of the tug slightly. Practice this maneuver with right-left spin, right-left sweep, top and bottom loops receptively. Play around with the duration of the tension to lengthen out the distance between loops.
- #8 Draw a square in the sky. Use the straight down wind line to bisect the square. Spin the kite [the natural directions] on each corner of the square and apply tension at the appropriate times. Practice this one until you can do a 270 degree out side loop on all four corners of the square. Rectangles, triangles, parallelograms?

Hell, you can just flop the kite around up there and tell everyone you are reproducing a Jackson Pollock painting!

#9 Spirals, circles and figure eights. With the finesse hand far out in front of the body get a tight spin going.

The trick here is to slowly increase the speed line is drawn in. Increasingly smooth transition of line tension takes the kite

from tight spin to loopy spin to an increasingly larger radiating circular track. Reverse this process and the spiral shrinks smaller and smaller all the way back down to a tight spin. The circle track is achieved by steadying the line tension. Make a circle so the right edge will brush the left side of the straight down wind line. With this circle fly the kite in a clock wise direction. Now flip it. Make a circle so the left edge will brush the right side of the straight down wind line. With this circle fly the kite in a counter clock wise direction. Practice transitioning from one direction to the other. The infinity symbol is achieved when you can alternate one circle at a time. Alternate circles one on top of the other straight down wind and "viola!" The figure eight. These maneuvers are Difficult. If you get good at them its a sign you probably don't have a job.

#10 Hanging out. Sweep all the way over to either side as far off wind as the kite will go. Spin the kite the natural direction. As it begins to try and find it's way back towards down wind, spin, and reassume the sweep. Haul in line until the kite is off wind again. Repeat. Keep it out there. Do this maneuver with as few spins as possible. Sometimes the kite will do a reverse spin. When it does, be ready. Its a tricky move. Sometimes the kite will "hang" off wind for periods of time with the spine parallel to the ground. Occasionally, as the kite finds it's way towards down wind it will only rotate one quarter of a turn the natural direction. [Creep] Then it rotates one quarter turn the reverse direction so the spine is parallel with the ground again. In stronger winds the kite may gain altitude on the down wind glide. If it does, adjust by hauling in line when the nose of the kite is at about the seven or eight o-clock position. left side. As you do so the kite will level out by the time it gets back to off wind. Practice paying out line by incorporating the old Indian trick or any way you can to maintain sufficient distance. How long can you hang out?

#11 360's. This one necessitates a cooperative wind. Sweep the kite as far off wind as it will go building momentum. When approaching the off wind area make sure you have the kite at a short distance [twenty or thirty feet] and crank up the speed. Keep hauling in line like a big dog until the kite travels all the way around. Use little baby steps allowing your body

to follow the kite. Practice this maneuver at a 10 ft. altitude. Then do a quick check to see where your excess line is. #12 Assents and dives. Play with the kite far up over head. Practice maintaining position straight up. Starting from over head see how far off wind you can fly past zenith. One of the marks of a fine kite is the range of maneuverability available when the kite is way out in back of you, way up high. Practice swooping the kite from the other side of zenith down to a position off to the side of the envelope. Power dive as fast as possible straight down wind and stop dead. Rotate one half revolution into a cobra. Try this at slightly inclined angles. Power dive full blast at slight inclines then stop at a very low altitude. When the kite rotates ninety degrees [spine horizontal] immediately assume a sweep.

#13 Cobra. Assume the cobra and tease it down to an altitude in the range of inches. Everybody "Limbo" now! How low can you go? If you think you're good at this one, try it out over a pond.

ne on one fighter kite competition in North America is a line touch contest. The objective of the pilot is to out maneuver their opponent, cross and touch kite lines in a predetermined manner. Either on the top of the opponents line or from underneath. An all encompassing account of kite fighting would require volumes. There are however a few basic principles we can investigate.

#1 THE CONDITIONS. A kite fight on your home turf is advantageous. There is comfort in the home environment that comes from familiarity. If you live on the coast you will be used to clean, smooth winds. That all changes when attending a contest inland. The dependable air you are accustomed to is tempered by hills, valleys, rivers, trees, fences and hosts of other influences including; ground heat, altitude, barometric pressure, the list goes on. When warming up at an away game familiarize with the local conditions. Look around. You will be better prepared to do combat when you know

the capabilities of your kite over by the parking lot, near a tree line or a small rise down wind. Know the path the wind traces on the way to the flying field. Run through the paces and compare your kites performance with a previously known quantity.

#2 THE EQUIPMENT. Selecting the right kite and flying line is a key ingredient to the recipe for success. Most fighter kiters have many different types of kites. Competitive kites should be tuned and at the ready. Have them filed in an order congruent with wind speeds. Zero to two knots. Two to five knots and so on. Sometimes it is necessary to forecast wind conditions for the time during your contest. If the wind speeds vary select a kite that flies well in the slowest ebbs and flows. A careful consideration of the spool and flying line is also significant.

Match the flying line to the kite. Never use line you have not practiced with and make sure line pays out efficiently from the

spool. You are not going to want any surprises.

#3 BE FAMILIAR WITH ALL THE RULES. So familiar in fact that you can find ways to use them to an advantage. Perhaps nuances of the rules will occur to you that are not apparent to others.

#4 READY POSITION. Contrary to popular opinion the contest does not begin when the judge says fight. The ready position is the real beginning. When maintaining the ready position you are already in action. This is a game of inches and split second timing. The first tactic the fighter kiter should be aware of is "get closer". The kite that is on the shortest length of line has a tactical advantage. The fighter kite travels on a arced path with the pilot being the pivot point at the center of arc. Distances the kite must travel are mathematically increased by the length of the flying line. [difference of radius times 3.14]. You might get an experienced pilot to fall for this one by using a smaller kite than he is flying. The idea being that your kite will appear farther away. A short distance can make the difference. Another tactic in a top touch is to tune your kite so it will cobra at a forty five degree angle. [Between the horizon and straight up]. Hold the forward hand far out on the flying line. You have already made your move. If your opponent's kite is flitting about or spinning when the judge says "Fight", he has to set up before putting the kite on track. Your kite is already pointed towards the back door. All you have to do is haul in line. The race will be over before it begins. The first one to the top usually wins.

#5 THE EDGE OF THE WINDOW. Most kite fights take place on the perimeter of the envelope. That means low to the ground, far out to the sides and way up high in back of the the pilots. When flying in the power zone [straight down or near down wind at a medium altitude] the kites are usually just passing through on their way to get somewhere. Practice staying away from the power zone and get familiar with the perimeter. Your skills will take a step up in class.

#6 PATIENCE & SAVVY. Sometimes we fly like a tiger, sometimes we fly like a lamb. Be patient. Wait for your opponent to make a mistake then pounce. Whatever you do, don't crash and never ever give up. In a kite festival atmosphere fighter kite contestants are often on the scene for several days prior to the big showdown. Grab a lawn chair and check out the competition. Observe what they do. See what their kites can do. Keep a tally of who they can beat and who they cannot. It will be worth a few points for you.

#7 PRACTICE. Kite fights are won and lost on the practice field. Set goals for yourself. Write them down. When you practice have an agenda or at least an idea of what it is you want to work on. Keep a note book. After each session write down a brief description of the days activities. Get together with your kite pals as often as possible and trade points. Set up scenarios from experiences or made up and take turns trying to score or wiggling off the hook. Take the time to teach new commers how to fly.

THE PHOENIX is a re-launch from the ground.

If the kite lands on or is blown over on it's front side after a crash, tug the line enough to get the nose pointed toward the on-coming wind. Then one good arm pull on the line should be enough to get the kite back up off the ground. My good friend Bruce Lambert can re-launch when the nose and leading edge of the kite are touching the ground. The kite stands up on edge assisted by line tension. Bruce does a quick double tug so the bow springs the kite off the ground and he is once again air-borne.

My brother Kevin MacInnis once executed a Phoenix out of the water. He had the kite three hundred feet out over Puget Sound and lost it. When Kevin saw the nose of the kite emerge he pulled the string. The kite popped up out of the water and into the air. Providence? Perhaps.

Its the stuff legends are made of.

STUNTS, TRICKS AND FANCY SHOOTIN'

THE CARTWHEEL Sweep the kite at a low altitude on a slight incline toward the ground. Anticipate ground contact at about a forty five degree angle off wind. When the wing tip touches the ground, roll the kite on edge about two hundred seventy degrees. When the nose points skyward snap it back up into the air.

THE TAIL DRAGGER is set up by assuming a low altitude cobra. Lower the kite until the tail momentarily touches the ground. The Honey Dripper is the same move but dunking the tail in the water.

BUZZING Flying in close proximity to various objects is a lot of fun. Following a garbage truck at the beach, darting in and out of the gap between tree branches or anything you can think of is great sport and terrific practice. As far as teasing dogs or baseball cap removal etc. I would have to plead no contest in a court of law. Safety guidelines aside, keep it sane.

PASTING Allowing the wind pressure to fix your kite to a secured object is called Pasting. Poles, buildings, fences anything is fair game. It is best to paste the kite to an object that is more or less down wind. If you are standing at a steep angle from the fixed object the kite may scrape along the surface as you haul in line for the re-launch. When the sun is cooperative use the shadow of your kite as a range finder for the last few feet. Especially if your target is distant.

truck. Land the kite in the bed and fly out. Cobra down inside a basketball hoop and fly out. Cobra a few feet inside the rim of a soccer goal and fly out. I once parked my van on the beach and used it for a kite target. I flew touch and goes onto the roof and made two point landings [tail and wingtip] while line tension kept the kite balanced on edge. My rig is a beast of a '71 Ford. If you don't want to do scud runs at your wheels, park the kite on someone else's. Start off on Chevvy Suburbans and work your way down to Harleys.

SQUEAKING AND HONKING The combination of a stiff breeze, waxed flying line and resonant sail material provides the fighter kite enthusiast

with the unique opportunity for some big laughs. Run your hands up and down on the taught flying line and sounds res-

onate from the kite. Annoy your kite pals and onlookers with your hilarious antics. The more astute may want to paint appropriate graphics on the kite for effect. A horn, a flock of geese or two lovers completing the circle of life. Those inclined to genius might try fixing a tin can to the end of the flyingline with a button to fashion a flying megaphone. Hmmm, Doppler effect!.

THERMALS Sometimes the best winds do not blow sideways they go up. A largish, very light kite is a must for every kite-box. If nothing else it could win a fight for you when none of the other competitors can get a kite off the ground. Some parts of the country are more prone to thermals than others but good up-drafts are where you find them. Micro weather conditions are affected by local topographies. Ground heat radiation is more conspicuous in large open areas with exposed hardened soil, rocks or asphalt slabs. On still warm days a savvy kite pilot will recognize the possibility of thermal conditions. Sometimes debris or birds ascending in a circular motion will be the tip off. It may be necessary to do self assisted launches from great distances to get into the position to "fish" for thermals. Then again you may find a more amiable wind at higher altitudes. Another type of micro thermal can be found above the face of a steep hill. The Southwest is loaded with nice warm rocky ones. Work the kite up hill. The closer the kite gets to the top the better the draft. Do this one on the sunny side of the hill.

OUTSIDE LOOP With the nose of the kite pointing skyward, give the line a great big yank and then slack off. In a light wind the kite will do an outside loop. In a heavier wind the kite will "Slingshot" up, go inverted and zip down wind on it's back. These maneuvers are made possible by the

curvature of the kite spine. A kite with the spine adjusted straight will not have a tendency to outside loop. I have yet to see anyone use the Slingshot move to get up and over for a top touch in battle.

BUGGIN Take n' git'cha' a quick little kite and adjust the pitch attitude of the bridle very high. With this radical bridle adjustment the kite will change directions very quickly when the line is slacked. Hold the line tight and pull up and down as fast as possible. The little kites jerky movements are enough to make a water skipper jealous. This is a fun one!

THE LAWN DART Power dive from way up high, straight down wind and keep on a commin". WHACK! In sand or soft moist soil the kite impales the earth.

It sticks in the ground nose first. Hence, Lawn Dart. Sometimes you get unlucky and do this move by mistake.

NIGHT FLYING Go to a well lit parking lot. A tennis court with lights approximate to the flying field is good also. Use a kite with a white sail material. Reflective materials such as Mylar do not work as well as white. They mirror as much darkness as they do light. Perhaps you can find an ultralight battery and light bulbs to adorn your kite. A phosphorescent paint job would turn the trick also.

THE SUN Spare no expense getting a good pair of sunglasses. There are many occasions when your kite [or an opponents kite] eclipses the sun. This is worth consideration especially in regard to competition. If an opponent is not wearing eye protection a situation may arise that could be taken advantage of. **GHOST KITES** are fighters made of clear transparent material or of a color that camouflages the kite with its environment. White or gray for cloudy days blue for clear days etc. Using a Ghost Kite is a great trick if you can get away with it. Most sanctioned events frown on the use of this type of kite. It would be very interesting to make a Ghost and paint a picture of a smaller kite on it. This could be used to dupe your opponent into a false sense of distance while still being legal.

BIRDS Various species of birds have different reactions to fighter kites. Seagulls might take a pass or two but are basically disinterested when they discover your kite has nothing to do with food. Sparrows, Robins, and starlings etc. scatter if the kite makes any abrupt movement. They look as if they've got that Hawk feeling. A kite flown near Pigeons will scare them away for the rest of the day. Larks and related species thrill in buzzing a fighter kite. They're just like us. They love to play.

DEEP SKY You don't often see people in the west flying long distance. In India its a way of life. I've heard tales of kite fights taking place a kilometer away from the pilots. It is a real kick flying Deep Sky even if you do it on your own just for fun. You will want to use a kite that is on the large end of the spectrum. Twenty-three or twenty-six inches across the wingtips. Adjust the bridle setting high. The kite should be barely controllable at close range. By the time the kite is on two-hundred yards or more of line the drag will compensate for the wild bridle setting. You might even consider rigging up a battery powered drill motor to a spool to bring all of that line back home.

Fighter Kite

An Overview

Conventional wisdom dictates "A fighter kite at first glance is deceptively simple". Often attractively decorated, the kite appears to be little more than a cross of sticks, sail material and a piece of string. The newbie kite builder soon learns that the combination of materials, construction, size and shape are myriad and directly affect the character of flight of the kite. There are five basic elements of a fighter kite. The spine, bow, sail, bridle and binding. Our task as kite builders is to combine these basic elements in a manner that best complement each other. When our task is complete, "kite synergy" is achieved. Experienced kite builders often can predict the flight characteristics of a new design. At least that is the intention. Seemingly endless changes, modifications and tinkering come with the territory of being a fighter kiter. The endeavor is rewarded when the builder/ pilot produces a kite that flies in a manner that suites their wants and needs. This is our mission. Practice is the great precursor to luck. Although luck can play a part, building a truly fine fighter kite usually points in the direction of the pursuit of perfection. "Always strived for, never attained". If the journey is more significant than the destination, our advice is to

"Build a lot of kites, play have fun and enjoy the ride".

THE SAIL

BODY, WINGS, FLESH AND BLOOD. The sail of a fighter kite is defined as a membrane that is stretched over the frame. Design considerations for the sail include type of material, flexibility, texture, porosity and aesthetics. Think of the sail as an air deflector. The sail offers resistance to the air and transfers energy to the bow and spine. The sail is the first noticed and therefor most obvious component of a fighter kite. Typically the sail defines the shape of the kite. Static and multi line sport kite enthusiasts are somewhat akin to fighter kiters' in the respect of the materials that are used for frames and bridles. One distinction we share less often are the types of materials that are used for the sail. Rip stop textiles are the prime choice for static and sport kite sail construction. Fighter kite people are more open to experimentation. We not only want our kites to fly but fly a certain way. Fighter kite builders understand the range of textiles to be a few options among many.

THE SPINE

The sum of all parts must be considered as a whole, simultaneously to fully understand the fighter kite. No part being more or less important than the next. It is a bit of subtle irony that pause to ponder a single element is a break in concentration. Still we need a place to begin.

The spine of a fighter kite is typically a supportive member that runs from nose to tail through the center of the kite. Think of the spine as a foundation from which other parts of the kite are fixed. It is the starting point of kite construction.

Design considerations for an effective spine include typ of material, length, shape, form, weight-point of balance and flexibility. For example: The proportions of an Indian kite are classic. The length of spine pre-determines the width of the kite from wing tip to wing tip. Shape of the spine for our purposes is the keel line the spine assumes when viewed from the side. Form is the shape of the spine when observed linearly. Weight is the total weight of the spine. Point of balance or fulcrum from nose to tail is directly affected by the total weight, form of the spine and positioning of other parts of the kite. Flexibility or degree of stiffness can be defined as a combination of plasticity and elasticity.

For our purposes we will define plasticity as the ability of a material to bend or stretch. Elasticity is the ability of a material to return to or nearly to its original position or shape. Another important concept is "Spring Rate". Or how far a flexible material is bent and at what weight of pressure. Sort of like miles per hour. Only spring rate measures weight per distance.

One other consideration is the time it takes for the spring to recoil.

When a spine is selected by the designer/builder it determines the contribution the spine will make to the "Personality" of the kite. A spine designed for high winds could be short, heavy and nimble. A long, lightweight and stiff spine may begin to define a light wind kite. The real key here is flexibility.

The old adage goes: "Stiff spine fast kite, flimsy spine slow kite". Fast and slow are relative concepts and related to air speed. They are not a gift or curse but a personal preference of the pilot. The important thing to remember is that the relative speed of the kite is very much proportionate to control. The speed/maneuverability curve is a trade-off. For example: A kite with pinpoint control is less likely to be fast.

A very fast kite is less likely to be very maneuverable. As with most man made flying objects this is the case. The exceptions are usually publicly funded and beyond the resources of a person that builds a kite for a \$1.00. Fortunately there is a broad middle ground between the poles of this apparent physical reality. Oh but wouldn't it be lovely to cheat the speed/maneuverability curve. It is every fighter kiter's dream.

At the 1997 Fort Warden Kite Builders Conference respected kite maker Richard Gareau said; "The spine is where it all begins". After absorbing that piece of advice my kites quality improved in leaps and bounds. I now spend more time making the spine than any other part of the kite.

TheBow

The fighter kite by its very nature is defined by the "Flexible" bow. This loaded spring is the heart and soul of the fighter kite. The bow of a fighter kite is usually a curved cross member that runs perpendicular to the spine. The bow assists the spine to make a basic frame-work of the kite. The width of a kite is often defined by the bow tips. Design considerations for an effective bow are type of material, length, shape, form, weight-point of balance and last but not least flexibility. Although a "static" kite may be designed with a flexible bow and a fighter kite can be tuned to fly "statically", flexibility is tantamount to maneuverability. Many characteristics for the spine hold true to the bow but to a much greater degree.

THE BINDING

As mentioned before; "No component is more or less important than the next". The binding however is the most 'significant' of the five components. Without binding to fuse together the components there would be nothing more than a collection of parts scattered about.

The binding of a fighter kite is defined as fixtures and/or fixatives that adhere the various components together.

Design considerations for the binding include type of materials, weight, flexibility, adhesion quality, and the merging of components for effect.

To a large extent binding materials consist of various tapes, glues and occasionally sewn hems or pockets. The merging of components is also a highly desirable method of binding. This way components can serve double duty or multi purposes. For example; A folded and glued hem of the sail could attend to the reinforcement of the leading edge, assist in securing the spine and function as a bumper or nose guard. The important thing to remember is that the binding works, is simple, light in weight and economical in the sense that components can serve multi purposes whenever possible.

Making a Bamboo Spine

EQUIPMENT:

- 1] Length of Tonkin Cane bamboo.

 The distance between rings should be 1 inch longer than finished spine length.
- 21 Hammer.
- 3] Saw.
- 4] 6 inch planer.
- 5] Thick bladed knife.
- 6] Pocket knife.
- 7] 40 grit, 80 grit abrasive paper and sanding block.



1] Wrap a piece of paper around pole just short or the rings and draw a line.



2] Rotate pole while cutting a little at a time.



3] Always split from top of section to bottom. Note direction of ring.



4] Initial split one side at a time. Line up knife from center out.



5] Always split bamboo in halves.Use thick bladed knife in twisting motion to pry apart.



6] Do not let halves wander. hold ends together or lay flat on working surface.



7] Remove ring bumps with planer.



8] With 1/8th section reduce thickness by half using pocket knife.



9] Use grain coloration as guide.



10] In this example the split wandered toward the inside or soft side of the section. By bending the section with the outside or hard side toward the inside of the curve while splitting the desired thickness can be corrected and maintained.



11] Split into 1/16ths.

A wandering split can be remedied in the same manner as the example in #10].



12] In this example the section is a slight parallelogram.



13] Using a planer make section square.



14] Split into 1/32nd.



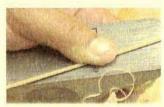
15] Straighten section by bending.



16] Use 40 grit abrasive paper with sanding block to make section straight and even. Sand section to a width of 3mm and thickness of 2mm. Always be aware the location of hard side. Do not sand hard side.



17] Using pocket knife dull the corners of the hard side. Two or three scrapes the length of the section should do it.



18] Use planer as draw knife to cut 45 degree angles off both corners of soft side.



19] The pocket knife shown has a curved notch filed out to be used as a shaping tool. Scrape section the full length to shape.

[no picture]

20] Use 80 grit abrasive paper to smooth soft side.

[no picture]

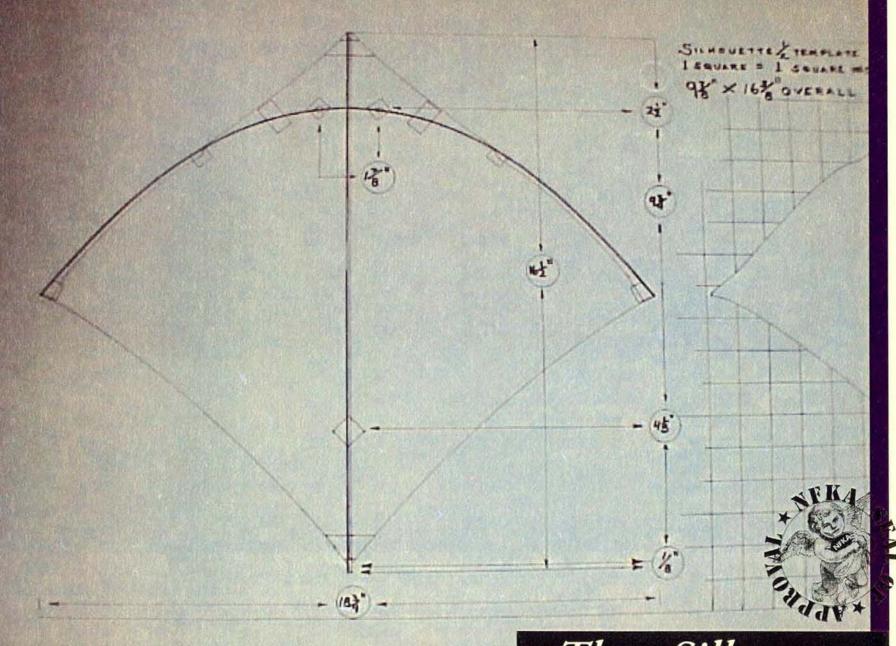
21] Straighten spine by bending.

The Silhouette

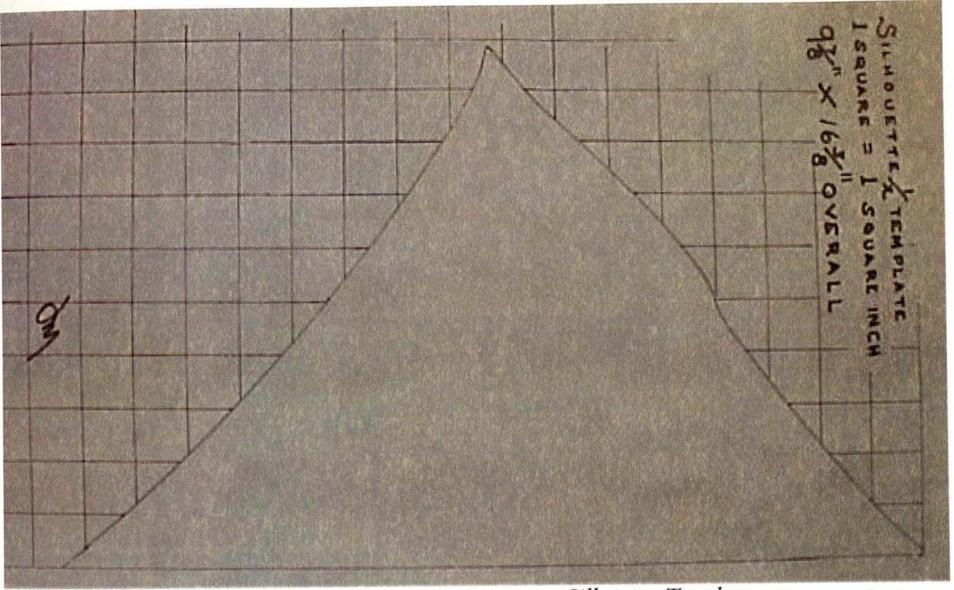
The Silhouette is a high performance fighter kite suited for winds ranging in speed from 1 to 4 knots. Handcrafted with the finest materials available this no frills fighter is an ultra light weighing in at 6 grams. +/-.

Measurements are 16.5 inches tall by 18.75 inches wide.

The development of the Silhouette was singular in purpose;
To produce a fighter kite that flies exceedinglywell.
Inspired by competition, the Silhouette is a synergy of design, components and construction delivering feel, control and predictability.



The Silhouette



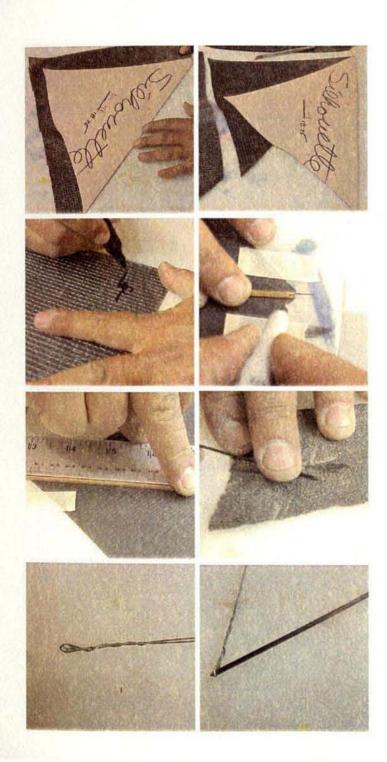
Silhouette Template - enlarge to scale by photocopy

Silhouette Material List

Tonkin Cane bamboo - 16.5" x 3mm x 2mm Orcon AN 36B - 17" x 17" Clear Tape - 0.5" wide & 0.75" wide Music Wire - 0.20 diameter x 25" long Carbon Fiber Rod - 0.050" diameter x 22.875" Braided Dacron - 15#-20# test, 5' Clear Packing Tape - 1" wide Acrylic Paint - A small amount

Glues (3) 1. Flexible drying water based 2. Rubber Cement 3. Finger Nail Polish

GO AHEAD AND BUILD ONE!



START HERE...

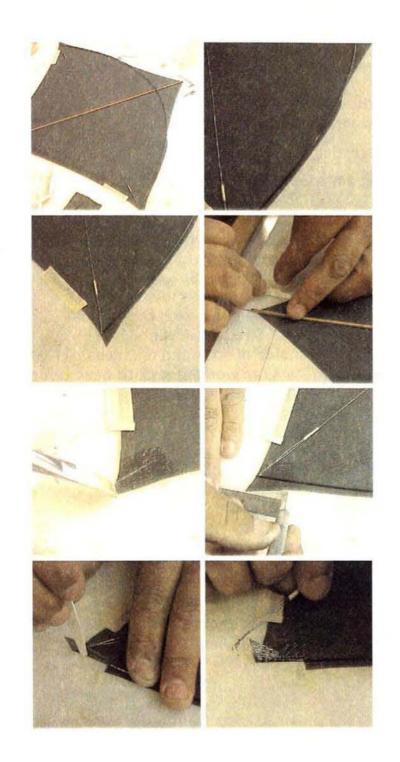
Fold ORCON sheet on the diagonal shinny side out. Line up the first rip stop thread. Place template up to and touching fold.

Cut sail with sharp curved blade X-ACTO knife.

I prefer to do all art work on the sail before construction. The initials are signed in the bottom center before building to avoid running over the spine. Unfold sail. Spread with shiney or textured side down. Use drafting tape to secure the kite to working surface. First apply one piece each on the nose and tail. Tapes should be centered. Stretch sail slightly. Next add pieces of tape on either side of nose and tail tapes. Now remove the center tapes. Mark the working surface near the nose and tail dead center with straight edge. Mark center of spine.

Use straight edge [before gluing] to insure alignment of spine. Leave straight edge in place. Apply flexible drying water soluble glue to hard side of straightened spine and set into place along side of straight edge. Allow 10 minutes to dry. Remove tapes. Cut carbon fiber bow to a length of 22 7/8". Sharpen ends of bow with 80 grit abrasive paper.

Wire jig is 18 3/4" long with a loop at both ends. The loop is such that it will accommodate holding the bow ends. Tape over any sharp spots.



Bow loaded. Apply drafting tapes 2" below wingtips. Sail should lay flat, wrinkle free and under little tension.

Check fit of bow.

The bow should align up to and touching or protrude just slightly beyond shoulder of sail. Do not leave gaps.

Align bow ends at wingtips.
This will insure symmetry of placement before gluing.

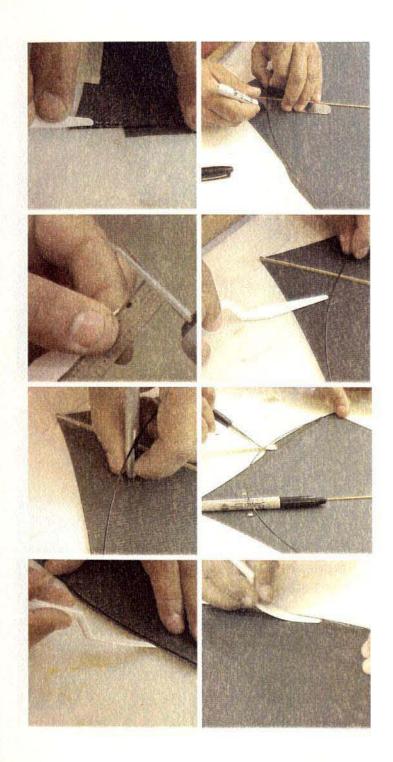
Apply 3/4 inch clear adhesive tape to nose and tail of sail. Practice with scraps before execution on kite.

Apply rubber cement to 1 square inch of wingtips and 1" of bow ends. Install bow while rubber cement is wet. Let rubber cement dry 10 minutes.

Cut sail 1 inch from wing tip as shown. Use a rocking motion with curved X-ACTO blade vs. a slicing motion.

Wrap wingtip flaps around bow ends.

Remove wire jig.



Burnish down wing tip flaps. The sail material should contact entire circumference of bow. Remove drafting tapes. Carefully cut clear tapes at nose and tail on sail edges freeing kite from working surface.

Mark for bridle holes. Marks measure 7/8" from spine directly under bow.

Cut tapes for bridle holes. Use 1/2 inch clear adhesive tape. I like holding tape with a plastic pallet knife and measuring each piece to insure symmetry.

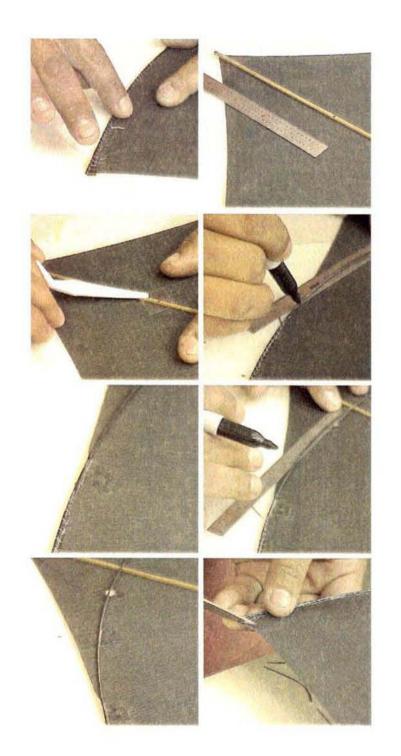
Place tapes centered directly over marks.

Punch holes centered directly over marks. If punch is not available heat straightened paper clip over flame and melt holes in sail from front of kite. Do not apply heat to bow.

Apply rubber cement to bow and sail as shown. Let dry.

Brush out any slight ripple in sail with the hand toward glued area. Set bow onto sail. Do this operation one side at a time. Slight stretch marks at wingtips are normal.

Roll Flaps around bow and burnish down. The sail material should contact entire circumference of bow.



Remove excess cement by gently rubbing sail from shoulder to wingtip.

Mark lower bridle point at 4 1/4" from tip of spine.

Tape lower bridle point with 1/2 inch tape. Practice with scraps first.

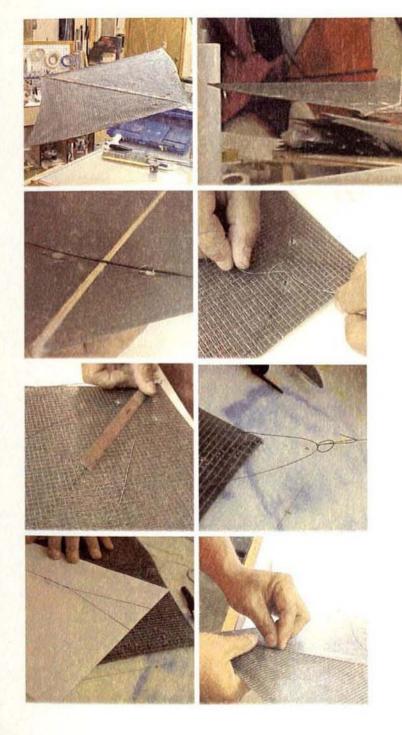
Mark shoulder. The marks are placed on the bow at the point where the sail meets. The ruler is an aid. If these points do not match up closely, average out the measurements with the rule.

Tape shoulder using _ in tape 1 inch long. Wrap tape from front to back of kite. Center of tape on mark.

Mark leading edge reinforcement. Measure 2 1/2" from point on spine where bow crosses toward wingtip.

Tape leading edge reinforcement using 1/2 inch tape 1" long. Line up tape end with leading edge but back-set tape 1/16". Tape bow to sail.

Cut excess material from wingtips.



Rubber cement or tape 24" piece of string to kite. Position ends directly over center of spine on front of kite. The lower end is aligned at lower bridle point.

The upper end is aligned between bridle holes. Suspend kite and note balance from wingtip to wingtip. Apply 1/2 inch clear adhesive tape to both wingtips as shown. Cut small pieces off from heavy side in increments until balanced. Fold over the remaining tape. Perfect.

Prepare bridle line by painting with artists quality acrylic paint. Wrap bridle line twice around bow as shown.

Tie with single over hand knot followed by double over hand knot.

Repeat on other side so top two legs of bridle measure 4" from between bridle holes.

Tie 1" loop at one end of line using bowline. Thread other end through loop around upper bridle as shown.

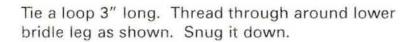
Snug knot at center as shown.

Use large needle to thread lower bridle leg. Twice around spine. Leave it loose.



Bridle length should reach just short of wingtip.

Tie lower bridle leg using single over hand knot followed by double over hand knot.



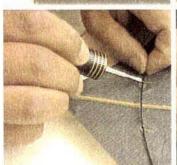
Shape the spine by carefully bending over your head.



Shape upper part of spine by carefully bending on working surface or on your leg.

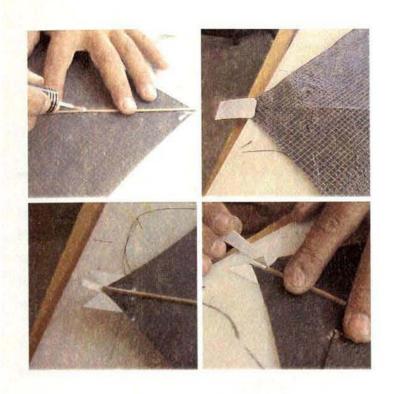








Upper bridle knots should measure 7/8 of an inch from either edge of spine. Glue into place using clear fingernail polish.



Glue lower bridle point front and back of kite using clear fingernail polish.

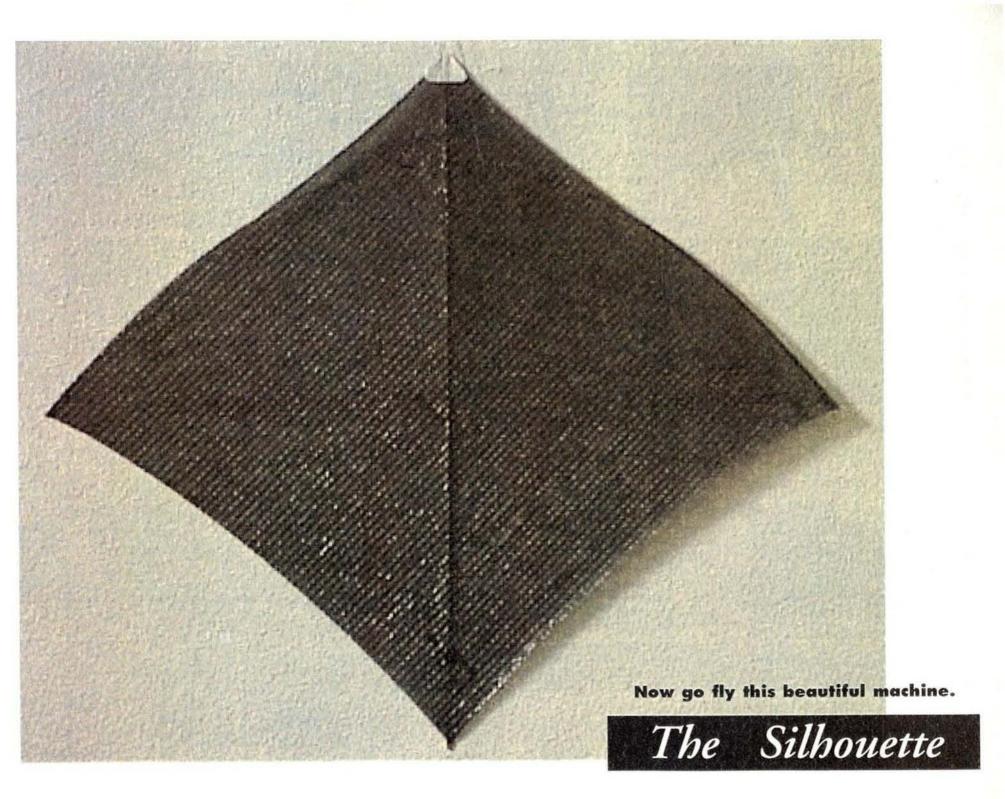
Tape nose.

Cut tape as shown.

Fold tape over nose.

Table tune kite as shown.





Fighter Kite Construction

...and from mere bits, the substantial incarnate!

In these days of rapidly accelerating technology, a lot of faith is bestowed to industry; It is difficult to imagine what life today would be like without it. However, mass production techniques and the sciences reveal a deeply secluded void when compared to the fruits of the craftsman. No manufacturer's conveyor belt is able to reproduce mastery the likes of a Stradivarius violin. For the human hands are a medium to artistry. Even more than that. Occasionally grace intervenes and the hands of the craftsman author an intangible entity known only by one name. Magic.

The fact that there is a collection of parts at the ready indicates the intention to build. This is a pregnant moment laden with many forks in the road. Every decision a builder makes directly effects the outcome of the project.

I repeat: EVERY DECISION A BUILDER MAKES DIRECTLY EFFECTS THE OUTCOME OF THE PROJECT.

A detail as subtle as the ambient temperature of the workshop could have a significant impact on the final product. As Mies van der Rohe so eloquently put it; "God is in the details."

We are not building anything as complicated as a research orbiter or submarine. We are however constructing a machine that will operate according to the dictates of nature. The deeper we understand the union of our machine with the natural world, the nearer we approach the synchronous.

Whether a builder creates a museum piece or a "quick and dirty" kite to just go out and fly, considerations abound. If you love fighter kites I can guarantee one thing. Your last kite will be different than your first kite.

"Listen to the wind. It will tell you what to do."

Over five hundred years ago the young student Nasdesh Puram asked of his mentor: [unknown] "Master, what is the difference between a fine kite and one with less desirable attributes?" His mentor's reply: "Very little."



Fighter Kiter's Skills Flying

As with many flyers, my introduction to fighter kiter skills flying was years ago when I had the opportunity to try to knock a cup off a stick. I didn't think much more about skills flying until I joined the distinguished group of flyers identified by being over 50 years old, and became eligible to participate in the Washington State International Kite Festival's (WSIKF) senior fighter kiter competition. This event is oriented around basic flying skills rather than fighting. After participating a few years I was asked for ideas and soon thereafter volunteered to organize the competition. Shortly after that, I was asked to organize a fighter skills event for the AKA convention.

As we learn and grow in our sport, skill events are rapidly becoming integral to the fun and excitement we share as fighter kiters. Most kiters have found ways to challenge themselves and maintain interest while flying solo and as you can see, many of the skill events I describe are derivative of these shared ideas. Shared ideas are not uncommon in our sport and they greatly enhance the enjoyment for all of us.

The best example of sharing of course is this book. Another example; while teaching a class at Fort Worden, Richard Garreau, was asked how he hones his single line flying skills. Richard responded with two ideas that I put to use. First, he told us about parking or pasting his kite to a stop sign from a distance, and allowing the wind to hold it in place. I incorporated this idea by covering a hula hoop with some netting and then mounting it all on a pole with the center about 7 feet high. He also talked about flying among tree limbs and branches (which we've most all done whether intentionally or not). I adapted some of this

idea to beach use by constructing a six foot hoop out of plastic pipe and creating ways of mounting it at various elevations above the ground. With the bottom of the hoop at ground level and the opening facing the kiter the challenge is to hover back through the opening. An added challenge is to fly back out again. We also mount the hoop in the air with the opening perpendicular to the flyer and the challenge here is to simply fly through the opening from either direction. Sounds simple, doesn't it?

Ideas are still free flowing. Some things being tried and tested are multiple sticks and cups placed around the flying field (timed event) as well as being able to land your kite to a designated spot such as on a target or in a large plastic bucket. We're working towards an obstacle course kind of event by combining multiple elements.

Some of the mentioned skill events are more successful than others. Popping a balloon with a fighter kite is extremely difficult. I've tried various techniques. String tethered helium filled balloons tend to lay on the ground with any kind of wind at all. So far, the most successful balloon popping event has been with using medium sized weather balloons filled with helium and closely attached to the tip of a tapered 14-

foot fiberglass banner pole. Most flyers can knock a cup from a stick, so this event usually ensures success and fun for all.

The following couple of pages are samples of handouts prepared for specific festivals.

With the novice event I've tried to simulate some elemental fighter kite characteristics such as which way the kite will turn most readily within the wind window as well some basic positioning for short line touch fighting.

During events I try to make sure flyers will be challenged, but also successful. The selection of events and placement of the obstacles can usually ensure both goals. If there are a lot of experienced flyers, the obstacles will be further away or if the winds are particularly troublesome, closer in. The group may be split between novice and experienced if the experience levels are really diverse. I try to keep all of the flyers together when possible because I think it's important to take advantage of and appreciate the camaraderie enjoyed by the flyers during this kind of competition. It's great to all stand around and cheer each other on and to possibly even deride the better flyers a bit.

You'll see reference to a starting panel and the intent here is to ensure all flyers have an equal starting posi-

tion for timed events. My panel is nothing more than a screencovered PVC rectangle about 18 inches tall with some support legs that I bury in the sand to hold the panel vertically. The panel is usually placed about midway between the flyers obstacles. and the Either the flyer or a field hand will place the kite flat against the panel, allowing the wind to hold it in place prior to launch. When everybody is ready, it usually takes only a slight tug on the flying line to complete a launch.



Chuck sets the cup on top of the pole in preparation for the Senior Skills Competition. Thea Foss Waterway, March 1999

Senior Fighter Kite Skills Competition

- To provide accurate timing of the events, kite launching will be done with the assistance of a field hand or launching panel.
- 2. Two minutes will be the normal time allowed for a contestant to complete an event. On consensus of competitors, times may be extended to compensate for extremely light or troublesome wind conditions
- Scoring will be the accumulated seconds that contestants use to complete events. Lowest combined scores for all events determines winners.
 - a. Grounding will be scored as 150 seconds.
 - b. Failure to complete an event within two minutes without grounding will be scored as 150 seconds.
- 4. Field layout will be with the target area directly down wind from the approximate center of the flight line.
 - a. The flight line will be a semicircular arch drawn in the sand around the target area. The approximate center of this line will be 60 to 100 feet upwind from the ground based targets, depending on the average skill and experience of the contestants.
 - b. As events dictate, flyers may fly from any location behind the flight line.
- 5. Events (3 to 5 of the following events will be staged as time, weather, number of contestants, and interests allow.
 - a. Knock cup from stick either with the kite or the line.
 - b. Paste kite to a stationary target mounted at approximately 6 to 8 feet high.
 - c. Pop a pole mounted balloon with a single pin taped to the nose of the kite.
 - d. Fly kite through ground mounted 6 foot hoop (with opening facing the kiter).
 - e. Fly kite through 6 foot hoop (with opening at 90 degrees to the flyer).
 - f. Land fighter kite on top of pre-positioned and flying single line kite, such as a delta. Fighter kite must remain on target kite with slackened line.
 - g. Land your fighter kite on a ground target or within a designated space.
 - h. Cut a pole mounted 6 foot crepe paper streamer with either kite or line.
- 6. Kites and lines are of the flyers choice and may be changed between events. Cutting and cutting type lines that may be hazardous to spectators and other kite flyers are prohibited.
- 7. Equipment failure: Upon the first failure, the participant will be allowed to tie a broken line or replace a damage kite. A second failure results in a non completion score of 150 seconds for the event.

AKA Fighter Kite Skills Competition

- To provide accurate timing of the events, kite launching will be done with the assistance of a field hand or launching panel.
- 2. Two minutes will be the normal time allowed for a contestant to complete an event. On consensus of competitors, times may be extended to compensate for extremely light or troublesome wind and flying conditions
- 3. Scoring will be the accumulated seconds that contestants use to complete events. Lowest combined scores for all events determines winners.
 - a. Grounding will be scored as 180 seconds.
 - b. Failure to complete an event within two minutes without grounding will be scored as 150 seconds.
- 4. Field layout will be with the target area directly down wind from the approximate center of the flight line.
 - a. The flight line will be a semicircular arch drawn in the sand around the target area. The approximate center of this line will be 70 to 100 feet (based on flying and field conditions) upwind from the ground based targets.
 - b. Flyers may fly from any location behind the flight line.
- 5. Events:
 - a. Knock cup from stick either with the kite or the line.
 - b. Paste kite to a stationary target mounted at approximately 6 to 8 feet high.
 - c. Fly kite through ground mounted 6 foot hoop (hoop will either be facing the flyer or mounted with the opening 90 degrees to the flyer).
- Kites and lines are of the flyers choice and may be changed between events. Cutting and cutting type lines tha may be hazardous to spectators and other kite flyers are prohibited.
- 7. Equipment failure: Upon the first failure, the participant will be allowed to tie a broken line or replace a damage kite. A second failure results in a non completion score of 150 seconds for the event.

AKA Novice Fighter Kite Skills Competition

- 1. All novice events will begin when the participant is in a comfortable flying position.
- 2. Novice flyers will begin non-timed events (a through d) by calling "in" when ready and calling "out" when finished.
- 3. Three attempts will be allowed for non-timed events.
- 4. One point will be awarded for the successful completion of each maneuver (a d).

5. Maneuvers:

- **a.** Fly your kite horizontally from left to right across the wind window and somewhere to the right side of center, turn or spin the kite counterclockwise three rotations and then exit the spin.
- **b.** Fly your kite horizontally from right to left across the wind window and somewhere to the left side of center, turn or spin the kite clockwise three rotations and then exit the spin.
- **c.** Fly at a comfortably low level to somewhere near the center of the wind window and then turn and climb vertically to a high "neutral position" and stop.
- **d.** Fly at a comfortably low level to somewhere near the center of the wind window and then turn and climb vertically to a high position and then rotate the kite and fly vertically down to a low position, rotate the kite, and come to a stop in the low hover position.
- e. Timed event; with a maximum of three minutes allowed, and beginning from a comfortable flying position, knock the cup from the pole with either the kite or the kite line.
- 6. A combination of accumulated points and the shortest time to knock the cup from the pole will determine the winner as well as second and third places.

I have been asked by several people how
I frame the fighters I build. Let me
first say, I in no way have all the
answers, nor do I have the only
answers. The techniques I will be
sharing are simply methods I have
discovered through trial and error.

THE SPINE

By far, the most frequently asked question I receive is, how I bow the carbon spines I use. The next question is, why don't you just use bamboo? To me, working with bamboo is an art, just as designing and building kites is an art. I'd rather spend my time on the latter, rather than on carving and shaping a piece of bamboo to achieve that perfect flex and shape. Besides, I've always been the type to stray from the traditional.

FRAMING FIGHTER KITES WITH MICRO CARBON AND FIBERGLASS

To frame a fighter with a carbon spine, you will need the following items:

0.070" solid carbon rod 1/16" superthane tubing 20# braided dacron line

Cut two pieces of tubing, each 1/4" long. Cut the rod to length by inserting it in the nose pocket and marking it slightly longer than the sail. When you insert it into the pockets it should have a slight bend to it. This is basically an attempt to minimize the effects of the inevitable stretch that occurs over the course of time. The bend should only be slight; now take the spine out of the pockets and slide one piece of the tubing on and position it between the nose and the bow. Slide the other piece of tubing on and position it somewhere above the lower bridle point.

This is the point where you have to make a decision. Where do you want the bend to occur along the spine? This is determined by several factors, but there is no set rule that I know of. For the most part it is trial and error and experience with the design you are working with. I generally try and get the bend in the upper 1/3 of the spine just below the bow. This is just a starting point, I tune from there. Start by flexing the spine in your hands to get a feel for how it bends in relation to the position of the pieces of tubing, and adjust their positions accordingly. Once this is decided, put the spine back in the kite and you're ready to make the bend.

As you've no doubt figured out by now, you will be tying the dacron line around each piece of tubing to achieve the bend. First start by flaring one end of the dacron. This is done by unraveling the end of the line a bit and melting it to form a flared end. Then tie a slip knot around the spine above the upper piece of tubing. The flared end keeps the slip knot from coming undone. Next measure the line down to the lower piece of tubing and cut the line about 1/2" longer than that length. Also flare this end and again tie a slip knot around the spine below the lower piece of tubing. Before tying the aforementioned knot, it will help to push the piece of tubing up the spine, so you're not trying to tie it under tension.

Once you've got the spine in place and centered on the sail, take a needle and thread and sew a few loops through the sail and around the spine. I generally do this just above the bow and just above the lower bridle point, but with different sized kites you may need to move these positions or add one. This prevents the spine from slipping to one side or the other during flight and unexpected ground work.

It's that easy. Now you have a highly responsive spine that can easily be tuned to your liking. Both pieces of tubing can be moved either up or down to shift the bend along the length of the spine. Or simply move one up or down to induce more or less bend.

THE BOW

In my opinion, the bow is likely the most important part of a fighter kite. It can either help or hinder the flight of your fighter.

When the average person thinks of a kite, the image of a diamond kite comes to mind. Generally a well made diamond kite is a stable kite. Whereas a well made fighter kite is essentially an unstable kite. I say essentially because they are not always unstable. More on that shortly. The diamond is stable because of the dihedral, which is built into the cross bow of the kite. The dihedral is the angle between the flying surface of the kite and a horizontal transverse line.

Fighter kites have no built-in dihedral, rather they rely on a flexible bow to give them their stability and forward tracking. When you pull on your flying line you put pressure on the sail which bends the bow back producing that dihedral I spoke of earlier. The flex of the bow is the key to a good fighter. If the bow has too much flex it will be hard to turn and have slow forward speed. If it doesn't have enough flex all it will do is spin. Your job as a fighter kite builder is to find the right amount of flex for the conditions you will be

flying in. The idea is to have a bow that flexes enough to allow straight tracking, with good forward speed when you pull on the line. When you're not initiating forward motion, the kite should be spinning, waiting for your input.

There are three factors which determine how stiff a bow you need:

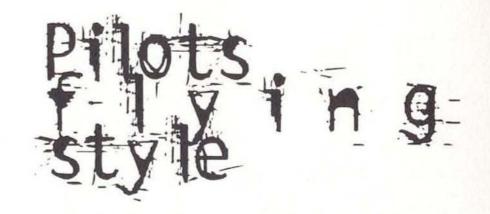
- 1) Sail area
- 2) Wind speed
- 3) Pilots flying style

Sail area - The relationship between sail area and bow size is very important. The larger the sail area, the stiffer the bow you need. This statement is relative. For example, if you have a 20" wing span using 0.05" carbon, this kite will likely be fast and responsive outside in 10 mph wind. Try the same kite indoors, and you would probably get frustrated because it would be nearly impossible to control. On the other hand, if you had a 30" wing span using the same 0.05" carbon, this kite would practically fold in half in 10 mph wind. Take this kite indoors and it will fly beautifully with little effort. Obviously these are two extremes. In reality, if you were designing a fighter for a specific purpose, the increments of wing span measurements with a given size of carbon would be much smaller.

When I build a fighter, I design the sail shape and size with a specific purpose in mind. Then I decide the bow size based on those specifications and my best guess. There is a considerable amount of trial and error in this process. Once the fighter is built I go out and test fly it. I adjust the bridle and the bow of the spine, and fly

it in different wind conditions. After I have a good feel for it's characteristics, I'll then decide whether I want to change anything or leave it as is.

Wind speed - Wind speed is fairly straight forward. The harder the wind blows the more the bow is going to flex. You can adjust the bridle to relieve the effects of this to a degree, but there is a point where you begin to sacrifice control and responsiveness. You could also change the bow to a stiffer one, although it is usually more convenient to have a different kite for different conditions. Another option, speaking from a design point of view, would be to go back to the drawing table and change the sail size. More on that later.



This is a decision of personal preference. Some people like extremely responsive fighters, which are fast spinning with fast forward speed. This style requires fast hands and fast reflexes, along with practice. I'll never forget what Richard Gareau once told me, he said, learn on a fast responsive fighter and you will be better off in the long run. Others enjoy slower, less responsive fighters, which take a deliberate effort to initiate a spin and have straight line tracking with minimal hand movement. Both styles can be fun depending on the conditions and your mood, but there is a natural tendency to be attracted to one style or the other. Your flying style is something you will grow into with time.

TIPS FOR TUNING AND TWEAKING YOUR CARBON OR FIBERGLASS FRAMED FIGHTER

To stiffen up a fighter, you can simply increase the bow size and try again. This is the quickest and easiest fix. But keep in mind that the difference in stiffness between each size carbon rod is significant. This is where fiberglass comes in. Fiberglass is more flexible than carbon of the same size, yet less flexible than carbon of the next size smaller. This effectively gives you twice the options, or half sizes if you will. The weight difference between carbon and fiberglass is negligible when dealing with micro sizes, so this shouldn't be a concern.

I've been known to use two pieces of carbon bound together with evenly spaced pieces of tubing, when I didn't have the size I needed. This actually worked pretty well, which led me to experiment with the variable deflection bow. I had the idea that I could get the best of both worlds, fast spins with the ability to track well in light winds. This is when I thought of adding an extra piece of carbon in the middle of the bow, using evenly spaced pieces of tubing. This gives a stiff mid section and a forgiving wing tip. I know, I know, bamboo, bamboo, bamboo!!! Yes, bamboo is perfect for tapered bows, but as I said before, I don't work with bamboo.

Another method I often use is to actually resize the sail to match the bow. This should be done in small increments of 1-2 inches at a time. It's surprising the difference an inch makes. Also, scalloping the trailing edge helps reduce drag which makes the kite more efficient and faster. It also decreases sail area without shortening wing span, which helps to stiffen up the kite and increase responsiveness.

I hope this has been of some help to you. My wish is that you will take what I've written and improve on it. You are only limited to your imagination. Try new things, experiment, this is how the sport grows. Have fun!



This Side Down by Allen Stroh

Last 4th of July ('98) Susan Shampoo, my 8-year old son (Eddie) and I went to a fun fly up in Belmont Shores (Long Beach). The folks that put on the event made a whole slew of one-line kites for the kids and my son got a couple of them. Not long after that event we were flying at Dog Beach (Ocean Beach) here in San Diego and my son started flying one of these 1-line "sack" kites ... like a fighter. Susan and I were both amazed as NO one had ever taught my son how to fly a fighter and neither Susan nor I had ever tried.

What happened after that was fairly predictable. We all got into fighter kites ... in a big way. Over the course of the next several months I purchased, for my son, some of the best fighter kites on the planet. Kites from Jeff Howard, Steve Bateman, Randy Shannon, Joel Shultze, Jim Wilson (to name but a few) and enough line and winders to keep us ALL busy learning the secrets, successes and failures of fighter kites.

For myself, I found it a real challenge. I'm a 2-line guy ... have been for close to 13 years now ... and I never really thought much about fighters until my son got us interested in them. Our interest (make that obsession) in them revived fighter kites in this area (San Diego) as we started showing up at the park (Mission Bay) and letting others try their hand. The other 2-line fliers got interested in them and the next thing we knew EVERYone was flying fighter kites at the park. They discovered just how much fun (and how addicting) these kites can be.

Eventually I decided it was time to make my own fighter ... bought some PC-31 lcarex and an assortment of very tiny (diameter) rods and dragged out my sewing machine (for the first time in years). When I was young, my mother taught me to sew ... thinking that it would help make me more self-reliant ... but this was a bit different from mending a shirt or a pair of jeans. THIS required a level of skill that I had never touched on before. So the experimentation began. To begin, I simply cut up a few pieces of lcarex and started sewing them together ... trying different stitches, different widths and lengths (of stitches) until I felt comfortable enough to begin working on a skin. I chose some black lcarex for the main sail and for the graphic, an arrow made from a piece of rainbow material that Peter Betancourt had sent me to repair one of my black rainbow Vanishing Point kites (a 2-line SUL kite).

Since I knew absolutely nothing about what constitut-

ed a good fighter, I simply picked a basic shape of a basic size and cut the sail ... hoping that it wasn't either too big or too small. I then cut out the arrow from the rainbow material and started sewing it onto the skin. When I was done, I sat back and looked at the kite with pride ... and then realized that I'd sewn the arrow on upside-down. Hence the name of my first fighter, "This Side Down".

During testing of the kite, I discovered (with Steve Bateman and Charlie M'Clary's help) that the rods I'd selected were WAY too stiff and wouldn't allow the kite to flex (bend with the wind) the way it was suppose to. HOW I discovered that was when the cross-spar broke (in two places) and the kite started flying REALLY well. That was a real eye-opener for me. I'm fairly versed in 2-line kites and in most cases, the stiffer the rods are (within a given weight category), the better the kite fly's. However, with fighter kites that rule of thumb simply does not apply. I reframed the kite in much smaller diameter rods ... and lo and behold, it flew like a champ. It was finished.

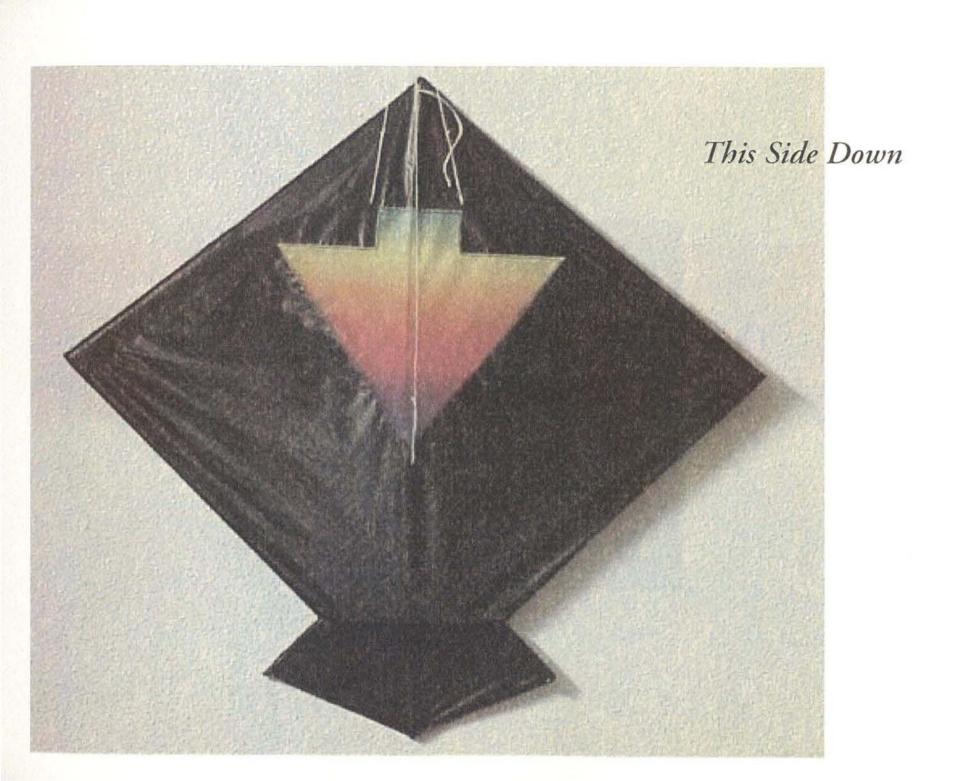
I met Bruce Lambert at the Avi Kite Festival last November ('98) and told him about the kite while he was letting me fly one of his creations. I hadn't brought my fighter with me because at that point it didn't have the graphic on it.

I didn't know (then) that one of the coolest things about fighter kite people is that they LOVE to swap kites. That was another introduction to fighter kites that had me baffled. Why would anyone spend so much time building a kite and then give it away (trade it, actually) for someone else's kite?

I'm still not sure I understand the concept but Bruce and I agreed that the next time we met we'd make a trade.

At the New Year's Eve Day Fighter Kite Fun Fly (phew!) at Mission Bay Park, here in San Diego, we met again and swapped kites. I got one of Bruce's Christmas kites and he left town with "This Side Down". I never even got a picture of my kite but hopefully Bruce will have one he can plug in here somewhere ... just so you can see what it looks like. I think I got the better deal, by the way, but Bruce seemed quite pleased with the trade ... and I guess, in the fighter kite world, that's all that matters.

Fighter kites are MUCH more challenging to fly than 2-line kites. They require a completely different set of skills and a REAL knowledge of what the wind is doing and how it affects your kite ... how you react to it and how you can make it work for you in ways that are somewhat predictable. A knowledge of a great many other things is required to create a successful design ... build it and THEN make it fly (something I'm still learning about) ... and as in most things, if you never attempt it, you'll never find out what it's all about.



I've seen some legendary fighter kite pilots do things with their kites that I could never begin to do with a 2-line kite ... and I think that more than anything else is what is so intriguing about fighters. That and the laid-back attitude and friendly disposition of ALL the fighter kite fliers my son and I have met over the past 8 months. They are a "breed" unto themselves and some of the nicest people I've ever met. It must be the kites and just the freedom of flying that makes them that way. Their willingness to share their knowledge (and their kites) is a model for fliers everywhere

...and I'm proud to be a part of that group.

Thanks, guys.



Variable Geometry Applied Throughout Fighter Kite Design

Fighter kites are maneuverable because they change their shape in response to the difference in air pressure between the front and back of their sail. Under low pressure, the sail is flatter and the kite turns easily. As the pressure increases, the sail is pressed back into a dihedral (keeled) shape, which tends to travel in a straight path through the air. The flyer controls the kite by controlling when these pressure shifts occur, and therefore the direction in which the kite flies. Fighter kites are unique in that this continual "shape-shifting" is not a by-product of the design, but is the defining characteristic of their flight.

The structure of the most common fighter kite design, the Indian and its derivatives like the Hata, is conceptually very simple, consisting of only four components: the sail, the bow, the spine, and the bridle. The spine and bow form the frame of the kite. They support and shape the sail. The bridle controls the alignment of the kite in the pitch and roll axes. (Aircraft literature speaks of three axes of rotation, pitch, roll, and yaw. These terms are also useful when discussing kites. Pitch is the "nose up-nose down" axis. Roll is the "bank left-bank right" or "barrel roll" axis. Yaw is the "nose left-nose right" axis.)

In conventional fighter designs only the bow and sail change their shape in response to changing air pressure, the spine and bridle do not.

The distinguishing feature of the Vari-Fighter is that all four components are designed to change their shape as the air pressure changes.

This allows the performance of the kite to be more easily optimized across all flight regimes, without requiring the compromises in performance necessary in traditional designs.

Having noted the conceptual simplicity of fighter structure, let me pay homage to the truth quickly encountered by all those who build a fighter kite: a great flying kite may seem a simple object, but it is a machine of subtle interactions which are not fully under-

stood by anyone. A good fighter's "dance-with-the-wind" is easily appreciated by the flyer, but is not so easily attributed to specific design features. However, many lessons have been learned through experience and experiment, and there are several principles and relationships which seem to hold true (most of the time). The following discussion is structured around each of the four components, the principles and their interactions, and how variable geometry applies to each.

THE SAIL

The sail is the most obvious of the kite's components. There are many different fighter kite designs around the world, usually distinguished by the plan of their sail. While the principles of variable geometry are applicable to most fighter designs, this article will discuss what is perhaps the most common design: a diamond shaped sail where the corners form the nose, tail, and wingtips, see Fig. 1. This sail

plan can be defined in a few simple formulas. I will use the same nomenclature as used in an article published in KiteLines magazine in 1993 where:

I = the length of the kite, measured from tail to nose, along the centerline.

w = the width of the kite, measured from wingtip to wingtip, perpendicular to the centerline.

t = the length of the kite from its widest point (tip point), measured to the tail along the centerline.

b = the length of the kite from where the bow crosses the spine, measured to the tail along the centerline.

S = square area of the sail = lw/2

A = aspect ratio = w/l

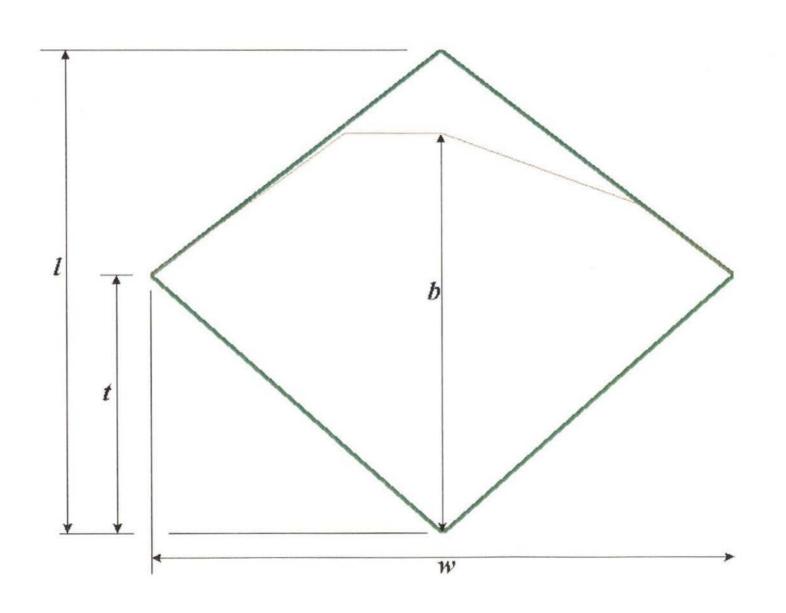
T = tip ratio = t/I

B = Bow cross ratio = b/l

The following relationship derives from the above formulas:

$$I = (2S/A)^{1/2}$$

Basic Fighter Kite Shape



Experience has shown that the material of the sail affects how the kite flies. Two kites, identical except for their sail material, will fly differently.

So, here is the first principle: there is no "magic" shape, which is the best fighter. Second principle: use smaller kites in stronger winds, larger kites in lighter winds.

As a guideline, practical values for the above relationships are: S = 100 - 350 square inches A = .9 - 1.2 T = .5 - .7 B = .6 - .85

Sail materials vary in their stretch, permeability, and smoothness. In flight, stretchy, permeable sails feel "gentler"; stretchless, impermeable sails feel "harder". Tyvek, light orcon, and ripstop nylon are gentler materials. Linear polyethylene, ripstop polyester (lcarex), and middleweight orcon are intermediate. Polyester film (Mylar) is impermeable, does not stretch, and feels "hard" to the wind.

THE BOW

The bow is what most clearly differentiates fighters from other kite species. It is flexed when attached to the sail. The bow's tension is what flattens the sail, and controls how much the sail becomes concave under pressure. Several materials are commonly used as bows, but it seems that the evolution is toward the highest stiffness-to-weight ratio. Bamboo is nature's composite material, and I do not believe any synthetic material

equals its stiffness-to-weight ratio. However, getting consistent results with bamboo requires much more effort on the builder's part. The most commonly encountered synthetic material is protruded carbon fiber rod. It comes the closest to bamboo's performance and offers great consistency and stability under changing conditions.

The bow and sail interact as follows.

When the sail is flatter, the kite yaws, so a bow, which is strong enough to keep the sail flatter, will give a "spinny" flight. A weaker bow will give a flight where the kite goes straight more easily. Strong and weak are relative to the wind speed.

Third principle: No single kite can fly well in all wind speeds. Light winds require a lower relative bow stiffness;

high winds require higher relative stiffness.

There is some maximum energy available at any given wind speed and sail area. A fast kite extracts more of this energy for its "engine", while wasting less in aerodynamic drag. A flatter sail is pushed harder by the wind and goes faster, so a stronger bow makes a kite go faster. But the stiffer the bow, the less dihedral, making the kite spin faster, which is harder to control while hovering and turning.

Fourth principle: a good fighter embodies a well chosen compromise between speed when flying straight and ease of control when hovering and maneuvering.

It has been found by experience that binding the sail to the bow for some distance inward from the wingtips makes the sail "grab the wind" better. A sail, which attaches to the bow only at the wingtips will pull less, and accelerate less, than one that is bound to the bow. This effect is proportional to the fraction of the bow to which the sail is bound. Binding the sail to the bow gives the best combination of speed and control. Assuming a reasonable sail shape, the relationship between sail area, bow stiffness and sail-to-bow binding is responsible for the overall "feel" of the kite, its pull, its speed, its controllability, and its best wind range

The bow's stiffness can be expressed in two ways, absolute and relative. A bow's absolute stiffness is simply the pressure needed to remove all tension from the sail. I usually use grams. If one measures many kites, the tension will typically fall between 40 and 300 grams. If one divides the absolute tension by the wingspan, relative stiffness is the result. I express it as grams per inch.

The relative stiffness is the most important factor in determining the wind range in which the kite flies best.

I use 5 grams per inch for light wind kites (0-3 mph), 6.3 gr./in. for medium wind (3-6 mph), 8 gr./in. for high winds (6-12 mph), and 10 gr./in. for very high winds (12+ mph).

If one measures the tension as a bow is flexed, the tension increases rapidly as flexure begins, but then rises slowly once the flexure passes a certain degree of curvature. Every fighter I've found practical has the bow flexed into this region where the tension

changes slowly as flexure increases. This region is large enough to give the designer wide latitude is choosing the shape of the flexed bow. This is also true for bows, which taper toward their ends. The shape of a flexed, tapered bow is different from a flexed, untapered bow, but the tension versus flexure relationship is the same.

One chooses a particular degree of flexure based on how the kite flies and esthetics; there is no single best amount.

The Vari-Fighter design is no different from any other Indian-derived fighter kite in the behavior of its sail and bow, but the spine and bridle are different, as follows:

THE SPINE

The spine of an Indian-derived fighter lies along the centerline of the kite from nose to tail. When the air pressure is low, the bow's tension will flatten the kite along the axis between the wingtips, and any shape the sail needs must, therefore,

come from the spine. When the pressure increases, the bow flexes and the sail takes a concave dihedral shape centered on the spine. The shape of the sail under pressure is determined by:

- 1) the sail's plan
- 2) the shape and stiffness of the bow
- 3) the shape of the spine.

The spine's stiffness and how the bridle supports the spine control the spine's shape under pressure.

The shape of the sail along the centerline is important to the performance of the kite. If we define the wingtip-to-wingtip axis as X, and the nose-to-tail axis as Y, then the front-back axis becomes the Z-axis. Since it runs along the Y-axis, the spine has a shape in only two dimensions, X

and Z. A spine perfectly straight in X is usually the builder's goal, since the spine is like the keel of a boat, a straight keel makes the path traveled straight. However, the shape of the spine in the Z (front-back) axis is another matter. The Z-shape of the spine affects the Z-shape of the sail, which is really the important thing.

Fifth principle:
a single sail Z-shape is
not optimal under all
wind pressures.

At high wind pressures (and the resulting high speeds) a flat Z-shape is desirable for two reasons: 1) to minimize the frontal area of the kite, and 2) to minimize the fluttering of the sail's trailing edge. Both frontal area and flutter increase aerodynamic drag, which slows the kite. In con-

trast, at low wind pressures (and low speeds, therefore), the Z-shape of the sail needs to be convex toward the flyer, so that the aerodynamic forces on the kite push it away from the flyer, which keeps the flying line taut and gives the flyer better control. The sail's Z-shape profoundly affects how easy the kite is to fly when hovering and out near the edge of the wind window (and beyond).

The Vari-Fighter design uses a spine that changes shape as the wind pressure changes. At low pressure, the spine is curved, convex toward the flyer. As the pressure increases, the spine is flattened out so that the sail is flat along the centerline at high speeds, minimizing drag.

The details of construction used to achieve this variable geometry in the spine will be discussed later. Now we move on to the fourth, and last, major component of the kite:

THE BRIDLE

The bridle of a fighter kite is as important as any other component. It is the component by which the kite is "tuned" to achieve optimal control during a flying session. Much previous literature has failed to give appropriate attention to the fighter bridle and its contribution to the fighter's performance.

Fighter kites change their direction of flight by yawing, but are not significantly maneuverable by the flyer in the pitch and roll axes. Indeed, most fighters are intended not to roll at all, since rolling will prevent the kite from flying in a straight line. Fighter bridles attach to the frame of the kite, the spine and bow, and to the flying line. Shifting the relative lengths of the legs of the bridle controls the alignment of the kite in the pitch and roll axes.

To be a bit more specific about bridle construction, it is useful to distinguish between two terms, "legs" and "points". I will define these terms as follows: a bridle point is an attachment of the bridle to the kite frame. A bridle leg is a length of bridle line that is straight when the bridle is under tension; any change in direction starts a new leg. Using these definitions, a two-point bridle is also a two-leg bridle. However, a three-point bridle may have either three or four legs, depending on its construction. A four-point bridle may have four, five, or six legs. Since it is easiest to construct adjustable connections at which only three lines converge, a three-point bridle will usually have four legs, and a four-point bridle will have six legs. It is the number of points that determines the degree of control over the kite, not the number of legs.

Most fighter literature describes a twopoint bridle, which allows adjustment of
the kite's attitude in the pitch axis only. A
few publications describe the three-point
bridle, which allows adjustment in both
pitch and roll. I have seen only one reference to a four-point bridle, used to keep a
thin, flexible spine straight. As this is
written, most high performance fighters
that place high in Western-style, "linetouching" competitions use a three-point,
four-legged bridle, which is used to tune
the kite as follows:

The roll axis is adjusted so that any minor asymmetries in the kite are "tuned-out" and the kite will fly in a straight line when dihedral is present.

The roll adjustment is not usually changed once straight flight is achieved. However, the pitch axis adjustment is typically changed during every flying session.

Moving the nose toward the flyer (decreasing the angle of attack, in airplane terms) makes the kite more prone to yaw,

moving the nose away from the flyer reduces the kite's readiness to yaw.

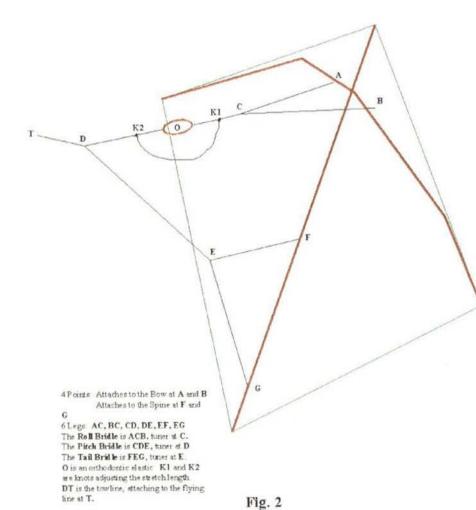
A good fighter is so responsive to changing wind speed that the flyer will want to adjust its yawishness for the conditions of the moment.

This tuning always involves compromise because the kite is flying in very different winds and at different attitudes to the wind as it moves across the wind window. At the edges, one would like more yaw, at the center, less, but conventional bridles are "fixed-tuned", they do not change across the wind.

The Vari-Fighter uses a four-point, six-legged bridle in which one leg is elastic.

The bridle performs two functions simultaneously: 1) it changes the tuning of the kite as the wind pressure changes and 2) it supports the spine's center so that the spine's shape change does not go too far.

The Vari-Fighter Bridle



The elastic leg is in the upper bridle, above the flying line connection, so that higher wind pressure pushes the nose away from the flyer. When the wind pressure decreases, the elastic pulls the nose toward the flyer, increasing yawishness. This elasticity allows the kite to re-tune itself for the wind pressure of the instant.

On a properly functioning Vari-Fighter, when one is flying dead downwind, going fast, pulling hard, the kite is tuned to go straight, not turn, and the spine is straight, minimizing drag. When the pressure is low, the flyer wants to turn, or the kite is out at the edge of the wind, where kites do not turn as well. Then the elastic pulls the nose in, the kite is more yawish, and the spine is curved, so the kite flies away from the flyer and control is more easily maintained.

One feature of the elastic bridle, which it took me some time to recognize, is that the end points of the range over which the bridle changes can be more extreme than one would ever use with an inelastic bridle. At the edges of the wind, my kite is much more yawish than I could ever tolerate if I had to fly that same tuning straight downwind. In the center of the wind, pulling hard, the kite is tuned much less yawishly than I could use if I had to fly that tuning out at the edge of the wind.

The overall perception of the flyer is that the Vari-Fighter design is very easy to fly, maneuverable at the edges, easy to hover, but fast, stable, and straight in long pulls. Also, one does not spend as much time tuning, since the kite has so much adaptability built-in.



Ed building his Vari-Fighter

THE VARI-FIGHTER, SUMMARIZED

The Vari-Fighter design is an extension of the principle of variable geometry into all a fighter's components. All fighters vary the geometry of their bow and sail; the Vari-Fighter adds the spine and bridle. The result is a kite that is easier to fly. My personal goal has been to build the highest performance fighter possible for competing in Western-style, line-touching competitions. However, the Vari-Fighter design principles are completely applicable to kites for other purposes: indoor flight, colored fabric graphic show kites, precision skill competitions,

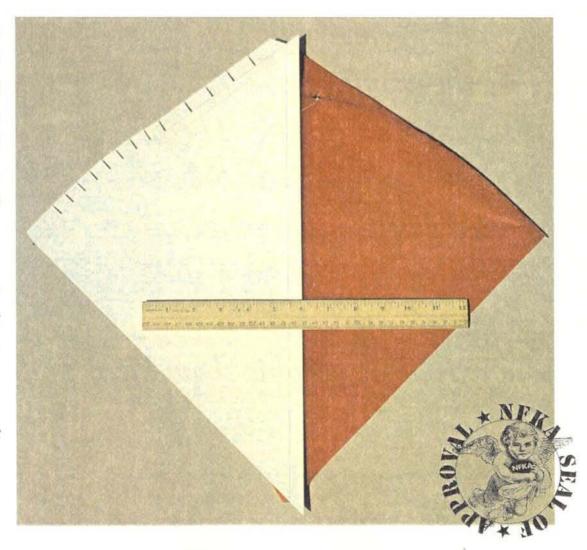
etc.....

Vari-Fighter AN EXAMPLE

What follows is an example of a high performance design, which uses Vari-Fighter principles. It is the best competition fighter design I know how to build as of April 1999. Its features have been validated in several kites of different sizes and wind ranges.

This example is a smallish, lightmedium wind kite. Hopefully the pictures and diagrams will convey what the words above cannot.

Photo shows the sail plan and the half pattern.



SPECIFICATIONS:

Size: S = 165 sq. in.

Length: $I = 17 \frac{1}{4} \text{ in.}$

Aspect Ratio: A = 1.11

Width: $w = 19 \frac{1}{8} \text{ in.}$

Tip Ratio: T = .5625

Tip position: $t = 9 \frac{11}{16}$ in.

Bow: length = 23 in., material = .06 in.

diameter protruded carbon (graphite) rod, extends 1/8 in.beyond the sail's wingtips.

All references to the wingtips, unless specifically noted, are to the sail's wingtips, not to the end of the 1/8 in. extensions, which are there to make construction easier and to act as a guard for the sail wingtip.

FLEXED LENGTH =

w = .84 of straight length, excluding the 1/8 in. extensions above.

TENSION =

110 gr. yielding 5.7 gr./in. relative stiffness, making this a light-medium wind kite (2-5 mph)

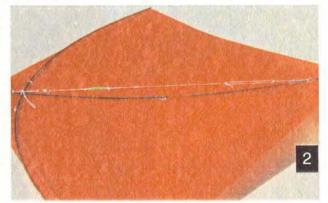
SAIL:

Ripstop Icarex fabric, 1/2 oz. per sq. yd. weight. Bound to the bow for .528 times the distance from the wingtip to the nose, 164 mm. The sail material is hot cut on glass. Hot cutting makes the sail much less likely to unravel, or tear, in the case of Mylar film. My Mylar sails last for years, as long as I keep them away from sharp things.

The shape of the leading edge is, from the wingtip: 1) the natural shape assumed by the bow when flexed, to the point on the bow where the sail binding stops, then 2) a straight line to the nose. The trailing edge is straight.

SPINE:

Graphite Rod, the same as is used for the bow. The spine is flexed into a natural curved shape by an elastic tensioner on its back



side, see **Photo 2**. When the tensioner is removed, the spine is straight.

BRIDLE:

12 lb. Braided Dacron (Cortland Micron fly line backing)

ELASTICS:

Orthodontic elastics of various diameters. They are cut from surgical tubing and are of high quality. The tension under stretch is adjusted by selecting the diameter and by using two. I have found I need to replace them at least once a season if the kite is flown even moderately frequently. I attribute this to their having to stretch severely. However, I still find them far superior to ordinary rubber bands.

SAIL AND FRAME:

I use a half-pattern, carefully flipped during cutting. The sail is hot cut on glass. The foldover tabs at the leading edge are 1/2 in. wide. Next, a 1/4 in. wide strip of thin acetate sheet (school report cover) is placed on the leading edge from the nose to 1/8 in. under the bow. I use 1/4 in. doubled sided tape under the acetate, and on the foldover tabs. Next, the bow is positioned so

that it intersects the leading edge at the junction of the straight and curved segments, and follows the bottom of the leading edge foldover tabs perfectly, and extends 1/8 in. beyond the sail wingtip. (The pattern is originally made by carefully tracing the natural shape of the flexed bow, another reason to use graphite for its consistency.) I hold the bow in place using thin wood strips, clamped to my bench.

The spine is then cut to the length of the sail. I use epoxy to glue a 1/4 in. piece of spine material crossways at the ends of the spine; this prevents the spine from punching through the sail. These end pieces are oriented so they are perpendicular to one of the spine's flexure predispositions, i.e., most graphite spines show one or two preferred orientations when flexed. The bridle attachment holes are then hot cut. The points on the bow are 10% of the wingspan apart. The tail point is 2 in. from the tail. The mid-spine point is halfway between the tail point and the bow-spine crossing. The

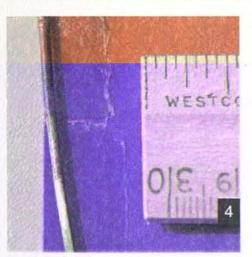
spine and bow are marked at the bridle attachment points and wrapped with clear 3/4 in. tape, above the bridle points on the spine, inward from the bridle points on the bow. Another piece of tape is wrapped around the spine, centered on the bow, to protect the spine from abrasion when the bow rotates as it flexes and as one anchor for the spine tensioner, see **Photo**3 for a close-up of the nose

area. I also make a tightly fitted, but freely sliding 1 in. long tube of aluminum foil and 3/4 in. clear tape on the spine between the tapes marking the tail and mid-spine bridle points. This tube will be taped to the sail later; its purpose is to prevent the spine from bending sideways.

Then the wingtips, nose and tail of the sail are taped down (back side of the sail facing upwards) with enough tension applied to keep the sail perfectly flat.



Contact cement (solvent based) is then lightly spread along the bow, and on the fold-over tabs and the sail they will contact, (I mask the sail with low-tack masking tape). After 35 minutes, the contact cement should feel just tacky. I cut the glue film at the edge of and between the foldover tabs, and then fold the tabs over the bow and down onto the back of the sail, starting at the wingtips and alternating sides. The tabs should go around the bow and straight down to the sail. A piece of 3/16 in. dowel, cut at 45 degrees, is a useful tool in laying the tabs down progressively, over the bow, then out onto the sail. No tension is used beyond what is needed to just fold the tabs over and press them down, otherwise one risks uneven tension in the sail. Also,



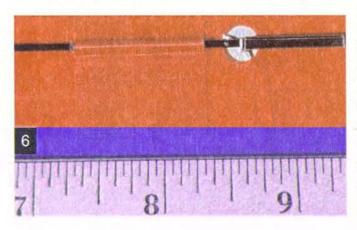
after folding over the two outermost tabs at each wingtip, I release the bow from the clamped wood strips. This causes the sail to feel the tension of the bow, and one can see if the rest of the tabs are being folded over with too much tension. See **Photo 4** for a close-up of the bow and leading edge intersection, and

Photo 5 showing the curved part of the leading edge.

Once the tabs are done, the sail is untaped from the work surface. The spine is then attached using 3 in. long pieces of 1 1/2 in. wide hot cut lcarex fabric completely covered on one side with the double sided tape. (In effect, one makes custom "crack and peel" tape



which perfectly matches the sail). The spine is taped at the nose first, then the sail is tensioned again, as the tail tape is set. If the spine has a slight curve, the spine should be placed so that the sail is "pot-bellied". The



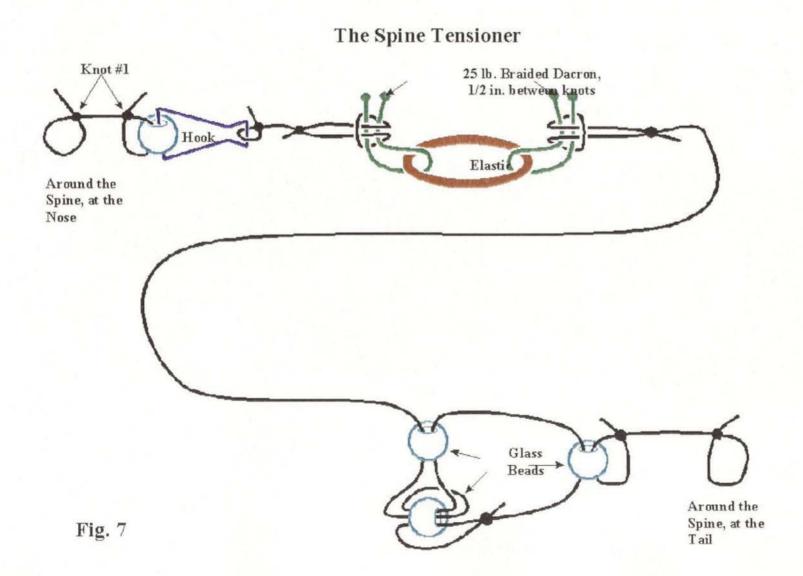
b o w should be in front of the spine, and the s a i I should be very flat a n d smooth. The bow is tied to

the spine and the nose and tail tapes are trimmed for appearance and lowered drag. The free-sliding tube is affixed to the sail by 1) a short piece of double sided tape under its length, and 2) a 1 in. by 2 in. piece of lcarex "crack and peel" wrapped tightly around it and down onto the sail, see **Photo 6** in which the nose is to the right. I put the tube just above the mid-spine bridle point on larger kites.

THE BRIDLE AND SPINE TENSIONER:

To minimize drag I use 12 lb. braided Dacron fly line backing, flame-sealed to prevent unraveling on the

ends. Adjusters (tuners) are made of small glass beads, sometimes called Indian beads. Over the years I've invented and borrowed the various knots and assemblies used in the tensioner and bridle. My goal has been to find knots and tuners that were small (low drag), did not creep, but were easy to loosen and adjust very precisely. The resulting bridle is, however, rather more complex than others commonly encountered. But the complexity is of the sort that results from repeating several instances of individually simple things. The effort taken to build this



bridle is repaid many times over on the flying field. Figure 7 shows an exploded view of the bridle.

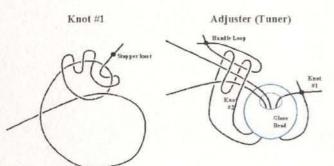


Figure 4 is an overhand knot noose variant that loosens easily, **Figure 5** is a diagram of an adjuster (tuner). The tuners all have three lines converging: one line is fixed, attached by a Knot #1 noose, the other two lines are the adjustable legs. Knot #2 holds the adjustment without slipping or jamming; it is a Larkshead variant I call a Noose-Larkshead. To make tuning easier on the flying field, I put a closed loop through the noose portion of the knot to use as a

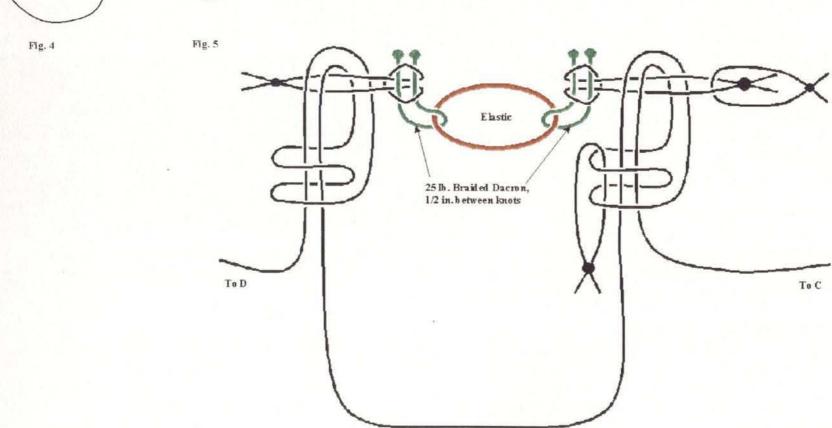
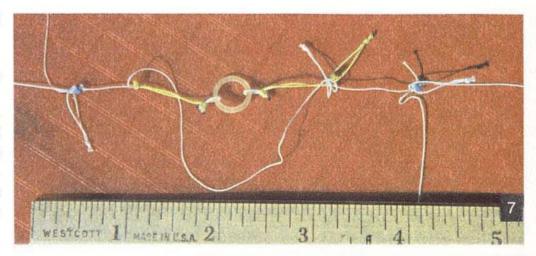


Fig. 6

"handle". Tugging on the fixed line and handle loop will loosen the knot easily.

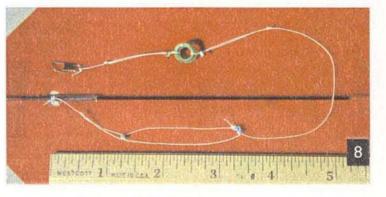
Figure 6 diagrams how the elastic is installed in the upper bridle.

Photo 7 shows how it looks when completed, the nose of the kite is toward the left. I usually put handle loops on only one side for field adjustments. The bridle subcomponents are assembled onto the kite in this order: the roll bridle, the tail bridle, the pitch bridle, the towline, the elastic.



THE SPINE TENSIONER:

The spine is curved at low air pressures by an elastic tensioner on the back side of the spine. The tensioner is strung between the outermost pieces of tape on the spine: the tail bridle point and the bow crossing tape. **Figure 7** diagrams its construction; **Photo 8** shows the completed tensioner, note that two or more elastics can be used. It is made of four pieces of line, one or more elastics, four beads, and a small closable hook. There is only one adjuster. In flight, the spine tensioner and the bridle are so adjusted that when the bridle elastic is fully extended, the



spine is straight. Recent flight testing on the high wind model suggests that a slight backward curve, concave away from the flyer may also produce good flight. At rest, there is 1/2 to 3/4 inch separation between the spine and tensioner line, measured at the spine's midpoint.

FLYING CHARACTERISTICS:

With many combinations of spine and bow diameter and all the bridle and tensioner adjustments available, the flyer has wide latitude in setting up and tuning the kite. I select and tune mine as follows. I set the bridle elastic range and the angle of attack so that the spine is perpendicular to the wind when the kite is straight downwind and the elastic is fully extended, and yet the kite is sufficiently yawish at the edge of the wind when the elastic is fully contracted. I select the kite for the wind by flying long horizontal passes at shoulder height. If the kite flies straight when in the center of the wind without my giving or taking line, then that kite is the correct one for the

wind speed. This selection results in the ability to steer the kite during horizontal flight by slightly giving or taking line. Taking line increases the wind pressure and the kite will turn toward the ground, giving line will let the kite turn up. This control is subtle and requires practice. Many fighter designs show this behavior: straight flight up to a certain pressure, then curving toward the ground as the pressure rises further. In the past I have always tried to eliminate this behavior and have the kite fly straight no matter how hard one pulled. However, this design is fast enough so that the flyer does not always need to achieve maximum velocity to be competitive. Therefore, the maximum pressure regime can be allowed to produce a curved flight path, adding one more dimension of control.

Another result of the low drag is flying fast enough to "get ahead of the line". This shows as a significantly increased amount of curve in the flying line, affecting the kite's attitude. This can cause the kite to behave as though it has overflown the wind: the line tension drops abruptly and the flyer loses control. To regain control the flyer must either 1) slacken the line, removing the wind pressure, to let the spine bend again to make the kite fly away from the flyer, or 2) take line in quickly, to remove the curve in the line, so that the kite is not in an overflown attitude. One can modulate the onset of this effect by changing the depth of the spine's curvature and the tension in the spine.

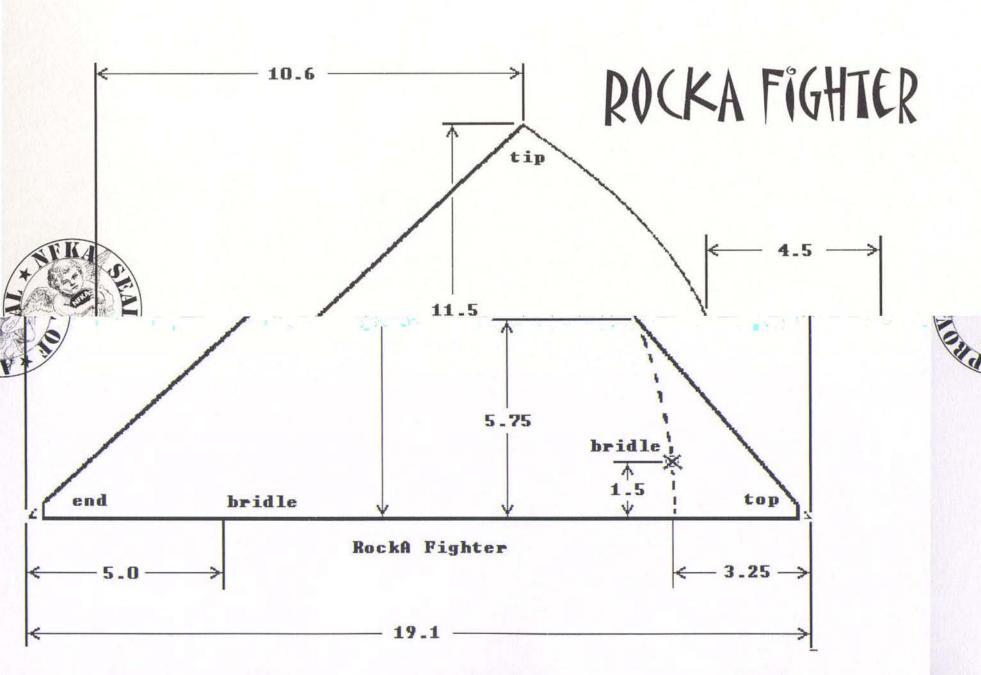
Overall, the Vari-Fighter design flies more easily than my previous designs, but it also offers additional capabilities, requiring the flyer to learn how to exploit them.

Patience

I am a slow kite builder.

To make a Vari-Fighter takes me about 6 hours elapsed (8 hours, if I make a new design's pattern, too), and I'm working just about every minute. But the result is worth the effort. Properly tuned, these kites are an absolute delight to fly. I hope others can share the delight.

BRIAN JVOHNSEN



ROCKA FIGHTER

PARTS LIST

- 1 pre-cut mylar sail
- 1 26" x 0.060" carbon fiber bow
- 1 19.1" bamboo spine
- 1 0.25" in heat shrink tubing for bridle anchor point on spine
- 1 bead for bridle yaw control
- 1 1 foot piece of line for lashing the spine to the bow
- 2 1/16" heat shrink tubing for bridle anchor points on bow
- 2 ripstop nylon wingtip pockets 1" x 3/4"

Fiberglass reinforced tape

- 2 2.5" x 3/4" pieces to attach the spine to the sail
- 0.5 inch wide JLAR (mylar tape)
- 2 1.5" wingtip reinforcement
- 2 9" leading edge reinforcement
- 1 21" spine reinforcement

Crystal Clear 2" wide packing tape

- 2 0.75" x 2" wraps around bow and sail where they meet at leading edge
- 2 6" x 1" bow to sail from wingtip pocket
- 4 0.5" x 2" wingtips holds the pocket on

Bridle

- 1 6" line bridle pick point loop
- 1 12" line yaw bridle
- 1 18" line spine to yaw bridle

SAIL

I've cut a symetrical pattern (full sail laid flat) out of formica that I lay out on the mylar sail material and hot-cut all around the perimeter. The curved portion of the leading edge is somewhat difficult to lay out at first because it needs to follow the natural curve of the bow fairly precisely. If you're making just one kite (or a very few), it may be easier to trim the leading edge after attaching the bow to the sail with the wingtip pockets (leave an inch or so of material to trim away).

ASSEMBLY

- **1)** Spray water on a flat surface. Lay the skin silver side down and use a squeegee to stick it to the surface. Dry the gold side of the skin thouroghly.
- 2) Start with the 21" length of JLAR tape down the spine. It will overhang the skin by about a 1 inch on either end. When taping, do not stretch the tape or the skin will buckle or curl. Burnish the tape down and press out any bubbles under it. I get JLAR tape at Great Winds Kites in Seattle grtwinds@dlux.net Other tapes do not have a mylar backing, so they will deform more easily than JLAR when over-stressed. The half inch tape seems to be adequate. You can get wider JLAR if needed.
- **3)** Apply the 9" JLAR tape to each straight section of the leading edge. The tape will overlap the straight section by about an inch on each end. Burnish the tape down. Don't stretch it.
- 4) Apply the 1.5" JLAR tape from the wingtip along the leading edge and burnish.
- 5) Trim off tape that goes off the sail at the nose and tail.
- 6) Pull the skin off the work surface and dry it.
- 7) Fold the spar pockets in half across the long dimension and in half again so that you have a corner pocket. Then tape them to the wingtips on the gold side of the sail. Tape one over the leading edge and one around the trailing edge.

Don't tape the pocket closed or upside down. Staple the pocket through the tape and sail paralel to the leading edge.

- **8)** Shape the bamboo spine by carving off the corners of the inside surface and beveling the ends down to the bamboo skin surface. Sand the spine to knock off sharp corners. Put the 0.25" shrink tubing around spine 5" from the tail end and shrink it on securely. Straighten out any bends in the spine by working it with your hands.
- straight section perpendicular to the spine. Turn the sail silver side up and apply the fiberglass tape to the nose and tail letting the tape overlap the ends by 0.75". Burnish it down where it covers the sail. Turn the sail over and tape the spine to the sail on the gold side, trimming and folding the fiberglass tape at each end. I slit the tape on each side of the spine from the end of the spine to the end of the tape. Fold that center section over the top of the spine and down the back. The two remaining sides of the tape are folded along the edge of the sail to the end of the spine, pressed down and over the spine. Trim any excess that hangs over the edges.
- **10)** Put the carbon bow between the sail and the spine and place the ends of the bow in the wingtip pockets. Securely attach the bow and the spine using the lashing line about 3.25" down from the nose of the sail. The precise place where it crosses may be slightly up or down in order to force the bow to align with the curved portion of the leading edge.
- **11)** Cut off two pieces of 2" x 0.75" packing tape and secure the bow to the sail where it meets the leading edge on each side. Start with the silver side up and angle the tape at 45 degrees so that half of it protrudes over the leading edge. Burnish it down then flip the gold side up. Wrap the tape over the bow using a tool to press the tape down around the bow before letting it contact the sail on the back.
- **12)** Cut one 6" piece of 2" packing tape and split it down the middle to make two 6" x 1" pieces. Start on the silver side of the sail and place it so that approximatly half of the tape makes contact along the curved part of the leading

edge. Don't overlap the pocket. Burnish it down then flip the gold side up. Make slices in the free edge of the tape at about 0.5" intervals perpendicular to the bow. Don't cut into the sail material. Bend each of the tabs around the bow taking care to press it tightly into the space between the bow and the sail.

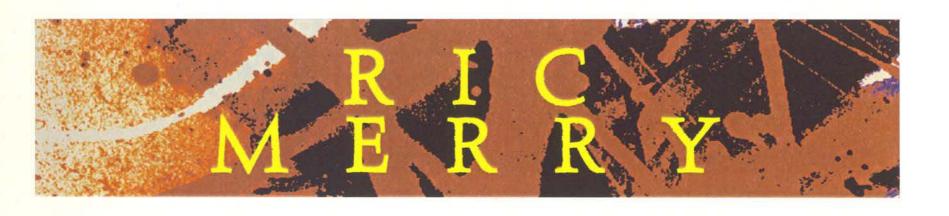
- **13)** Cut some 0.75" squares of packing tape and place them between the sail and the bow under the bridle points and burnish them down for reinforcement. Melt holes in the sail for each of the 3 bridle attachement points at the outside edge of each piece of shrink tubing on the frame.
- **14)** Attach each end of the 12" line to each side of the bow with the loop on the silver side of the sail. Attach one end of the 18" line to the tail bridle point. Slip the center of the 12" loop through the bead creating a larkshead knot around the bead, centering it over the spine. Tie the free end of the 18" line through the bead and legs of the 12" loop. Gather both ends of the 6" line together and tie a single overhand knot in them. Pull the loop securing the knot tightly, then attach it to the 18" leg of the bridle using a double larkshead or Prussik knot.
- 15) Put a slight bend in the spine down at the level of the wingtips.

J.B.R.U.C.E. J.A.R.V.J.E

The rules from Vic in '83

- 1. Launch
- 2. Fight
- 3. Touch from below

4. Period



TACTICS FOR FIGHTER KITE COMPETITION

LIFTED FROM THE FIGHTER KITE NEWSLETTER VOL. 2, 1992

Very little has been written on the tactics of competition. This may be due to A) It's hard to put many of the concepts ot words. B) The knowledge itself is hard won and perhaps not readily shared. C) For the most part, one must "pay the dues" for this knowledge.

Here is some basic, simple, & common sense tactical information about fighting kites...the same basic, simple, and common sense information that usually takes it's leave from my mind the second I step into the competition circle. Here lies the secret worth the price of your annual subscription rate.

HAVE PATIENCE

Typically I see people (including myself) get into the circle and when the whistle blows if the opponent doesn't come over to meet them half way within 60 seconds (which can seem like an eternity) they go after them and soon find themselves the loser of the point. Do this twice and the match is over. What has happened here? Let's call the veteran flyer A and Mr. "Let's get it on" flyer B. By the rough diagram above we can see that each flyer has an area of theoretical maximum manuverability aproximately 5 to 10 degrees directly down wind in which he has maximum speed and the ability to get on either side of the wind thus being able to turn left or right with equal ease. There is also an area of equal maneuverability or vulnerability depending on your perspective which is slightly larger than the aforementioned in which B would really like A to come play in. Any fight outside of this pie shape or near the edge of for either flyer will result in little speed, slow response, and lazy turns in one direction only. B in his adrenelin intoxicated state has flown out of his area of maximum efficiency, through the area of equal opportunity and directly into an area of no return; A's area of maximum ability in which he is greatfull for this minimum effort, easily won point.

The moral of the story; Make your opponent come to you. If your opponent is a subscriber to this newsletter (or at least to this same logic) make him meet you half way in the area of equal vulnerability / maneuverability. There are no time limits in fighter kite competition, no one will accuse you of being a pacifist. Often the most critical adjustment to be made is that of brain rather than bridle. Fly as if you were playing a friendly game of top / bottom without an audience and you'll probably be flying at your best. First and foremost of course is HAVE FUN.

BAMBOO SPINES

I like to start with a pole about 3inches x 6feet. This allows about 3 spines per split section. Often the pole will have a split running its length-that's OK, use it to your advantage by inspecting the interior of the pole for insects, bore holes, rot, & other creepy crawly things. Sometimes an end section of the interior will be blackened, that's OK too but don't accept a pole whose entire interior is black. The further distance between knots the better as these will end up on the face of yur kite sail.

My favorite tool for splitting poles is an old fashion meat cleaver I picked up at a 2nd hand shop. It is easily sharpened and the back of the blade is 1/4inch thick. Although it's not too important to have a real sharp tool at this point, it is nice when starting the initial split. The seight of the cleaver is an advantage which allows you to initiate and maintain the split without a mallet and a third hand.

Always begin the split at the top and work towards the base of the pole. You can tell tip from bottom by running your hand over the knots or nodes of the pole, the grain so to speak runs from bottom to top so your finger should run more smoothly and meet less of a ridge while running in this direction. Bamboo should always be split in equal halves. Split 1/2s into 1/4s and 1/4s into 1/8s. At this point you can remove the buld of the internal knots or nodes by knocking them down with a knife. I then use a Stanley Surform Shaver to take the knot down to the level of the rest of the section.

Use a knife when working with the narrower sections. An older kitchen knife 1 inch deep & 1/8 inch thick works well. I use a high-carbon Dexter Russel commercial fishermans knife & an Accusharp sharpner from this point until finished product for the finest of work.

Until now it should have been easy to maintain equal splits. This becomes more difficult with the narrower sections & the blade can go off to one side leaving

you with unequal splits. This is to be avoided. How?...Practice, patience, and holding your mouth just right.

Continue splitting in equal 1/2s until the desired rough width of spine is attained. The shape of the stick will be triangular & only the inner 2 sides will be shaved.

The finer shaping will be done by drawing the stick across your knee while maintaining pressure with the knife against the bamboo. Bamboo will slice through the toughest of pants so I use a chunk of leather to protect myself and keep those un-sightly blood stains off my work. Both sides of the spine are equally shaved until the correct, symmetrical size is obtained. One side may seem easier to shave than another as well as any given section. Take your time & be careful. **This is fun, remember?**

The final shaving can be done with the blade at a 90 degree angle to the stick. This results in a much more controlled and finished cut. Most fighters utilize a curve in the spine at the intersection of the bow. This is from a stove or alcohol lamp.

As the area begins to turn a golden brown remove the spine from the heat and put the desired bend into it. Set the bend by immersing the spine in cold water for a few seconds. Finish up with fine grit sand paper.

Additional Reading

- How to Split Bamboo for Kites C. Douglas Engh KiteLines Summer-Fall '85 A non-traditional woodworkers approach using Western techniques & tools
- Japenese Kites Concept & Construction Dan Kurahashi
 1870 Kensington Ave., Burnaby, B.C., V5B 4E1 Canada
 Traditional Oriental technique. Revised '92 Edition \$4.00 plus postage.
- Fighter Kites Phillippe Gallot. St. Martin's Press, New York NY USA A sketchy mix of Western & Eastern techniques.

FIGHTER LINE WAXING

Article By: Garry Smith, Puffin Kites

Edited By: Ric Merry

Waxing your own fighter line has many advantages. One being you can at last have line to suit your specific needs. Imagine the flexibility you have in choosing line from 1 lb. up to suit every flying condition. Most kite shops at best carry only 18 lb. waxed linen line. Once you're set up, waxing your own line is quick and inexpensive.

Let's choose the line you'll need. My preference is natural fibers (cotton or linen). Synthetic line tends to burn my fingers whereas natural fibers, even un-waxed, seem to be easier on the digits. Crochet thread makes excellent fighter kite line. It comes in a variety of strengths, however, the labels don't state breaking strength. To check this you can use a small pull type fish scale. It's interesting to note much crochet thread is made in India (I wonder if people who crochet realize they're using fighter kite line?). Crochet thread is readily available, either 100% cotton or synthetic, in varying lengths, strengths and cost.

For very slippery line use a mix of 1/3 parts bees-wax & 2/3 paraffin. For waxed line like that found in kite shops use 1/3 paraffin & 2/3 beeswax. To melt the wax use an old coffe can atop the stove. Use warm to low heat and mix the waxes thoroughly.

Construct a take up spool to fit a vaiable speed electric drill. The take up spool is a plastic line spool with a wooden dowl glued into the spools center hole. If the dowel is too big for your drill chuck or you're using and electric screwdriver you can drill a hole in the center of the dowel, glue a nail in place and cut it's head off.

NELSON BORELUI

There is a new fanatic generation growing rapidly: the indoor kite flyers. They get together for hours in school and health club gyms or other high ceiling buildings. They fly and dance with their kites at the beat of their favorite music. They pause for a while to cool off, to have drink of water, to exchange flying tips or change kites and back they go to their flying machines.

flying fighters indoors

INTRODUCTION

All "conventional" outdoors kiters have experience the surprise or even the disbelieve of ordinary, "normal" people when they learn that you and others fly kites. That there are so many varieties of kites. That kiters are so dedicated and serious about... kiting. Well that's nothing compared with the reaction you get when they hear about your indoor-kite-flying: " Are you kidding?" "Do you put a big fan on?" " "Do you open the door for the air to flow in?" Yet once they see how it works they love it...

Indeed, indoor kite flying is a delightful entertainment, exercise and show. Unlike outdoor kiting weather is not an issue. Indoors is an all seasons, 24-hour affair. All one has to do is to book the gym in advance, if necessary pick up your kites and go, alone or with a group, for one or two hours of fun.

True, most indoor kiters fly dual and quadlinners. Within the single line minority the fighters are the pilots' favorites. As in outdoors there are individual preferences in the selection of indoor kites. Needless to say my preference —and bias— is towards the fighter kites for indoor flying. As in the case of outdoors one can do much more with indoor fighters. Indoor fighters have a special ability to generate unique artistic ideas from the flyers.

Construction of Indoor Kites

The basic elements are the same as in the classic Indian Fighter: spine, bow, sail and two bridles. The differences are in the weight and size of the kite. Heavier / smaller kites are faster and more difficult to maneuver. Lighter / larger kites glide gently, graciously and are much easier to maneuver.

A small kite is 18" high and 22' wide. A medium kite is 23" high and 30" wide. A large kite is 40" high and 55" wide.

The overall weight of the kite should not exceed 2 gm per square foot of sail.

SPARS

Bamboo is the best for spars. For a medium size kite the spars should be 2/3 to 3/4 the spar size of made in India kites. The thickness of the bamboo depends on the size of

the kite, the weight of the sail and how much gliding and speed one wishes from the kite. The thinner the spars the more gliding and less speed. The bow should be tapered down distally.

Carbon fiber rods can be used: 0.07" to 0.04 " for the spine and 0.05" to 0.03" for the bow. The pros and cons as well as other debates with respect of bamboo are the same as in outdoors'.

SAIL

Thin rice paper or thin Mylar work best to keep the overall weight down The Mylar's thickens should not exceed 0.005". It can be as low as 0.002". It takes a while to get use to the behavior of very thin Mylar. But once mastered it is relatively easy to handle and very rewarding in performance.

CEMENTING

Contact cement, slightly thinned, is the best to fasten the spine and bow. Apply a thin layer of cement to the spine, let set for a few seconds and apply it to the sail (a metal ruler may be used as a guide for the spine placement). Place the bow on top of the sail, and tape the ends exactly where you wish them to be when the kite is finished. Lift the bow two inches at its center point. Apply a thin layer of cement under and on the external part of the bow. Let the bow down to the sail and make gentle pressure along the bow. With a sharp knife cut the sail 1/8" away from the bow. Fold the 1/8" sail onto the side of the bow. Remove the tape from the tip and complete the operation at that end of the bow. Treat the "nose" of the sail with a piece of Scotch tape in both sides and cut the excess. Allow the glue to set for 30 minutes or more, before flying the kite.

BRIDLES

Reinforce the attachment points with a small piece of tape. Two point bridal works well. The bridal should not go beyond the with of the sail.

ARTISTRY

Brush or airbrush acrylic painting can ad a lot to the looks of the kite without adding too much weight. Fringes of Mylar or other materials can give character and balance to the kite. Indoor fighters have a special ability to generate unique artistic ideas from the flyers.

FLYING

Space: minimum 40' x 40' floor space, 20' ceiling. Gyms, basketball courts, atriums can make good flying arenas. Avoid places with strong forced air ceiling outlets, they upset the fly. Start with a medium size kite, it is easier than the small kite. Cut a 20'-30' long thing line and attach a little weight to the end. Attach the line to the bridles. The lower bridal should be longer than the upper. With the kite on the floor, pull up gently and walk backwards while letting out line. Let the kite gain altitude while going over your head. Walk backwards in the opposite direction of the kite. Give the line a gentle tug to cause the kite to turn around. Walk around with the floating kite. Feel the kite.

With smaller kites one has to be prepared to move faster. Start the same as with the medium size kite. Through the kite out and up into the air with brisker movements. The kite will invite you to spin it Do it, horizontally and vertically.

Music can ad to the joy of indoor flying. Any music will do it. However it is nice to select a piece that can be conducive to choreographing the fly. To develop a 3-4 minute routine. Try pair or team choreographs with same or different kite size

COMPETITION The AKA is planning an indoor competition for the 1999 Convention in Muncie Indiana. The rules are in the hands of the AKA sports kite rules committee- see page 20 of the March 1999 issue of Kiting. The Internet has some interesting pages on indoors e.g. http://www.yikeskites.com/indoor page.htm Regretfully there is still little reference to single liners.



I have been flying Free flight models' airplanes for about 20 years and most of the ideas have come from flying tissue-covered models and other modelers.

TISSUE:

I use about any kind of Tissue that can be purchased. The biggest secret is to use a "Cheap Lacquer" to Dress the tissue. The reason for the cheap is that it contains thinners that will evaporate away, thus leaving just enough lacquer. The amount to spray on is subjective to the tissue, you want just enough to place a shine on the tissue. The lacquer will glue the fibers of the tissue together, making it easier to work with. Dressing will also make the tissue more wind/water proof. Note: If there is no cheap Lacquer to be found

NOTES ON BUILDING ONE OF NEIL'S FIGHTERS

use a mixture of 60-40 of Nitrate model airplane dope and thinner. The faster the drying time the cheaper the lacquer.

APPLIQUE:

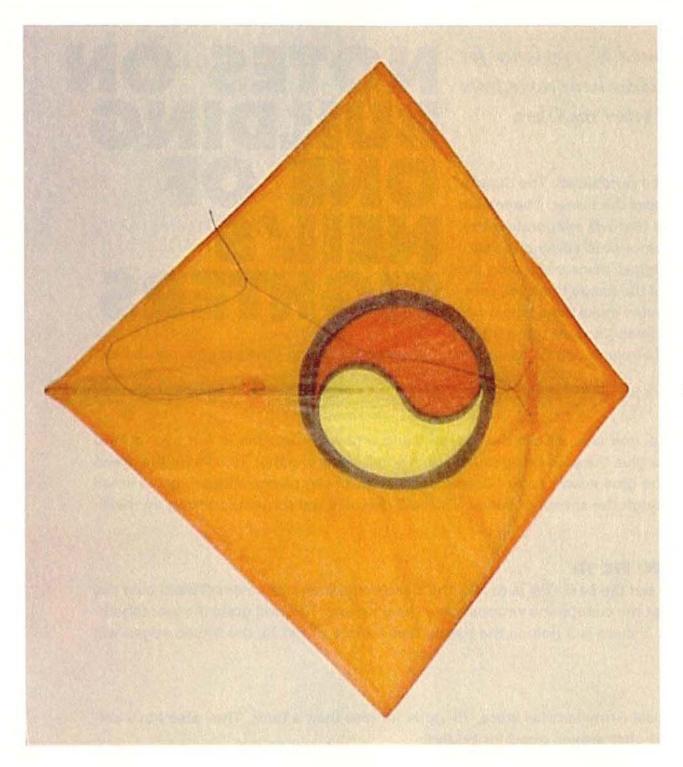
Once the tissue has been dressed/dried, you can cut out the design using a new e-xacto blade run over a hard Arkansas stone. I use glass to cut on. To glue the pieces together I run a small bead of either Testors (in the green tube) or Duco cement. Don't worry if the glue seems to dry before you get all of the pieces aligned, use a small paint brush to wick lacquer thinner through the sheets of tissue. This will dissolve the cement, creating an invisible glue line.

YA GOT A HOLE NOW SO HOW TO FIX IT:

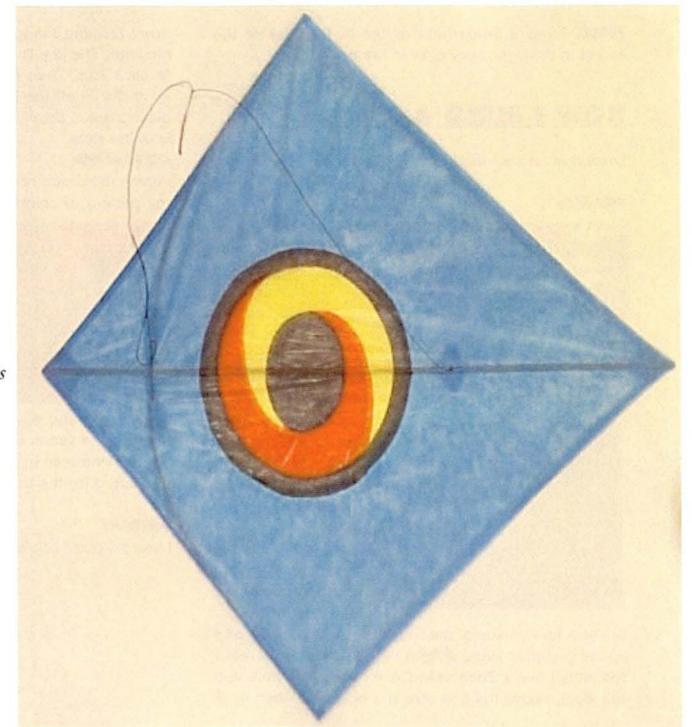
You could take the Scotch tape method but the best way is to take the Duco cement and run a small bead over the tear and then place a small piece of Cigarette cellophane wrapper over the glue/tear. This will draw the tear together and make the tear almost disappear. If there is a hole in the tissue, tear a piece of tissue, the frayed edges will help make the repair disappear.

LINE:

I have gotten some silk line from my local Army surplus store, 75 yards for less than a buck. They also have cotton suture thread, good for outlines and once waxed good for bridles.



One of Neil's Fighters



Inother One of Neil's Fighters

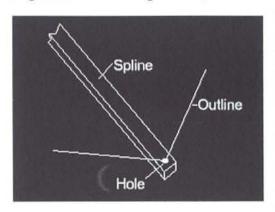
MISC. I use a small hole drilled in the rear of the spline to draw the curvature in the bow.

HOW I BUILD A FIGHTER.

Once that I have found the plan I am going to use.

FRAME:

I split a piece of dry Bamboo that is at least 4 to 5 times bigger in width and height then I will need. A meat cleaver is the tool of choice for splitting. I was once told that by splitting a bigger piece it reduces the stress in the bamboo. The length is close to the finished length. To shape and size the Bamboo, I use a carving knife that was purchased at Woodcraft Woodworking supply. The model is the Swedish Beginner's Carving Knife, sku # 03a54. I also use a



small Stanley plane with a new iron cut out of an old saw blade. Once the spline and bow are shaped, I drill a small hole on the bottom spline and slot the ends of

the bow and the top of the spline. Then tie the bow and spline together using a figure-eight pattern. To make the slots I use a Zona saw. Once I make the hole and the slots, I pass the line thru the hole and then back

down forming a loop. I then tie the free end with a double knot. The line is run around the outside of the kite in each slot. Then pulling the line I get the shape I want. To tie off the line use a couple of half-hitches. I place a small drop of glue on hole and where the line is in the slots.

COVERING:

I dress the tissue of choice with Lacquer. I then layout my pattern of colors or applique. I then make a fold where the spline will make contact with the tissue. I place a bead of Green Glue down the spline and place it over the fold, letting dry before going on. I tape the whole kite down to my bench pulling out the wrinkles and leaving the edge I am working on free. Then cut the tissue about 1/4 inch from the line. Fold over the tissue, making a crease. The crease should be on the line. Place a small bead of green glue and fold over the tissue. If the glue dries before it is smooth then use a small brush and wick a small amount of Lacquer thinner into the seam. Do this to all sides. I then glue on tissue reinforcement on the front where the tissue is punctured for the bridle holes.

BRIDLE:

I use a 3 point bridle that Randy Shannon taught me.

G A WID G

THE RULES OF ENGAGEMENT

I've been fortunate to participate in rokkaku battles around the globe.

Some kiters enjoy the rigors of kitemaking competition. Others live for the thrill of sport kite contests. But I have to tell you - nothing gets my competitive juices flowing more than the starter's whistle in one of these kite destruction derbies.

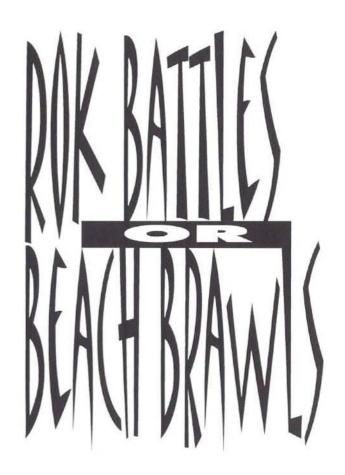
One of my favorite contests was in Lunen, Germany. Over sixty kites rose to the challenge and the sky was seemingly pushed aside by the mass of colored appliquÈ. It was a good, clean, hard fought battle and everyone came off the field unbruised and happy.

It isn't always like that. The problem is that as you travel from event to event, you never really know what the ground rules are going to be.

The classic case arose in an early contest at Long Beach Washington back in about 1989. It was their first rok battle, and the announcer was busy whipping the crowd and fliers into an appropriate frenzy. "Anything goes!" he exhorted -- and the fliers believed him.

Within thirty seconds of the whistle, the first body-block was thrown. And as kites came down, team members simply dropped their lines and started chasing and tackling opposing team members. Spectators, the bigger the better, were recruited on the spot. I particularly remember leaving the field with a muddy footprint in the middle of my back.

The "Great Long Beach Rok Battle and Beach Brawl" came to mind mid-way through a recent World Cup rok competition. The judges team was pushing hard. When I moved in for a tip, one hit me from behind and another low from the front. A third judge circled the confrontation with a large water cannon and aimed for my head.



"This is the way we do it in Germany", one fighter said. "We're not in Germany", I tersely replied. Besides, I've been to Germany...

This brings us to the

First Practical Rule of International Rokkaku Etiquette:

Physical contact among combatants is strictly forbidden.

Of course, accidents do happen.

In Verdun, my good friend Peter Lynn struggled for a wrap and, missing my line, twisted his string under my arm. I still bear scars from where he pulled-in trying to cut "something" loose.

In Berck, France, a fighter kite enthusiast attached three feet of glass coated manja to his fighting line. As his kite came down, Pete Dolphin reached up to protect his face and found his leather glove cut clear through.

In another battle, contestants brought heavy hemp cord into the fight. You couldn't cut it with a knife or burn through it with a match. We protested the line, without success. Then, to further my protest, I stepped into a nearby storage room and emerged with several length of coated telephone wire. I quickly knotted the wire together and lofted my kite into the stiff breeze. Whenever an opponent came near, I simply snapped the heavy wire at the kite and it moved away.

More protests followed. "Gomberg is using high tension electric cable" someone argued. "No" said the organizer -- "it's only phone line and that's o.k."

So...

Rule Two of fighting is:

Artificially abrasive lines, or lines that are impossible to cut should not be allowed.

We're looking for fighting skill as much as a good tangle.

In Uchinada, Japan, I struggled through an active heat until only two of us were left. I engineered a double wrap and shifted downwind, sure that I had a cutting advantage. Suddenly, the head judge blew his whistle and announced I was "out". I stopped in mid-field, dumbfounded.

"What have I done?", I argued. "You crossed the boundary!" "What boundary?" "Between this banner and that tent!!" "Well, when was that announced?!?" "The announcer explained at the beginning of the contest." "Yes, but that was in Japanese!!!"

Rule Three:

Tell everyone the rules.

Most of the regulations that confound you are designed to get contestants to actually compete. Unfortunately, the best strategy for winning a rokkaku battle is to only engage minimally, and wait for the crowd to thin out a bit. But that's the exact opposite of what the spectators and organizers want you to do.

Usually, judges will warn contestants for not engaging. Other times, they will devise strategies to bring you closer together. The one I like the least is the "shifting boundary".

As soon as the starting whistle is blown, boundary judges start moving the lines to shrink the competition area. This happened to me last year in Europe where we suddenly found that the lines were moving faster than the fliers. It may have been fun to watch, but wasn't much fun to fly in. The battle was over with in well under three minutes, and the results were determined more by luck than by skill.

Final Rule: If we really want fliers to compete, then the answer is reward engagement rather than discourage it.

Judge the events the way they are actually scored in Shirone and Hammamatsu. You don't just get points for being the last kites in the sky. You also get rewarded whenever you tip or cut someone else down.

This approach has been used in Wildwood the last three years and works well. People still accused me of hiding out or "sand-bagging".

But now I could point to my score for cuts and tips to support my first place finish.





the hummingbird

The Hummingbird

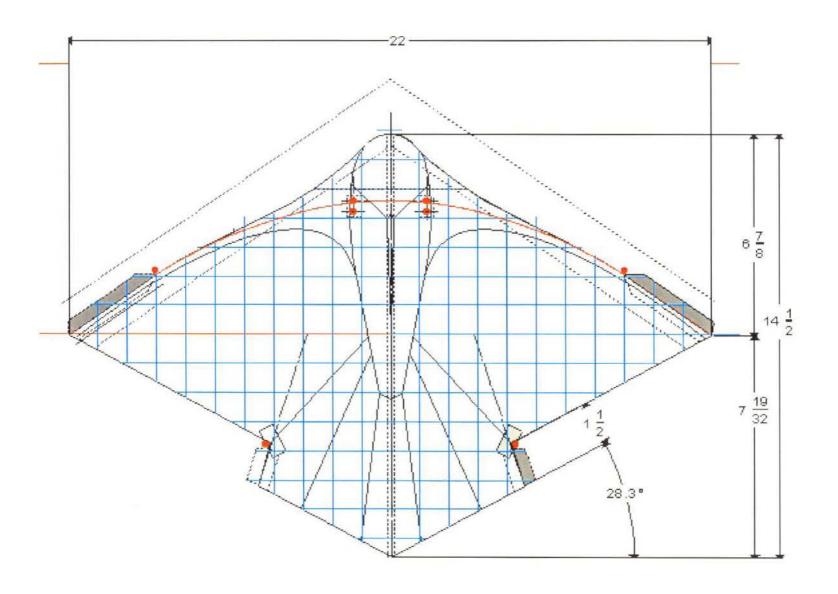
The shape was intended to accent the bird-like quality of movement that I see in a fighter. The shape is certainly influenced by Randy Shannon's AVI kite.

Originally, I intended to use a rather deep but light bow to hold the tail tips in position. Tried it- didn't like it. So battens on the luff edge seem to solve the problem of holding the tail tips in place.

The method of laminating is pretty simple. Layer all the clearphane over a full size drawing by brushing down each color (static holds everything in place) and cutting through all layers inside the kite's outline but not cutting the outline it's self. You then remove the individual pieces until the color you want showing is uppermost except that you must, for the time being, leave remnants of the clearphane in place where you want the prismatex to be the only layer of the final skin. Using a construction grade contact cement, spray the entire surface lightly but completely. Next peel off everything you do not want to appear on the final design. You should now have the full sized drawing with all the color

applied. Carefully roll the prismatex over the entire drawing. Next, apply tape where required for reinforcement and make the final outline cuts. With it still on the drawing set the spar pockets, tape down the battens and fold over the outer edges of the tail. A strip of double edge tape is applied to the sail along the centerline and the pre-shaped spine goes over this.

Flight is quite fast (fast enough to use in a fight) and tracks well enough although it doesn't hold a horizontal run as far as I would like. Turns start fast and get faster- to the point the kite turns into a blur by the third rotation if the line is left slack. Gentle pressure will slow it and allow the rotation to continue but it takes a bit of practice to hold it in spin just above the ground when you are trying for an undercut. I don't use that often, preferring to cobra in that situation- and this does cobra (in good sunlight it really does look like a hummingbird hovering). It is a bit hard to launch out of hand. Likes about 20' of line out before real control is obtained.



The Hummingbird

INSTRUCTIONS FOR BUILDING MC HUMMING DIND

- ® Spray a moderately heavy coat of all purpose spray adhesive to the back of the full size drawing. Roll the drawing onto a standard sheet of poster board being careful not to allow wrinkles to form in the drawing nor bubbles to develop under it.
- ® Spray entire face of drawing and poster board, following the manufactures instructions, with a repositionable stencil adhesive.
- ® Position a piece of blue clearphane over the bird's body and lightly cut about 1/8" to 3/16" outside the pattern line. Remove rough-cut pattern and lay aside. Discard scrap.
- ® Position a piece of yellow clearphane over the bird's tail. Repeat above procedure.
- ® Position a piece of red clearphane over the bird's head. Repeat above procedure.
- ® Reposition rough-cut body, head and yellow tail feather patterns onto drawing making sure that they overlap at color separation lines.
- ® Roll green clearphane carefully over entire poster board. Allow no wrinkles nor bubbles. Lightly cut all color separation lines. Remove green that lies over red, blue and yellow. Apply a light, but full covering, mist of all purpose adhesive spray. Remove and discard all remaining green except wing leading edges and three tail feathers.
- ® Starting at the top, roll on prismatic film. Allow no bubbles or wrinkles. Starting from one side, peel the prismatic film off the drawing (the color panels should come up with it). Turn this over and reposition on the drawing with the color panels now on top.

I've spent a lot of time bent over a drawing board and until about three years ago done all my drawing with pencil and paper. But after I got my computer I wanted to get into CAD. Didn't want to spend an arm and leg tho. Found shareware on the net at DeltaCad, downloaded and, after a couple of hours playing with it I ordered the authorized version for \$50. (Their web site is http://www.dcad.com) If you have done any drafting with a T-square, triangle, compass and scale you will be able to produce full sized or scaled plans of anything you can conceive in your head.

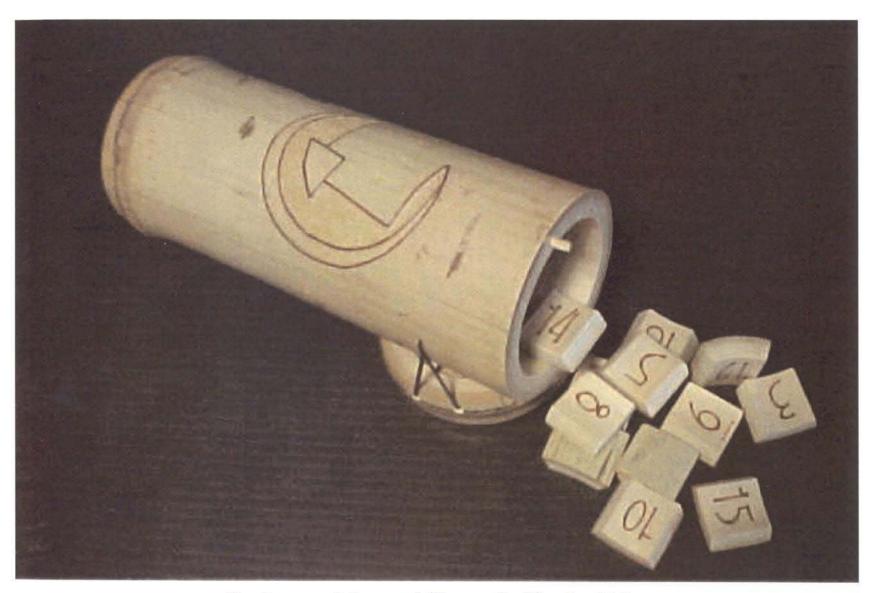
Of course you may use the plan any way you would like, but of course as a kitegod, I would like credit.

Yes, the line parallel to the LE is reinforcing tape. I find that some extra lines (such as the one in question) aids in the laying down of the materials. On the final drawing you will find rough trim lines and punch holes shown. And you are right on about the end result being a laminated skin. Still working on such things as which face of which material is facing which way (does that make any sense at all?) and which type of adhesive is used where. This last is undoubtedly some of the confusion you have about the layering and unlayering of the clearphane.

Getting quiet a bit of flying time on the Hummingbird and letting anyone who wants play with it.

Getting exceptionally good reviews.

MANI D JAAM

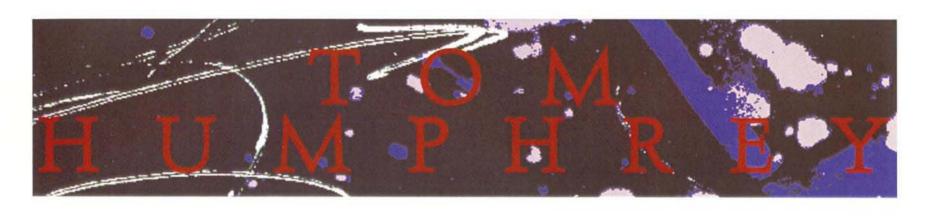


Bamboo container and tiles crafted by David Jam

Gifted to NFKA and used in our super-sacred Flyer-Positioning Ceremony preceeding combat competition.

It has become our most honored artifact.

THANKS, DAVID.



THE DRAGONFLY FIGHTER

and the value of patience.

PATIENCE? What on earth does patience have to do with fighter kites? For a sport like fighter kiting, you might not see patience as relevant. I believe that for the fighter kiter, patience is important, and if you want to build your own fighters, patience is vital. This chapter concerns kite building and design - and while many fighter flyers don't build their own kites, the information in this chapter can also show you what to look for when you purchase a kite. Keep in mind that the differences in performance that I speak of are often small, and yet even small differences in performance may make a big difference to you.

I have been involved in the sport for about three years, and in that time I've gone from a man who had never seen a fighter to someone helping advise the AKA on fighter rules. Three years seems a short time - So why mention patience? During the last year I've had the benefit of being active in the NFKA, which gave me direction and insight. I have devoted many long hours to experimenting on kite design and flying fighter kites. The more I learn, the more I realize how much more there is to learn. As you read this, remember that the price of the hard won experience that is passed on in these pages is patience and persistence. This is like any other craft - expect to make mistakes, be patient, reflect on your mistakes, and then overcome them. I once asked a terrific fighter flyer and builder how to build a successful fighter; since at that time I hadn't been able to make a workable fighter. His answer: build lots of kites. He was right. I had to experiment and find out what worked. Then I had to find what I liked best and refine it.. Now my fighters fly and maneuver the way I like them to. Later on I'll show you my Dragonfly fighter, and if you like my design, use it as a starting point for your own designs. Of course, that takes patience!

THE EFFECT OF SAIL SHAPE ON FIGHTER PERFORMANCE

We begin with the Indian style fighter - a small, diamond shaped kite with a flexible bow from wingtip to wingtip curved towards the nose of the kite. There are other kinds of fighter kites, but for now we will examine the most popular and talk about how to change it's behavior to suit your needs.

The first important design element is the shape of the sail. Sail shapes affect your kites lift, drag, spin, and tracking. You need to be able to predict how your fighter will react. By the way, predictability in a fighter kite is desirable. The only unpredictable part of fighters should be the way that you fly them! Let's start with lift. Larger sails generate more lift for their weight than smaller kites. While a smaller kite can be made with lighter materials, all things being equal a larger kite will generate more lift. Lift is generated at the front of the kite from the leading edges to the middle of the kite between the wingtips. Wind spills off the rear of the kite, causing drag. Drag will slow the flight of your kite. While large kites generate more lift, they also generate more drag. Surfaces not necessary for lift add to drag. Spin refers to speed of spin, and thus the speed at which you can turn. Faster spin requires faster reaction time for the pilot. Tracking refers to how well the kite flies in a straight line. Elements which increase spin tend to decrease tracking, and straight tracking can be had at the expense of spin. Tuning the kite can also effect spin and tracking, but sail shape will define the range of possible spin speed and tracking ability of your kite.

Let's start with the simplest fighter shape - a square flown on edge. The common Indian fighter starts from roughly this shape. All sides are equal; and a line drawn between the wingtips splits the spine in two. I call this imaginary line the wingtip line, and we'll see how moving the wingtip line can effect our kites. We will assume that the sail is symmetrical on either side of the spine, and the kite is balanced around the spine, tuning is ideal and we have steady wind conditions, so that we can minimize other effects on our flight. This diamond sail shape works well. It will spin controllably - and quickly. If the line between the wingtips bisects the spine, there is a balance between instability (spin) and straight line maneuverability (tracking).

When we move the wingtip line down past the center point, control is difficult without counterbalancing items like tails or tassels at the end of the spine like you see on Indian fighters. This adds drag to the kite, and weight to the base of the spine as a counterbalance. When we move the wingtip line up towards the nose of the kite, The effect is to slow down the spin of the kite, while improving tracking. However, as the wingtip line nears the kites nose, there is a loss of maneuverability because the kite is unable to spin effectively.

Another important point concerns Aspect Ratio. Aspect Ratio is little more than the ratio of a kite's width to its height. A high aspect ratio is a short wide kite, and a low aspect ratio is a long, thin one. High aspect kites tend to have more lift and faster spin; Low aspect kites tend to have less lift and track straighter. Most fighters I have seen and flown have been high aspect; or at least the same width as height. I have built and flown low-aspect fighters, and they can be good kites, but in my experience they are not as agile as neutral or high-aspect fighters. Kite design being what it is, however, it is not unlikely that a low aspect design will be studied and refined to the point where performance is as good as a high aspect kite.

I would advise the novice kite designer to consider a slightly high aspect design as a starting place. If you begin with a proven sail design, you can learn a building technique that works well for you before you start to experiment with sail geometry.

So far we have examined kites with straight leading and trailing edges. Curves also have advantages. If you want to reduce drag and sail flutter from the trailing edge of the kite, one solution is to cut out the trailing edge slightly. I use this technique, and it works well. I should also point out that some kitebuilding materials don't respond well to curved shapes, particularly ripstop fabrics. Some kites have their leading edges follow the line of the bow, and come to a sharper point at the nose. This allows more leading edge support by the bow, which gives a cleaner airflow over the sail that will help increase the speed of the kite. A novice kite builder may find these things appealing, but particularly for a leading edge, they are difficult to do well.

Now we'll look at two other factors in kite design apart from sail shape. The first are what I call extras - tails, battens and tassels. The second is flexibility. Extras add weight to your kite but provide them with advantages. Tails (usually the triangular Indian kind) help to stabilize your kite and provide it with ballast from head to tail - which slows spin somewhat. Tassels can provide the same service, but tend to produce more drag. Tassels placed at the wingtips, as the traditional Nagasaki Hata kite does, can be trimmed to help balance the kite if it favors one side or the other. Sail battens change the stiffness of the sail, which can channel the washout of air that occurs over the trailing edge of the kite. It reduces trailing edge flutter, which can increase the forward speed of the kite by decreasing air turbulence at the trailing edge. They can be

used to support changes in sail geometry such as trailing edge cutouts or extensions that might effect the strength of the sail and the maximum wind range of the kite.

Flexibility is the degree of flex in the bow. It is important to have the right bow for the sail you've chosen. There is a range of flexibility in which your kite can perform. If the bow is too soft, the kite will become hard to maneuver because it will require a lot of line release to turn. If the bow is too stiff, the kite will simply spin, because you cannot exert enough pressure on the sail to bend the bow properly. Larger kites require stiffer bows, and smaller kites require a more flexible bow. "Soft" kites, or flexible kites, tend to be slower than their "Stiff" counterparts. Different kinds of bows have an effect on flexibility. The most common bows are bamboo, fiberglass rods and carbon fiber rods. Bamboo is naturally flexible, and the rate of flex can be adjusted by massaging one side or the other to make sure that the flex is even. Fiberglass and carbon fiber rods flex evenly along their length, but both are heavier than bamboo. Carbon fiber is stiffer than fiberglass of the same weight, and is somewhat less hazardous to handle.

I use synthetic (fiberglass and carbon fiber) bows in my kites. The best design advice ever given to me concerns bows, and it has saved me a lot of frustration. When using a synthetic bow, use a three point bridle. This allows you to easily make tiny balance adjustments. If a kite with a bamboo bow and a two point bridle is spinning in one direction more than the other, massaging the bow will soften that side and even out the imbalance. A synthetic bow will not react to this. By using a three point bridle, tuning balance

becomes a matter of moving along the yoke line until you even out the spin. Synthetic bows are great, but they will never act like the traditional bamboo bows of paper Indian fighters. Western fighters require western approaches. Of course, for every rule there is an exception - other ways to balance kites with synthetic bows are possible and even practical. I use the three point bridle; its simple, elegant, and best of all - proven.

All of these factors come into play in fighter kite design. The practical upshot of this study of sail shape is that you can design a kite that fits your flying style best. It takes patience to analyze your flying style and determine what you like in a fighter. The best way to find this out is to learn a construction technique that works for you, use materials you are comfortable working with, and build a lot of kites! If this sounds like a lot of work, it is. Of course, with patience, persistence, and design help like this reference book, you are rewarded with your own kite that cost you only the materials and time you would gladly spend on this project. Nothing compares to flying your own kites.

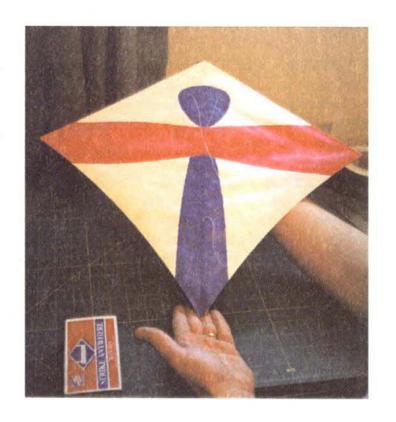
I also want to caution the reader that while perfection is something to strive for, it is not altogether necessary. A fighter will fly right if built within a certain tolerance. If you operate within this range, your kites will fly, and this range of tolerance is actually somewhat broader than you might think. Go with your instincts - and don't give up on your kite. I have found that for lack of a little better tuning or some simple fix many of the kites I saw as failures might have flown. Fighter kites require a lot of attention in order to keep in tune, and unless you are patient, you'll miss that unique fighter kite experience.

THE DRAGONFLY FIGHTER

construction plans

The time has come to show you a design of mine. I'll show how I build the kite, the materials I use, and suggest alternate materials. There may be several ways to build the this kite, and my methods may not work well for you. Adapt your own methods to the kite plan.

The Dragonfly has a high aspect ratio, but is only slightly wider than tall. I have cut out the trailing edge slightly, and the wingtip line is above the center line, which makes a kite that is reasonably fast and tracks well without being too sluggish in a turn. I have scaled this plan up from my original model. I build it with a bamboo spine and carbon fiber bow. This kite could be built with Mylar, Tyvek, plastic or ripstop fabric, and the bow could be fiberglass, although that would make the kite softer, and thus slower. The curve in the trailing edge could be changed according to your preferences - My plan uses one of the deepest cutouts I can draw with my metal curve ruler, about 5/8" (about 1.5 cm) inset from a straight trailing edge at its deepest point. I admit this is not scientific, but the result works. Angled cutouts work also, but you must be sure that the sail is reinforced where that cutout weakens it. Curves have no single stress point worth noting. My last word on trailing edge curves is this - some sail materials will stretch, and that curve will stretch along its entire length. As a result the Dragonfly design works best with low or no stretch sail materials!



KITE SPECIFICATIONS: 20" wingspan, 17-3/4" spine length. The wingtip line bisects the spine 7" from the nose of the kite. Trailing edge should be cut out 5/8" on a smooth curve from wingtip to tail of kite. 3-Point bridle attachments are on the bow 1" on either side of the spine, and 9" down the spine from where the bow and spine cross.

TOOLS AND MATERIALS NEEDED:

Rulers, preferably metal
Curve stick or flexible curve for trailing edge of sail
Wire cutters to trim carbon fiber bow (Coaxial cutters are best)
X-acto knife for cutting Tyvek
Needle for threading bridle lines
Clear packaging tape, 2" width
Contact cement

Super glue
Typek for sail. There are several grades of a

Tyvek for sail. There are several grades of Tyvek, but I like to use the smooth, stiff kind. Get the lightest grade you can find.

.060 Carbon fiber rod for bow, 24" long

BOW SETTER - a bow setter is nothing more than two vinyl end caps joined by a length of line with a line tensioning slider in the middle. This allows you to insert the tips of your rod into the vinyl caps and adjust the curve of the bow to fit your kite.

BAMBOO STICK FOR SPINE - (dowel can be substituted, but if you do, sand or plane the dowel until you have a flat side to it, or to save weight and make shaping easier, sand down two opposing sides of the dowel. If you use a dowel, mark where the wingtip line will be, and put a slight bend in the dowel just in front of it.)

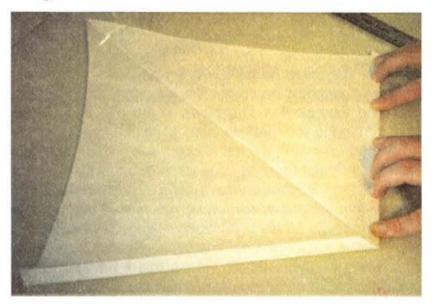
LINE FOR BRIDLE -(I like to use LaserPro 20lb. dacron line for bridles; it is strong and waxed along it's entire length)

POSTER BOARD for sail pattern template

Create a half-pattern template out of cardboard or poster board. Draw a vertical line, marking two points 17-3/4" apart. Measure 7" down from the top point, and draw a horizontal line through this point. Mark a point on this line 10" from the horizontal line. Connect this point to the top point.

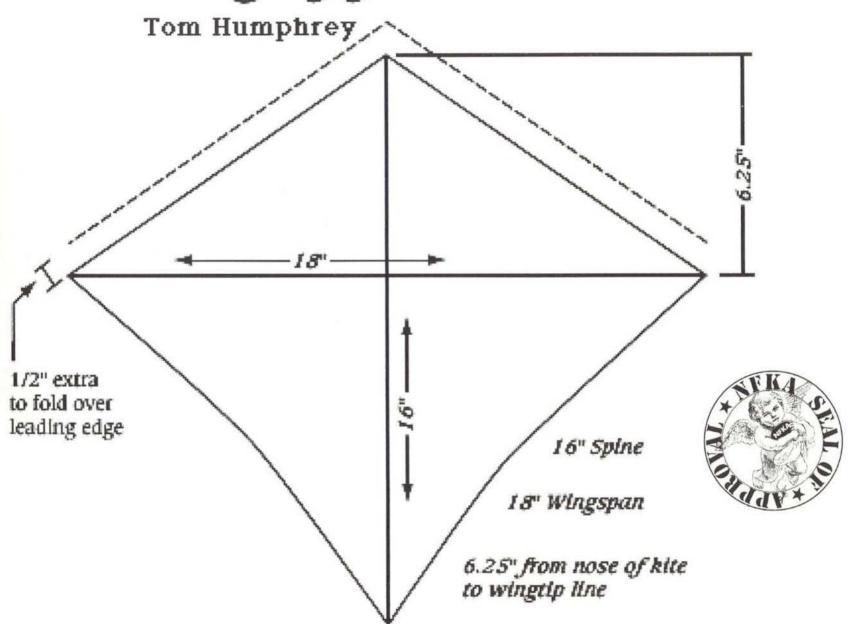
Draw a line parallel to this line 1/2" out from it for a foldover allowance. Now draw your curve from the wingtip point to the lower mark. A beginner may want to make this a straight edge. The result will be somewhat slower than the original. Cut out the pattern along the outside lines. The vertical line is your spine line.

Fold a sheet of Tyvek in half and tape it down to your working surface. Place the spine line of your template on the fold, and trace out the sail on the Tyvek. Carefully cut the sail out of the Tyvek, using a ruler to keep the lines straight. The curve will be tricky, so cut out the curve first. Unfold. This gives you a symmetrical sail. The pattern leaves 1/2" of extra Tyvek at the leading edge to fold over the bow. Fold this extra over the leading edges. You can fold the point of the extra Tyvek down along the spine fold and glue it down.

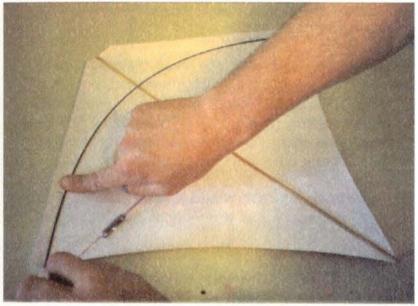


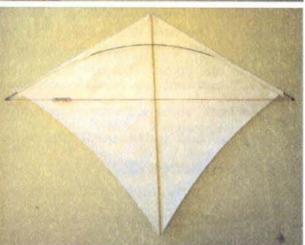
Put a bead of contact cement down the center fold. Put another bead of contact cement on the face of the spine. Stick the spine down onto the fold. Remember, you only get one try, so be as careful as possible.

Dragonfly I



Put your bow into the bow setter and adjust the tension so that the bow can fit from wingtip to wingtip. Place the bow onto the sail (over the spine) and fit into the creases at the wingtips. Mark a point about 3-1/2 inches in from each wingtip, to show where to put down your contact cement. Coat the bow ends with contact cement and carefully put it aside.



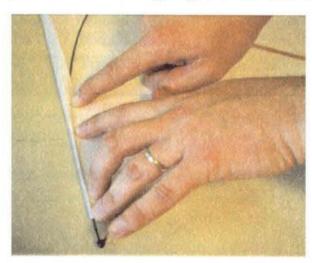


Put a bead of contact cement on the sail at the wingtip, and also lightly coat the foldover and the base of the fold up to the mark. Place your bow onto the kite so that the cemented edges meet, and fold the Tyvek over the bow. Smooth the Tyvek down over the bow and let the cement dry. There will be a small end of the foldover that does not meet the sail; this will be cut away later. Put a bead of glue down the leading edge and glue the leading edge down to the back of the sail.

While the cement is drying, it is a good time to decorate the sail. For Tyvek, you can use permanent markers. Just be sure not to accidentally remove the bowsetter before the cement is dry.

When the cement is dry, remove the bow setter. The sail should now be under tension. Clip off the exposed ends of the bow with the wire cutter and cut away the extra Tyvek left over at the wingtip.

Prepare a 2" x 4" piece of packing tape. Place the tape sticky side up on your work surface and place the nose of the kite over the tape so that the ends of the 4" side just meet the leading edges of the sail. Smooth the tape



down over the front of the sail. There will be a section of tape exposed. Cut the tape down to the sail edge on either side of the spine and fold this strip over the top of the spine stick. Then carefully fold the tape over the leading edges and smooth it down over the back of the sail, wrapping it over the spine and the strip of tape folded over it. Repeat this process at the tail of the kite. This will be harder to follow with the curved edge of the Tywek, but get as close as you can. The sail is now finished and reinforced.

Measure 1" from the center of the spine where the bow crosses it, and mark the back of the sail where the yoke lines will go through. I place a loose-leaf binder reinforcement over the mark to limit how far the hole can tear. For extra reinforcement, you can place a small square of tape over the binder reinforcement. Cut a 1" x 1" piece of packing tape and wrap it over the spine between the yoke line marks. This will reinforce the point where the bow is tied to the sail.

Measure 9" down from where the bow crosses the spine and make a mark. Place a 1" x 1" piece of tape over the spine with the mark at the center and wrap it over the spine. This will be the lower bridle point. Push a needle through the tape at the back of the sail on either side of the spine next to the lower bridle point, and on either side of the spine where the bow crosses it (One hole below the bow on one side, and the other above the bow on the other). Then push a needle through the sail at the yoke line points. Care has to be taken to get beneath the bow. Thread a line through the cover where the bow crosses the spine, and tie the bow to the spine, leaving the knot at the back above the bow.

Thread the yoke line through one of the holes made 1" from the spine. Tie the line to the bow. Thread the other end of the yoke line through the other hole. Pull the line through until the center of the yoke line is 4" above the front of the sail and tie off the other side. The yoke line is now ready.

Tie a small overhand loop in a longer length of line, and put the end of the line through the loop twice in a double larkshead knot around the yoke line. Tighten the knot to the center of the yoke line, and thread the other end through the holes at the lower bridle point. Pull this tight. Pull the line back through the cover to the yoke point, and then pull the line past this point about the width of two to three fingers. Tie the lower bridle knot at the base of the kite. This gives you the proper bridle lengths. Tie a tow loop out of the excess bridle line and attach it to the bridle with a double larkshead knot. Turn the kite over and coat the line with super glue where it attaches to the bow and spine. This keeps the knots from slipping and possibly tearing the sail.

Carefully put a slight bend in the bamboo spine from about the wingtip line forward.

Congratulations! You are ready to tune and fly your new Dragonfly!

Tips on Tuning and Flying

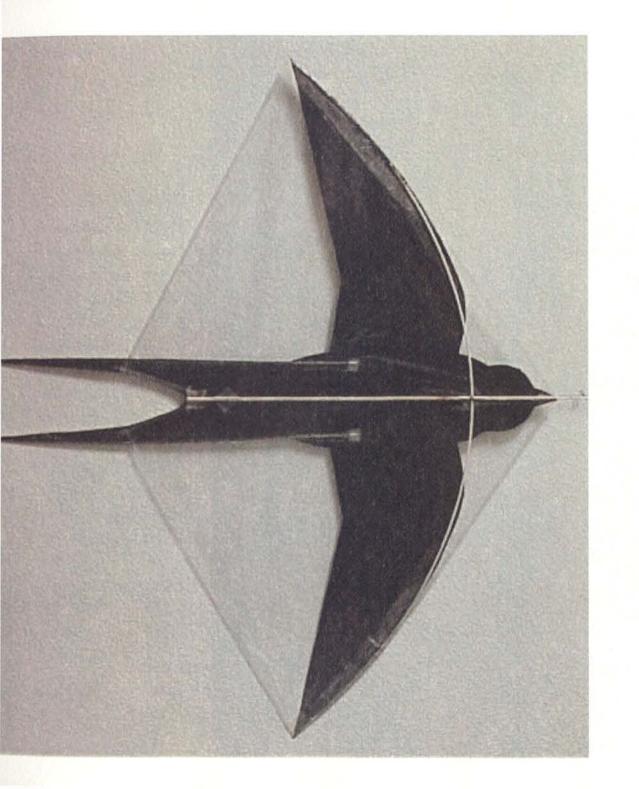
Once you have your kite and a clear place to fly, you need to work on your flying skills. There are a lot of skills and techniques involved in flying fighters that the average kite flyer with a stable kite doesn't need to worry about. The first thing to remember is that while bringing in and letting out line you almost always leave extra line lying in loops on the ground in front of you. Learn to keep your feet still so that you don't accidentally step on the flying line. A lot of my early trouble with flying fighters was due to "happy feet". Before you begin to move around while flying, get to know where you drop your extra line.

Another important tip is to resist the temptation to pull the line in towards your chest when moving your kite. Instead of standing with your back to the wind, turn your body to the side with one foot slightly forward. When you pull in, pull in across your body, pulling from the line in front of you down past your hip, hand over hand. When you pull towards your chest, the maximum amount of line you can bring in to move your kite is about 3 feet per pull. If you pull down past your hip, you can pull in about 6 feet per pull. If you need to close in or to escape an opponent, pulling line in fast is vital.

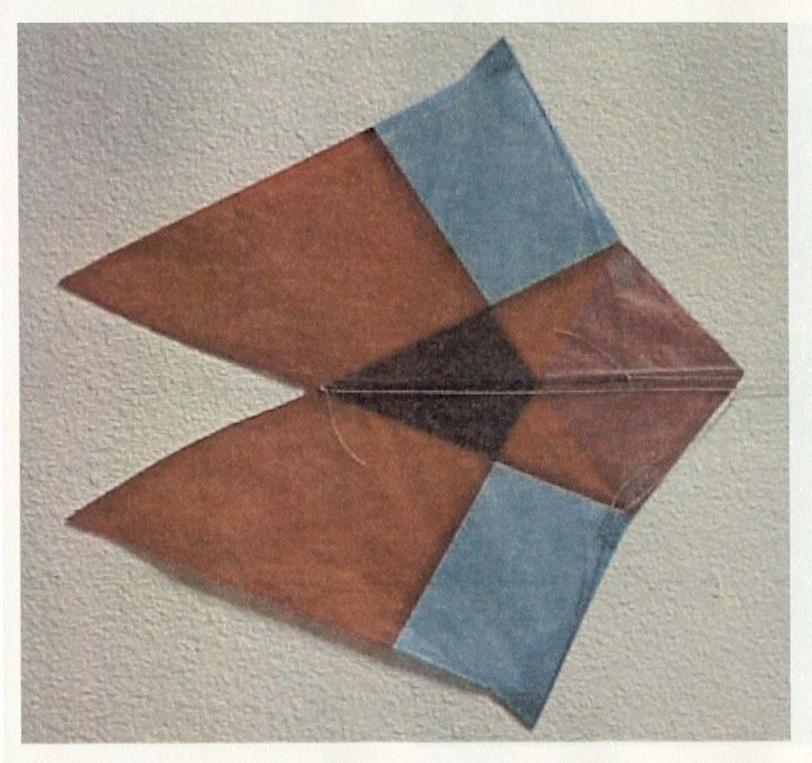
When you fly, always check your kite's tune. This sounds obvious, but remember that everything from wind conditions to crashes to transport and handling of your kite can change its tuning. I build kites with three point bridles, so I have two adjustment points that change my tune. The yoke line and the tow point. Remember that a well balanced kite will turn equally well in either direction, and if your kite favors one side you can slide the yoke line in tiny increments to the other side. Moving the tow point will adjust for wind speed. Up for higher winds and down for lower winds. Remember that very small adjustments may be all that you need!

This is like any other craft - expect to make mistakes, be patient, reflect on your mistakes, and then overcome them.

STAUFFER STAUFFER



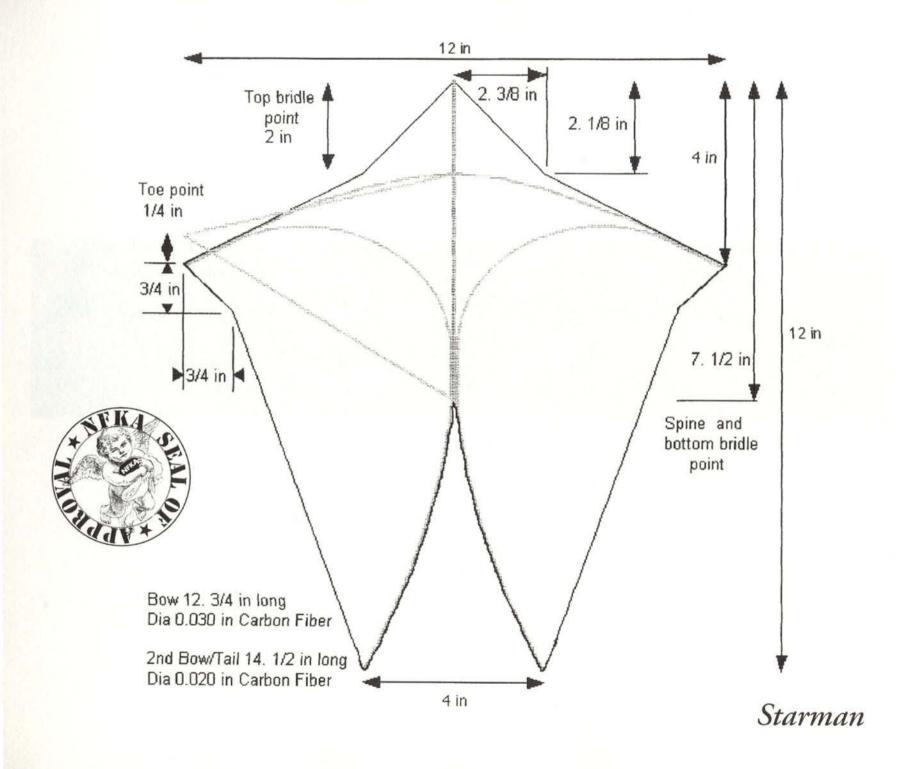
Swallow



Starman

The Starman kite was designed by Australian NFKA member and world class kite maker, Peter Stouffer. It was his response to the Footlong Hotdog Challenge at the 1998 Washington State International Kite Festival. The only rule in the Footlong Challenge is the kite's spine must be no longer than 12". This is a light wind version.

Flies great!





DOUBLE BOW & DOUBLE LEADING EDGE FIGHTER

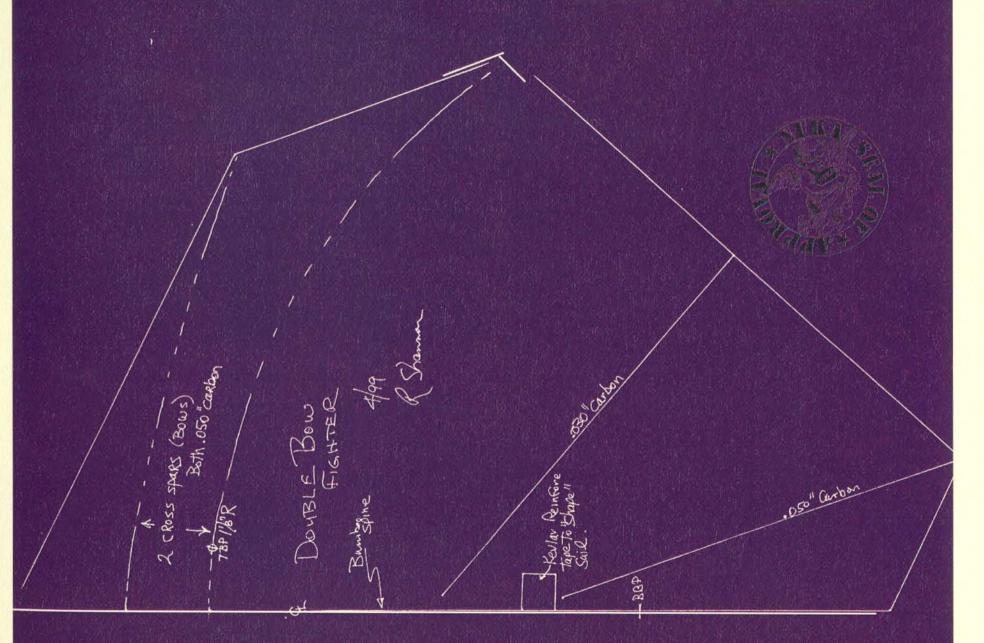
I wanted to build a fighter with a "double" leading edge. The first prototype had the to spreader inverted. The sail looked more "Bird-Like" but flew really slow. This model, however, is fast, tracks real straight and spins similar to a round fighter.

TIPS:

- **1. Battens.** I use them in almost all my designs and really like the way they increase performance. They help with tracking by imparting some form of boat keel affect to the lower sail. They incease spin by adding weight in a good area, the bottom of the kite. Look at the "typical" Indian fighter, they use battens.
- 2. **Nylon.** I double fold all my extension hems to give a consistent strong hem that will enable a kite to fly more consistently on a day to day basis.
- **3. Bridles.** I three point bridle everything. Fast, effective balancing without weight. I played with MANY various bottom bridle points and found little change in the "sweet spot". (somewhere below half-way between the cross spar and lower quarter of the kite.
- **4. Sails.** Oven roasting bags, they hold Design Master paint well and are strong. Chinese paper from Michael's stores. It comes in 12" or 15" wide by 60'.
- 5. I feel the trailing edge can change a fighter's characteristics as much as anything. I think more experimentation of small trailing edge sail cuts could greatly improve a kites performance. I have always liked the flight characteristics of my various "V" tail designs. Some built in lighter/competition materials and weights as Steve Bateman is doing, could make a real nice fighter.

Good Luck & Steady Breezes.

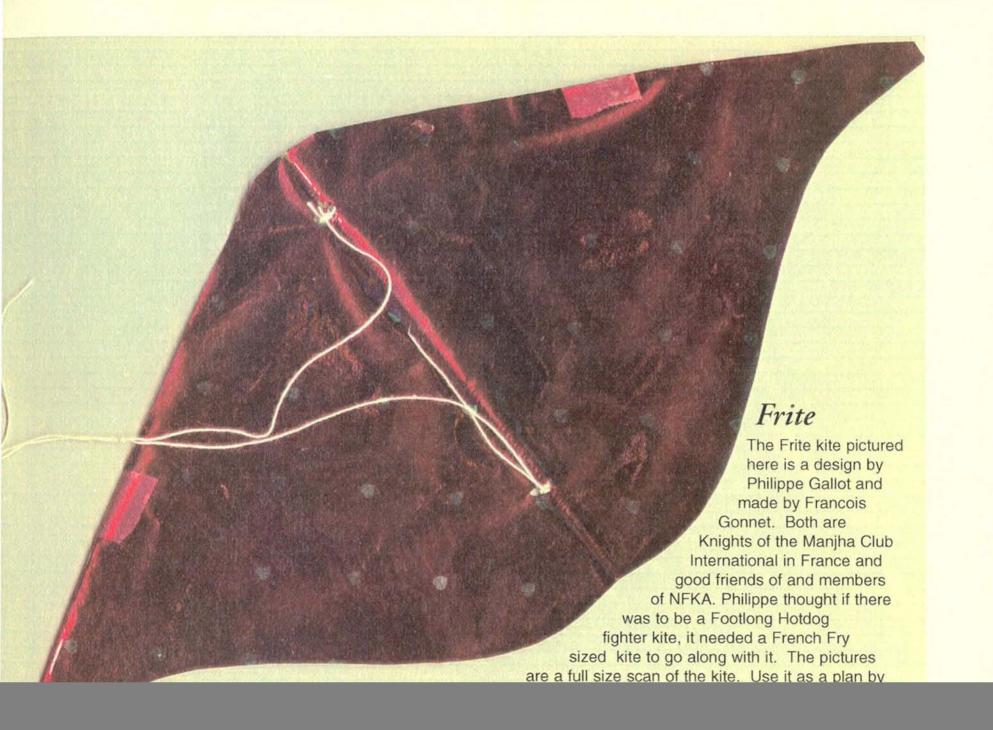
DOUBLE BOW FIGHTER

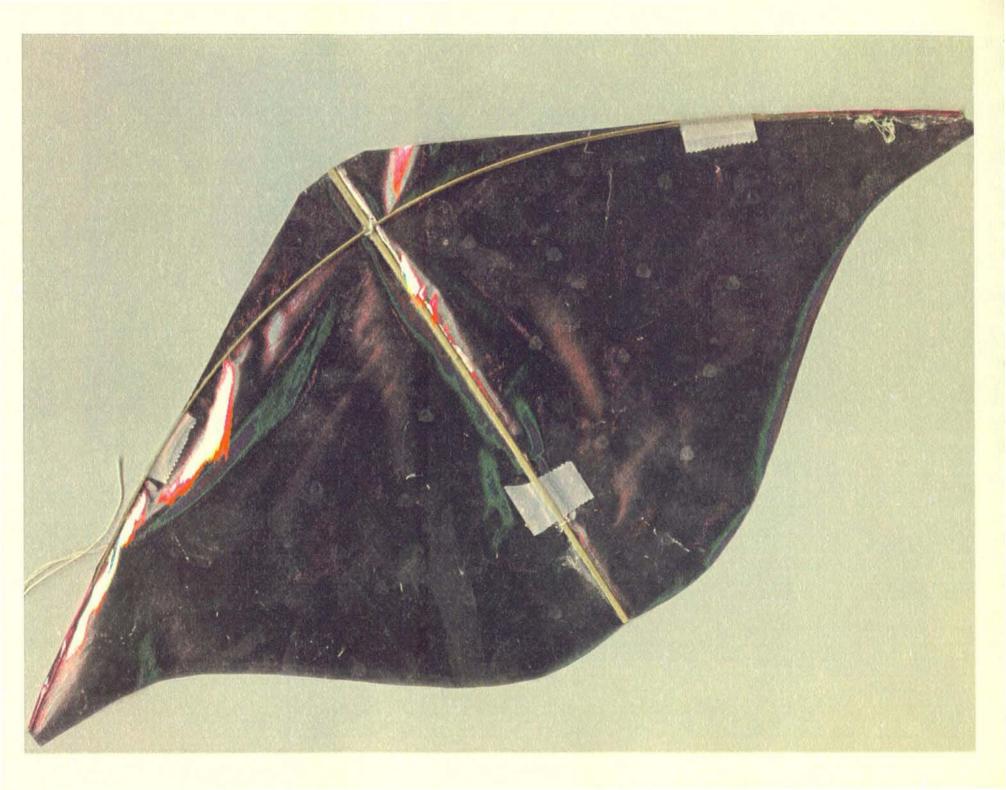


PHILIPPE GALLOT



FRANCOIS GONNET





SGORDONI SCHIMIONT

Mel Govig once wrote that a fighter kite library would "...fill only a small shelf." Well, seventeen years later, the shelf has grown considerably. Because it's so difficult for me to keep track of all of the material I've stumbled across in books and magazines, I decided it was high time to compile a bibliography. Fortunately, the NFKA book project has provided an opportunity for me to share this work with other fighter kite enthusiasts.

You can use this bibliography in different ways. For example, maybe you need to track down an article, a kite review, or a set of plans. Searching through twenty pages of material should be a whole lot easier than going through mounds of books and magazines. The bibliography can also help you to make decisions. You might decide to pass over a plan if, according to the bibliography, key dimensions were omitted. The width and thickness of a fighter's bones are probably more important than is the case for other types of kites. If the spar is too thick, the fighter will be uncontrollable. If it is too thin, the kite will be unresponsive. If a spine's cross section is too small, it will break in a crash. If the cross section is too large, the kite may be too heavy to fly well in light winds. These observations are not exactly news, so I was amazed to find that vital dimensions were often neglected in fighter kite plans.

I intentionally stayed away from compiling material found on the World Wide Web. The main reason I did this was because online search engines can do a much better job informing you of fighter kite-related subjects than I can. Take the time to visit sites like the ones established by:

NFKA:

(http://www.eskimo.com/~johnsen/nfka/) and Gina Hsiung (http://www.csun.edu/~hfoao033/fighters.html).

It's a great big world out there.

The material is listed chronologically. Books are listed first, then magazines. Note that of the 43 books listed, only eight are devoted to fighters. Still, don't ignore the rest; some first rate plans can be found on the pages of the other books. Magazines make up a large percentage of the printed matter. Sometimes, the fighter kite-related item is only a letter to the editor, but it may contain some real pearls of wisdom.

Finally, more so than most types of writings, bibliographies are doomed to become outdated almost as soon as they are printed. I hope to keep this fighter kite bibliography as current as I can. You can help by informing me of materials you run across that I have omitted. Any suggestions you have are most welcome.

Fighter Kite Bibliography

BOOKS

- 1. Woglom, G.T., Parakites: A Treatise on the Making and Flying of Tailless Kites for Scientific Purposes and for Recreation, G.P. Putnam's Sons, 1896. This turn of the century book contains an early Western description of the Nagasaki hata, line cutting devices, and a detailed account of a typical battle between two contestants. It is stated that the parakite evolved from kites like the Nagasaki hata.
- 2. The Boy Mechanic: 700 Things for Boys to Do, Popular Mechanics Co., 1913. Plans are provided for a "Chinese Kite": actually, a typical fighter kite. Dimensions are not given for the bowed spar and for the bridle. Instructions for making a reel and cutting line, and for flying the kite in combat are included.
- 3. Beard, D.C., The American Boys Handy Book, Charles Scribner's Sons, 1916. An entire chapter is devoted to "War Kites." Unarmed kites are described which are bowed diamond kites with tails. The overall proportions are similar to those of a typical fighter. The object of combat with unarmed kites is to capture an opponent's kite by entangling its tail in the flying line. Armed kites are also described which are hexagonal in shape, with line cutting devices attached to their tails.

- 4. Ridgeway, H., Kite Making and Flying, Gramercy Publishing Company, 1962. A form of kite combat is outlined in which balloons are attached to each flier's line and each kite is armed with one or two nails. The object is to burst each other's balloons, as many as possible in a given time period.
- Yolen, W., The Young Sportsman's Guide to Kite Flying, Thomas Nelson & Sons, 1963. Fighter kites in India, South America, Japan, and Thailand are briefly described. Instructions on kite fighting with cutting line are also included. The duel between Will Yolen and Edward Hanrahan is immortalized in a series of photographs.
- 6. Gobhai, M., Ramu and the Kite, Prentice-Hall, Inc., 1968. This is a nice little story about an Indian boy who learns how to fly a fighter kite, how to fight, and how to accept the loss of his kite.
- 7. Wagenvoord, J., Flying Kites in Fun, Art, and War, The Macmillan Company,1968. The book provides an account of some of the kite flying activities of Surendra Bahadur and George Kelly, co-founders of the Go Fly A Kite store.
- 8. Yolen, J., World on a String: The Story of Kites, The World Publishing Company, 1968. Descriptions of kite fighting in India, Thailand, Japan, and South America are included. A photograph of an Indian painting showing a girl flying a tukkal fighter is also provided.
- 9. Newman, L.S. and Newman, J.H., Kite Craft: The History and Processes of Kitemaking Throughout the World, Crown Publishers, Inc., 1974. A photograph of a miniature Indian painting showing two women flying tukkal fighters is included. Color photographs of an Indian fighter and a Nagasaki hata are provided, along with black and white photographs of the following fighter types: a Star of India, a Nagasaki hata, and a tukkal. Flying and fighting instructions based on Surendra Bahadur's "Indian Fighter Kites" are given. A sequence of photographs illustrates the construction of a Mylar and bamboo fighter by Frank Rodriguez. The construction of a Nagasaki hata is also shown.
- 10. Streeter, T., The Art of the Japanese Kite, John Weatherhill, Inc., 1974. One of the book's chapters is devoted to Shigeyoshi Morimoto, a Japanese maker of the Nagasaki hata fighter kite. Color photographs of three hata kites are included. Two black and white photographs show hata sail designs from Morimoto's pattern book.

- 11. Bahadur, A. and Skwarek, M., "Kites: Ancient Craft to Modern Sport," The Family Creative Workshop, Vol. 8, Plenary Publications International, Inc., 1974. Fairly detailed instructions are provided for constructing an Indian fighter kite using bamboo and tissue paper. Note that only the width and length dimensions are provided for the spar and spine; it must be assumed that the thickness of each stick is the same as its width. Also, it is stated that 5-mil Mylar can be substituted for the tissue paper. The thickness of the Mylar should probably be 0.5-mil, not 5-mil.
- 12. Lloyd, A., Mitchell, C., and Thomas, N., Kites: How to Fly Them, How to Build Them, Holt, Rhinehart and Winston, 1975. The book's dust jacket is decorated with an Indian fighter what could be better than that? A form of the present line touch competition is described, and plans for a Korean fighter and a Nagasaki hata are included.
- 13. Pelham, D. The Penguin Book of Kites, Penguin Books, 1976. Black and white photographs of several fighters (the Indian Star, the tukkal, a Nagasaki hata, a Korean fighter, and a typical Indian fighter) are included. It is stated that the tukkal fighter has been flown in India for over seven hundred years (mine seldom last that long). Some sail designs from a Nagasaki hata maker's pattern book are also shown. Patterns are provided for the Nagasaki hata, the Indian fighter, the Thai chula and pakpao, and the Korean fighter. Only overall dimensions are included; informa tion such as the width and thickness of each stick and the lengths of the bridle legs are usually left to the reader's imagination.
- 14. Yolen, W., The Complete Book of Kites and Kite Flying, Simon and Schuster, 1976. Yolen's famous kite battles with Pablo Diablo and with the Maharajah of Bharatpur are recounted. Plans are provided for a Korean fighter and two variations of an Indian fighter. The width and thickness of each of the sticks used for the Korean fighter are not specified. Fighter combat involving flying lines coated with lipstick instead of ground glass is described.
- 15. Thomas, W., The Complete World of Kites, J.B. Lippincott Company, 1977. Kite fighting in Korea, India, Latin America, and Thailand is described. Information is given on how to fly a fighter and what to do during a duel. Plans for a Brazilian fighter are included.
- 16. Brummitt, W., Kites, Western Publishing Company, Inc., 1978. Instructions for building an Indian fighter are provided. However, the width and thickness of the curved spar and of the spine are not given.

- 17. Bahadur, D., Come Fight a Kite, Harvey House, Publishers, 1978. Instructions on how to launch and control an Indian fighter are provided. Three types of combat (one-on-one, team, and free-for-all) are outlined. Line cutting techniques are described.
- 18. Hiroi, T., Kites: Sculpting the Sky, Random House, Inc., 1978. Plans for a 4-stick Korean fighter and for a Nagasaki hata are included. However, the thickness and width dimensions of the sticks used for the kites are not given. In addition, the bridle for the Korean fighter is not described.
- Lloyd, A. and Thomas, N., Kites and Kite Flying, The Hamlyn Publishing Group Limited, 1978.
 Fighter kites from Japan, Korea, Thailand, and Malaya are briefly described. Color photographs show a tukkal fighter, typical Indian fighters, and Indian fighters in kit form.
- 20. Moulton, R., Kites, Pelham Books Ltd, 1978. Plans are provided for an Indian fighter, a Nagasaki hata, and a tailed fighter from the West Indies. Width and thickness dimensions of the sticks used to make the kites are generally not included.
- 21. Tyrrell, S., Kites: The Gentle Art of High Flying, Doubleday & Company, Inc., 1978. Indian fighter kites and kite fighting are briefly described. Instructions for making an Indian fighter are included. Although the drawings show a two-leg bridle (no dimensions are given), the kite is described as having no bridle!
- 22. Marks, B. and Marks, R., Kites for Kids, Lothrop, Lee & Shepard Books, 1980. Plans for a Nagasaki hata are provided. Dowels 1/8 inch in diameter are used for the spar and spine.
- 23. Olney, R.R. and Bush, C., Better Kite Flying for Boys and Girls, Dodd, Mead & Company, 1980. This book devotes an entire chapter to kite fighting. Several black and white photographs show Vic Heredia and his famous kites in action, as well as some of the sail designs available on Vic's Fighter Kites. Line cutting and tail cutting combat are both described.
- 24. Hart, C., Kites: An Historical Survey, Paul P. Appel, Publisher, 1982. Kite fighting in Korea, Japan, Malaya, Indonesia, and Thailand is described. Black and white photographs show Indian fighters and the Thai chula and pakpao.

- 25. Thiebault, A., Kites and Other Wind Machines, Sterling Publishing Co., Inc., 1982. A brief description of kite fighting in Thailand is provided along with plans for a Thai chula. Only overall dimensions are given, however.
- Ito, T. and Komura, H., Kites: The Science and the Wonder, Japan Publications, Inc., 1983. An attempt is made to explain the maneuvering ability of the Nagasaki hata.
- 27. Botermans, J. and Weve, A., Kite Flight: Complete, Easy-to-Follow Instructions for Making 40 Different Kites, Henry Holt and Company, 1986. Plans for a tukkal, a hata, a Korean fighter, and an Indian fighter are included. Details, as well as important dimensions and bridling information, are practically nonexistent.
- 28. Backes, W., Drachen aus aller Welt: 40 Modelle zum Nachbauen, Ravensburger Buchverlag, 1987. The book includes plans for an Indian fighter, a Nagasaki hata, a Thai pakpao, a Thai chula, and a Korean fighter. All of the important dimensions are provided, including bridling information. Instructions are given on how to fly and tune fighters. Doesn't it just figure that the book would be written in German!
- 29. Eden, M., Kiteworks: Explorations in Kite Building & Flying, Sterling Publishing Co., Inc., 1989, pp. 226-232. The book includes plans for the Szilagi Fighter and for Caleb Crowell's version of a Nagasaki hata.
- 30. Gallot, P., Fighter Kites: 29 Original Designs to Make and Fly, St. Martin's Press, 1989. In addition to the author's creations, the book contains designs by Ludovic Petit, Tony Slater, Takeshi Nishibayashi, and Martin Lawrence. Most of the designs are based on the Indian fighter, but there are also plans for a miniature Rokkaku, a Korean fighter, and an Indian Star. Advice is also provided on flying fighters, flying line, spools, bridle adjustments, kite box construction, and games.
- 31. Schimmelpfennig, W., Making and Flying Kites, Castle, 1989. The book contains plans for a Nagasaki hata, and an Indian fighter.
- 32. Toy, L., Flight Patterns, Sky High Press, 1990. The book includes plans for a large (span = 33 inches) fighter. Instructions on flying the kite are also provided.

- 33. Fighter Kite & Rokkaku Competition Rules, American Kitefliers Association, 1991. Rules are presented for six types of contests which involve fighter kites: line contact, precision, general skill, freestyle, one-on-one cutting line fights, and team cutting line battles.
- 34. Gomberg, D., The Fighter Kite Book!, 1992. Instructions are provided on how to launch and maneuver a fighter. An entire chapter is devoted to fighter kite tuning (bridle adjustments, fighter balance, and spine bowing). Another chapter is concerned with flying line and line storage devices (spools, winders, and baskets). Instructions for building a fighter are included. Competitions involving line cutting, line touching, precision, and freestyle performances are described. Scattered throughout the book are snippets of advice from fighter kite experts.
- 35. Hosking, W., Kites, Mallard Press, 1992. Indian and Thai fighters are described. Black and white and color photographs show examples of these kites. Kite fighting in Malaysia, Korea, and Japan is mentioned. The basic technique used to control fighters is outlined. Cutting line competitions are also described.
- 36. Morgan, P. and Morgan, H., The Ultimate Kite Book, Simon & Schuster, Inc., 1992. The book's color photo graphs show examples of a tukkal fighter, a Thai pakpao, a Korean fighter, a typical Indian fighter, a Grandmaster, Tony Slater's Butterfly, Joel Scholz's Butterfighter, and Vivian Comma's Kiskeedee. Techniques used to launch, maneu ver, and retrieve a fighter are briefly described. Line cutting is also mentioned.
- 37. Turpin, S., A Beginner's Guide to Flying Indian Fighter Kites, 1994. This pamphlet contains 17 pages of useful information on launching, controlling, and landing a fighter. Adjustments and repairs are also discussed.
- 38. Crumplin, G., Not an Indian Fighter Kite: A Personal Evolution of Rip-Stop Fighter Kites, 1995. Plans are pre sented for 20 fighters. The designs represent a variety of shapes, some based on traditional kites, and others derived from modern designs. Information on launching and maneuvering fighters is presented. Combat rules involving line touching and kite touching are also suggested.
- 39. Streeter, T., A Kite Journey Through India, Weatherhill, Inc., 1996. This book is a fascinating view of India seen through the eyes of one who is "patang gela" ("kite crazy"). An added bonus are the many color photographs of beau tiful fighters in a variety of shapes.

- 40. Veen, H. van, The Tao of Kite Flying: The Dynamics of Tethered Flight, Aeolus Press, Inc., 1996. The book contains a short chapter that discusses a fighter's variable stability, a consequence of its flexible spar. Instructions for building a large fighter (span = 47 inches) are also included.
- 41. Colors of the Wind: A Guide to Modern Kiting, Colors of the Wind Press, 1997. The book contains an introduction to fighter kites by Richard Gareau.
- 42. Kent, S., The Creative Book of Kites, Smithmark Publishers, 1997. The book contains color photographs of a tukkal fighter and two typical Indian fighters (one with a fantail and one with a tassel tail). Plans for a simple variation of an Indian fighter and detailed building instructions for a Brazilian fighter are also included.
- 43. Skinner, S. and Fujino, A. (editors), Kites: Paper Wings Over Japan, Thames and Hudson Inc., 1997. The book contains a brief explanation of how a fighter flies. Photographs showing fighters made by Takeshi Nishibayashi, Seiko Nakamura, and Akihiro Ogawa are also included.

MAGAZINE ARTICLES

- Gilmore, R., "Secrets of Making and Flying Chinese Kites," Popular Science Monthly, Vol. 176, No. 4, April
 1960, pp. 178-182. A Chinese fighting kite, called Gin Yiu, is described as being similar to the diamond shaped kites
 found in American dime stores except that hooks and razor blades are mounted at the wing tips. No plans are includ
 ed for the kite.
- 2. Gonzalez, L.H., "Fighting Kites," Kite Tales, Vol. 1, No. 4, July 1, 1965. Gonzalez, who designed the AKA logo, describes the winged box kite that he used for kite fighting. Combat involved collisions between kites.
- 3. Mots, F., "Frank Mots Reveals How to Make His Acrobatic Kites Perform," Kite Tales, Vol. 2, No. 3, April 13, 1966. Frank Motz describes how to maneuver his tailed kites. The technique may be applicable to tailed fighters such as the Brazilian pião. He also mentions a form of combat called "kite catching".

- 4. Farrell, B., "Secrets of the Kite," LIFE, Vol. 63, No. 22, 1 December 1967, p. 25. This is creative writing especially for fighter kite enthusiasts.
- 5. Farrell, B., "Confessions of a Kite Hustler," LIFE, Vol. 67, No. 12, 19 September 1969, p. 32. The author continues the story of his devotion to the art of flying fighters.
- 6. "Vent Your Hostility Fight a Kite," Kite Tales, Vol. 6, No. 1, Summer, 1971, pp. 24-25. The article describes two Korean fighters sent to AKA headquarters.
- 7. "Newest Book," Kite Tales, Autumn 1973, p. 45. The article describes a record set by Douglas Fales for making a fighter revolve 1,520 times in 32 minutes.
- 8. Mansell, T.H., "Malay Fighting Kites," Kite Tales, Autumn 1973, p. 46. The author describes kite fighting in Indonesia based on his own experience. Instructions for maneuvering fighters are also provided.
- 9. Barwood, H., "A Beginner's Guide to Fighter Kites," Kite Tales, Autumn 1974, pp. 13-14. The article describes how to control a fighter and includes a plan for a fighter with a Mylar, sail and a spruce frame.
- 10. "Letters to the Editor," Kite Tales, Vol. 8, No. 4, Fourth Quarter 1974, pp. 3-4, 9, 46. Kite fighting is discussed. John W. Evans calls attention to an article in The Boy Mechanic, published in 1913, that describes how to maneuver a fighter kite.
- 11. "A Name to Remember," Kite Tales, Vol. 8, No. 4, Fourth Quarter 1974, pp. 21-22. A biography of Hal Barwood, the author of "A Beginner's Guide to Fighter Kites," is provided.
- 12. "Letters to the Editor," Kite Tales, Vol. 9, No. 1, First Quarter 1975, pp. 1, 2, 7, 48. John Loy states that the form of fighter kite used in the extreme southern part of India (Cochin) "...because the breeze is very capricious, has the bow drawn in by a bowstring. The surface aft of the bow therefore has considerable dihedral... In addition a cluster of tissue paper streamers is attached as tail. The result is a very stable yet responsive kite." He also points out that the Indian fighter is the forerunner of the delta kite.

- 13. "To Answer Your Question," Kite Tales, Vol. 9, No. 2, Summer 1975, pp. 12-14, 48. Fighter kite combat is briefly described. "... As far as Kite Tales is concerned, kite fighting is the only truly competitive kite flying which reflects the flier's skill and knowledge of kiteflying. In short, it not only involves a lot of knowledge about how to fly kites well but also a knowledge of how to make them fly badly."
- 14. Bahadur. D., "Legend and Fact of Kite Fighting," Kite Tales, Vol. 9, No. 2, Summer 1975, pp. 30-32. The article describes kite fighting in India and Thailand. Information on flying fighters is provided, along with advice on how to cut an opponent's line.
- 15. "New Kite Fighter," Kite Tales, Vol. 9, No. 2, Summer 1975, p. 56. Eugene Hester's introduction to fighter kite competition is described.
- 16. "Letters to the Editor," Kite Tales, November 1976, pp. 2, 4. Lincoln Chang describes the Filipino fighter, empha sizing the need for adding weight to the nose in order to stabilize the kite.
- 17. "World Record Falls," Kite Tales, November 1976, p. 16. The article describes a new duration record for indoor kite flying set by Gulu Gurbuxani. He kept a fighter flying for 1 hour, 5 minutes, and 12 seconds. This feat sur passed the record set by Dinesh Bahadur (46 minutes and 1 second).
- 18. "Letters," Kite Lines, Vol. 1, No. 1, Spring 1977, pp. 8, 10-11. Wayne M. Schmidt describes a method for determining the proper point to attach a flying line to a bridle. The technique was found to be applicable to Nagasaki hata and buka fighters, as well as other kite types.
- 19. Govig, M., "What's New: Kites, Books, Sundries," Kite Lines, Vol. 1, No. 1, Spring 1977, pp. 41, 43, 45. The Kung Flew fighter kite is reviewed. It is also pointed out that "...Another group of Mylar fighters (by several manufacturers) is plagued by a design problem that makes them slide off to one side and hit the ground under certain conditions. These are made with a fiberglass spar and rattan center stick without any bow in it."
- 20. "News From Here & There," Kite Lines, Vol. 1, No. 1, Spring 1977, pp. 47, 49, 51, 53. Louis Denov reports on his experiments, with Vic Heredia, adding balls of putty to the nose, tail, and wing tip of a fighter.

- 21. Eden, M., "Two Exciting Kites You Can Build From Scratch," Popular Mechanics, Vol. 148, No. 2, August 1977, pp. 96-98, 155. The article includes plans for an Indian fighter made of tissue paper and hardwood dowels.
- 22. Govig, M., "What's New, Kites, Books, Sundries," Kite Lines, Vol. 1, No. 4, Winter 1977-78, pp. 16,19, 20, 23 The Grandmaster fighter kite is reviewed.
- 23. "Introducing the Beautiful...Grandmaster Kite," Kite Lines, Vol. 1, No. 4, Winter 1977-78, p. 34-35. This advertisement for the Grandmaster fighter dedicates the kite to Will Yolen.
- 24. Govig, M., "What's New: Kites, Books, Sundries," Kite Lines, Winter-Spring 1981, pp. 12-15. Ed Hanrahan's Falcon fighting kite is reviewed.
- 25. Govig, M., "Fighter Kites: How to Pick and Wield Your Weapon," Kite Lines, Vol. 4, No. 2, First Quarter 1982, pp. 38-41. The article compares commercially available fighters, including the Aussie Fighter, the Scrapper, the Grandmaster, and Vic's Fighter Kite. The article also discusses tails, flying line, line cutting devices, how to maneuver a fighter, combat techniques, games, and etiquette. Plans for an "Easy Learner Fighter" are included. Note that the kite's spar diameter should be 2mm or 3/32" instead of 1/16" if fiberglass is used.
- 26. Teekell, G., "The Authentic India Fighter Kite," Kite Lines, Vol. 4, No. 2, First Quarter 1982, p. 41. The article is illustrated with photographs showing the construction of an Indian fighter by a native craftsman.
- 27. Govig, V., "Kite Clouds of India's Utran," Kite Lines, Vol. 4, No. 2, First Quarter 1982, pp. 42-43. Based on a conversation with Mukesh Shah, the article describes kite flying in Ahmedabad during the Utran holiday.
- 28. "How Come My Kite Won't Fly," AKA News, Vol. 4, No. 6, December 1982, p. 15. The column discusses ways to correct asymmetries in fighter kites.
- 29. Johnston, J., "Kites of Trinidad," Kite Lines, Vol. 4, No. 3, Winter-Spring 1983, pp. 40-45. The article includes plans for the Trinidad Common Kite, a small fighter (span = 14.85 in).

- 30. Govig, M., "Fighter Kites Follow-Up," Kite Lines, Vol. 4, No. 3, Winter-Spring 1983, p. 56. The article includes a revision to the fighter kite plans in the previous issue. The use of weights and other adjustments are also discussed.
- 31. Leigh, D., "An Essay on Simple Pleasures," Kite Lines, Vol. 6, No. 2, Summer 1986, p. 33. Basic dimensions are provided for a large fighter produced by the Wycombe Kite Company.
- 32. Govig, V., "Empty Spaces in the Sky," Kite Lines, Vol. 6, No. 2, Summer 1986, p. 69. James Lambrakis, maker of the Grandmaster single-line maneuverable kite, is remembered in this article.
- 33. Spaulding, R., "Thai Kites: Ancient Tradition, Perennial Excitement," Kite Lines, Vol. 6, No. 3, Winter-Spring 1987, pp. 61-71. The annual competition between chula and pakpao kites is described in detail. Plans for both types of kites are provided. The history of kites in Thailand is also included in the article.
- 34. Fales, D., "Fighter Kite Myths and Facts," Kiting, Vol. 10, No. 2, March 1988, pp. 10-12. The article discusses the construction of Indian fighter kites using traditional materials.
- 35. Govig, M., "What's New: Kites," Kite Lines, Vol. 7, No. 2, Winter 1988-89, pp. 14,16,19. The column reviews the Sky Delight Butterfighter and Butterflier, and Indian fighters by Karl Szilagi and by Carlisle Kiteworks.
- 36. O'Shea, R., "Fighter Kites," Stunt Kite Quarterly, Vol. 1, No. 3, Spring 1989, pp. 20-22. The article introduces fighters to stunt kite fliers. The fighter kite scene at the 1989 AKA convention is also described.
- 37. Govig, M. and Govig, V., "What's New: Kites," Kite Lines, Vol. 7, No. 3, Summer 1989, pp. 14, 16. The American Beauty kite, a very large fighter (span = 56 inches), is reviewed.
- 38. Peters, G., "Kites Over Ahmedabad," Kite Lines, Vol. 7, No. 3, Summer 1989, pp. 42-45. The author describes his experiences at an international kite festival held in Ahmedabad, India.
- 39. Morrison, P., "Kites of Makar Sankranti," Kite Lines, Vol. 7, No. 3, Summer 1989, pp. 46-49. The article describes kite flying in Ahmedabad on Makar Sankranti. Color photographs show scenes in Ahmedabad, including the preparation of manjha.

- 40. "Fighter Kites," Stunt Kite Quarterly, Vol. 1, No. 4, Summer 1989, pp. 38-39. Rules for fighter kite competitions are described in this article.
- 41. Toy, L., "Make Your Own 'Wire Hair Terrier' Kite," American Kite, Vol. 2, No. 3, Fall 1989, pp. 50-51. The article provides instructions for building a kite based on a design by Takeshi Nishibayashi. It is a four-stick kite, similar to a Korean fighter, but without a hole.
- 42. "Tips & Techniques," Kite Lines, Winter 1989-90, p. 26. Mel Govig provides information on Korean fighters (hole size and proportions).
- 43. Hosking, W., "Kitemaking: The Art and the Science," Kiting, Vol. 12, No. 4, July 1990, pp. 5-6. Plans and fly ing instructions are provided for the Gem Single-Line Stuntable Kite.
- 44. Govig, V. and Govig, M., "What's New: Books," Kite Lines, Vol. 8, No. 1, Summer 1990, p. 19. Phillipe Gallot's book Fighter Kites: 29 Original Designs to Make and Fly is reviewed.
- 45. Freidin, S., "New Zealand 1990," Kite Lines, Vol. 8, No. 1, Summer 1990, pp. 30-35. The article contains pho tographs of Australian Robert Hart's fighter "looping the hoop".
- 46. Toy, L., "Bud Koger's TY Fighter," American Kite, Vol. 3, No. 4, Winter 1990, pp. 51-52. Detailed plans are presented for a durable fighter with a Tyvek sail, a fiberglass spar, and a reinforced wood spine. The kite is fitted with an adjustable three-leg bridle.
- 47. "Letters," Kite Lines, Vol. 8, No. 2, Winter 1990-91, pp. 10, 13. Philippe Gallot describes an aerial battle between a fighter kite and a flock of birds.
- 48. "In the Wind," Kite Lines, Vol. 8, No. 2, Winter 1990-91, pp. 62-63. The column describes how fighter kites are used to hunt bats in Java.
- 49. Govig, M., "What's New: Kites," Kite Lines, Vol. 8, No. 3, Spring 1991, pp. 14,16. The column reviews the Black Feather, the Merlin Kites Fighter (the Dancer), and Stan Swanson's Japanese Bee.

- 50. "Letters," Kite Lines, Vol. 8, No. 4, Summer-Fall 1991, pp. 10, 12. A Grandmaster fighter pilot describes an unusual encounter with some seagulls.
- 51. Govig, M. and Govig, V., "What's New: Kites," Kite Lines, Vol. 8, No. 4, Summer-Fall 1991, pp. 15-16.

 The column reviews the Carlisle Kiteworks GA Fighter, the Flying Colors Indian/Hata Fighter, the Goodwind's Kites AstroFighter, and the Factor Kites Righteous Fighter.
- 52. Govig, M. and Govig, V., "What's New: Kites," Kite Lines, Vol. 9, No. 1, Winter 1991-92, pp. 15-16.

 The column reexamines the Goodwinds Kites AstroFighter after its bamboo battens were replaced with more flexible ones made of fiberglass.
- 53. Angeletti, M., Govig, V., and Govig, M., "What's New: Books," Kite Lines, Vol. 9, No. 2, Spring-Summer 1992, pp. 17-18. *David Gomberg's The Fighter Kite Book! is reviewed.*
- 54. Schiros, J., "Characters in Kiting: Bruce Jarvie," Kiting, Vol. 14, No. 4, July 1992, p. 7. Some of Bruce's experiences as a fighter kite devotee are related.
- 55. Gomberg, D., "Difference of Opinion," Kite Lines, Vol. 9, No. 3, Fall 1992, pp. 12-13. The letter gives Gomberg's opinions concerning the Kite Lines review of his book on fighter kites. Mel Govig's reply is also provided.
- 56. Atkins, I., "If Homan Walsh Could Do It...," Kite Lines, Vol. 9, No. 3, Fall 1992, pp. 38-39. The article describes the crossing of the Niagara Gorge by a Grandmaster fighter.
- 57. Govig, M., "Fighters Front & Center," Kite Lines, Vol. 9, No. 4, Winter 1992-93, pp. 38-40. The article includes a data chart on available fighters.
- 58. Alden, E., "How to Make a Family of Fighter Kites," Kite Lines, Vol. 10, No. 1, Spring 1993, pp. 26-28, 30. The article describes "...a family of fighters whose behavior is similar over a wide range of wind speeds". It also discusses construction techniques, a three-point bridle, types of flying line, line waxing, reels, and line handling.

- 59. Freidin, S., "High Winds & High Spirits in Java," Kite Lines, Vol. 10, No. 1, Spring 1993, pp. 32-34, 56. The article describes Javanese kite fighting games.
- 60. Govig, M., Govig, V., and Ianuzzi, A.P., "What's New: Kites," Kite Lines, Vol. 10, No. 2, Summer-Fall 1993, pp. 17-18. The Merlin Kites Hornet, a Korean fighter variant, is reviewed.
- 61. Voss, A., "Kampf an einer Leine," Drachen magazin, Vo. 5, No. 4, 1993, pp. 64,66,68. Color photographs of tra ditional Indian fighters illustrate the article. One of the photos shows a sky filled with fighters, their lines intersecting like the strands of an enormous web. Surprisingly, several of the kites are equipped with streamer tails. The article also contains plans for an Indian fighter.
- 62. "Kampfdrachen-Nachtrag," Drachen magazin, Vol. 6, No. 1, February/March/April 1994, p. 48. A drawing showing the curvature of the spine of the fighter described in the previous issue is provided.
- 63. Fabre, P., "Pipas do Brasil," Kite Lines, Vol. 10, No. 4, Spring-Summer 1994, pp. 31-37, 39. The article describes a Brazilian fighter which is five-sided and has a tail.
- 64. "Variable Winds Aloft: Letters to the AKA," Kiting, Vol. 16, No. 3, May/June 1994, p. 7. Hardeep Singh describes flying fighters in Punjab, India. He states that the kites are flown at distances of up to 200 meters.
- 65. Singha, R., "India's Rich Kiting Tradition," Kiting, Vol. 16, No. 4, July/August 1994, pp. 1, 5. Kite related activities in India are described. It is pointed out that "...Many innovative kite designers...use complex computer ized mathematical models based on the laws of aerodynamics to design faster, lighter and more efficient kites."
- 66. Atkins, I., Govig, V., Ianuzzi, A.P., and McKerrow, S., "What's New: Books," Kite Lines, Vol. 11, No. 1, Fall 1994, pp. 22-24. The book A Beginner's Guide to Flying Indian Fighter Kites is reviewed.
- 67. Govig, M., "At Peace at a Kite Fight," Kite Lines, Vol. 11, No. 1, Fall 1994, p. 31. Mel Govig expresses his admiration for the Korean fighter kite experts he saw at the Seoul International Kite Festival.

- 68. Fabre, P., "The Superfast Fighter Kites of Korea," Kite Lines, Vol. 11, No. 1, Fall 1994, pp. 31-35. The article describes Korean fighters, the reels used to fly them, their exotic cutting line, and the experts who build and fly them.
- 69. Govig, M. and Graves, M., "Design Workshop," Kite Lines, Vol. 11, No. 2, Winter-Spring 1995, pp. 12-13. The article explains how to make Randy Shannon's Baby Cicada.
- 70. Arnold, D., Govig, M., Govig, V., Graves, M.J., and Tanaka, B., "What's New: Kites," Kite Lines, Vol. 11, No. 2, Winter-Spring 1995, pp. 15-18. Frank Schwiemann's Bat fighter is reviewed.
- 71. Bowen, J., "Kite Review," Kites Magazine, July 1995, p. 9. Geoff Crumplin's Hex fighter kite kit is reviewed.
- 72. Bowen, J., "Book Review," Kites Magazine, July 1995, p. 28. Geoff Crumplin's book Not an Indian Fighter Kite is reviewed.
- 73. Graves, M.J., Govig, M., and Govig, V., "What's New: Kites," Kite Lines, Vol. 11, No. 3, Summer-Fall 1995, pp. 13-16. Trlby's Little Square kite is reviewed. It is pointed out that, if the tail provided with the kite is replaced with a longer, lighter tail, the Little Square can be flown like a tailed fighter kite. "Refresher course: Tailed fighter kites are maneuvered by first yanking them into a stall and then letting them spin. To recover from the spin, use either a rapid retrieval of line or short yanks on it to take the kite off in the direction it is headed."
- 74. Graves, M.J., Govig, M., and Govig, V., "What's New: Kites," Kite Lines, Vol. 11, No. 4, Winter-Spring 1996, pp. 15-17. The Jordan Air Mighty Mite fighter is reviewed.
- 75. Lowe, S.C. and Tuladhar, N.M., "Nepal's Kites: Above the Clouds," Kite Lines, Vol. 11, No. 4, Winter-Spring 1996, pp. 36-41.
- 76. Graves, M.J., McKerrow, S., Govig, M., Govig, V., Welsh, J.C., and Young, R., "What's New: Kites," Kite Lines, Vol. 12, No. 2, Fall-Winter 1996, pp. 12-15. *The Carlisle Kiteworks GA Pro fighter is reviewed.*

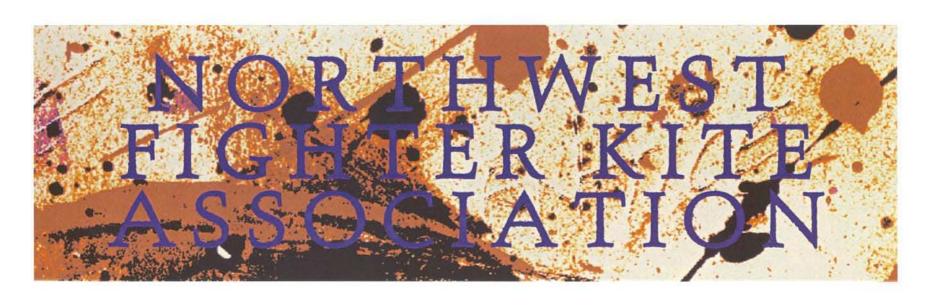
- 77. Govig, V., Govig, M., McKerrow, S., and Sloboda, A., "What's New: Books," Kite Lines, Vol. 12, No. 2, Fall-Winter 1996, pp. 19,21,23. The books A Kite Journey Through India and Not an Indian Fighter Kite: A Personal Evolution of Rip-Stop Fighter Kites are reviewed.
- 78. Fabre, P., "Dieppe: Blessed by the Gods," Kite Lines, Vol. 12, No. 2, Fall-Winter 1996, pp. 31-34. A competition between fighter kites from Indonesia, Brazil, Korea, India, and Japan is briefly discussed.
- 79. McKerrow, S., "The Korea International Kite Festival," Kite Lines, Vol. 12, No. 2, Fall-Winter 1996, pp. 39-43. Fighter kites from Hong Kong and Tahara fighters from Japan are described.
- 80. Fabre, P., "Speeding Lines: A Weekend in Hong Kong," Kite Lines, Vol. 12, No. 2, Fall-Winter 1996, pp. 47-50. The article provides a detailed description of the fighter kites flown in Hong Kong.
- 81. Thompson, W., "Fighter Kite Competition," Kiting, Vol. 18, No. 6, November/December 1996, pp. 10-11. The fighter competition at the 19th AKA Annual convention is described.
- 82. Graves, M.J., Welsh, J.C., Govig, M., and McKerrow, S., "What's New: Kites," Kite Lines, Vol. 12, No. 3, Spring-Summer 1997, pp. 24-27. The following fighters are reviewed: Richard Gareau's Patang, My First Fighter by AirWares, Lil Miss Take by R. Kites, Stan Swanson's Lazer, and the Merlin Kites Gem.
- 83. Streeter, T., "India: A Tour With Tal Streeter," Kite Lines, Vol. 12, No. 3, Spring-Summer 1997, pp. 36-39. Kite-related activities in various regions of India are described. Information is provided on the rather mysterious tukkal fighter. A photograph of an unusual cranked-wing fighter is also included.
- 84. Devaney, T., "Montreal Expo," American Kite, Vol. 10, No. 3, Fall 1997, pp. 36-40, 42. The article includes photographs of fighters by Randy Shannon and Richard Gareau. Gareau also gives his philosophy of fighter kites.
- 85. Hosking, W., "Flirting With Danger," American Kite, Vol. 11, No. 1, Spring 1998, pp. 51-57. The author relates some of his experiences with fighters. Plans for a fighter kite are provided.

86. Devaney, T., "The Man Who Would be King," American Kite, Vol. 11, No. 3, Fall 1998, pp. 43-47. Devaney interviews kite fighter and entrepreneur Dinesh Bahadur.

PATENTS

1. Heredia, R.V., "Kite Construction," Patent No. 4015802, Issued 5 April 1977.

This patent describes Vic's Fighter Kite. Polyethylene film and aluminum are specified for the kite's sail and spar respectively. The bridle consists of two legs which terminate in a "plurality of loops."



Thanks for purchasing this book.

We have included a membership application should you be interested in joining the Northwest Fighter Kite Association (NFKA). Our members are people who share a passion for flying those magnificent flying machines known as fighter kites. Building them. flying them, fighting them and learning about them is our primary focus. The 3rd Saturday of each month is our regularly scheduled group flying/meeting time. We meet on a flying field or beach, flying and talking until the grins get firmly pasted on. Since we're in the Northwest, the schedule is a rain or shine deal. We also fly at many kite festivals in Washington and Oregon. NFKA dues are just \$15 per member FOR LIFE. Please fill out the application at the bottom of this letter, enclose in an envelope with your check and mail to the address on the form. You'll get a really neat-o membership card and be updated regularly on club activities and flying schedule via cyberspace.

Thanks again! Now go fly a fighter.





FIGHTER KITE ASSOCIATION

PO BOX 1508 OCEAN SHORES WASHINGTON USA 98569

www.eskimo.com/~johnsen/nfka/html

Thanks for your interest in joining the Northwest Fighter Kite Association (NFKA). Our members are people who share a passion for flying those magnificent flying machines known as fighter kites. Building them, flying them, fighting them and learning about them is our primary focus. The 3rd Saturday of each month is our regularly scheduled group flying/meeting time. We meet on a flying field or beach, flying and talking until the grins get firmly pasted on. Since we're in the Northwest, the schedule is a rain or shine deal. We also fly at many kite festivals in Washington and Oregon. NFKA dues are just \$15 per member FOR LIFE. Please fill out the application at the bottom of this letter, enclose in an envelope with your check and mail to the address above. You'll get a really neat-o membership card and be updated regularly on club activities and flying schedule via cyberspace.

Cut off this section, fill it out and mail to the address above.

YES! I'm so excited I can hardly sit still!

Sign me up as a member of the Northwest Fighter Kite Association Here's my \$15. Now, when do we fly?

NAME		PHONE ()
ADDRESS		
FAX _()	e m a i l	

www.eskimo.com/~johnsen/nfka.html

Definitions

Line Touch Rules, Guidelines And General description: Pairs of fliers compete in

matches to see who can be the first to touch an opponent's line from either above or below. Winners advance to compete with winners of other matches until an overall winner emerges.

A work in progress...

Governing 1999 Northwest Fighter Kite Association Sponsored Competitions Rules, Guidelines and Definitions exist to promote a sense of fair play for the sport of competitive fighter kiting. It is our wish participants conduct themselves as ladies and gentlemen and that by example;

HONOR, INTEGRITY AND COMMON COURTESY BE THE STANDARD.

RULES

- 1. Contestants must adhere to predetermined "pilot area" rulings and guidelines established for the event.
- 2. Grounding of kites is not allowed.
- 3. Kite adjustments are not allowed after initial contest launch.
- 4. All points stand regardless of kite or line damage.
- 5. Contestants are not allowed to call time out during a tangle.
- 6. Cutting line and/or devices such as maniha and kevlar are not allowed.

GUIDELINES

A supplement to rules and definitions; Guidelines address the practical applications of operating and/or participating in a fighter kite contest. They may be adopted, modified or discarded to accommodate local preferences, size or scope of event.

1. The primary concern for safety issues is that no persons or property sustain injury or damage resulting from contact by kites or flying line.

It is strongly recommended contest environments remain absolutely separate from overhead power lines that there is no chance kites or flying line become entangled with same.

2. It is recommended the flying field be clearly marked or partitioned to separate flying activities from onlookers or passers by.

Whenever possible the flying field should extend a minimum of 300 feet down wind from the flying area.

Whenever possible the terrain should not obstruct the wind.

Recommended distance from wind obstructions is ten times the height of the obstruction.

It is recommended onlookers up wind of the box remain seated when within 60 feet of pilots or kites.

3. Prior to contest it is recommended a pre-flight meeting take place. The purpose of meeting is to introduce contestants with officials and make known safety issues,

field layout, rules or any significant information. At this time, wants and discrepancies will be settled in a democratic manner.

It is recommended a drawing of "lots" determine the order in which contestants participate.

4. Contest formats may vary congruent with number of contestants or scope of event.

Suggested formats are; Touches alternate between over and under, all over touches, or all under touches.

Contestants are awarded 1 point for scores. The number of tangles in a match should add to an odd total. Best of three, best of five or best of seven accordingly.

This type of format nay be used in conjunction with single, double, or triple elimination.

A round robin format may be adopted that every contestant has the opportunity to tangle one another. In a round robin format contestants engage in a set number of tangles. Three, five, seven accordingly.

The contestant with the highest over all number of points is determined winner.

A combination of formats may also be used. Example: Double elimination format until the final eight contestants are determined then the format changes to round robin to determine winner.

Ties are flown out to determine winner.

5. Only fighter kites by definition, single line maneuverable kites of any type are allowed to be used.

- 6. Line reservoirs of any type are allowed to be used.
- 7. Flying line of any non-cutting type is allowed.
- 8. Any type of line manipulation is allowed.
- **9.** It is recommended a down wind line be defined by a wind indicator. A secured pole with a ribbon secured to the top works well.

The wind direction indicator should always bisect and remain perpendicular to the box.

It is recommended kites and flying line be clearly visible.

The use of "ghost kites" [transparent sail material] or "camouflage kites" [colors that blend into the environment] should be covered in the pre-flight meeting.

11. Contestants will use a pilots area "box". Of primary concern is that no contestant have angle of wind advantage over another.

It is unfairly advantageous if a contestant stands to the rear of an opponent.

It is unfairly advantageous if a contestant's wind is at more than a ninety degree angle to the back line.

12. What constitutes a violation of the pilot area "box" ruling will be determined in pre-flight meeting.

Recommendations vary from touching the line, one foot over acceptable, one foot over not acceptable to being completely over the line.

Penalties vary from none [prompted to return to box by

referee or judge], warning [followed by penalty for second violation] to penalty [forfeiture of one tangle].

13. Grounding constitutes forfeiture of one tangle.

Intentional or accidental contact with the ground immediately after a touch constitutes grounding.

Contestants must demonstrate semblance of control after each tangle.

The first kite to ground forfeits the tangle. In the event of simultaneous grounding the tangle will be re-flown.

14. The determination of semblance of control is a judgment call issued by the head judge.

Recommendations for determination of decisions are as follows:

Immediate grounding after a touch constitutes forfeiture of the tangle.

For non-immediate groundings following a touch, the head judge will determine semblance of control.

15. All tangles are flown to completion regardless of damage to kite[s] or flying line.

A contestant may exchange a damaged kite for another one only during a match, and only after a tangle.

At the time a contestant exercises this ruling the opponent has the option of exchanging kites or adjusting existing kite.

Contestants are allowed to splice knotted or broken kite line only after a tangle.

16. Contestants may exercise one of three options for the retrieval of downed kites.

Assistance by appointed spotter, assistance by pilot appointed spotter or self spotted.

17. Time outs by contestants are allowed only after a tangle to exchange kites, splice line or retrieve downed kites.

18. Delays or postponements of tangles, matches or contests due to increment weather are highly discouraged.

In the event of extreme weather or act of god where safety is an issue the head judge may delay or postpone contest.

In the event of encroachment of flying field or air space where safety is an issue the head judge may temporarily delay contest.

19. A contestant's refusal to engage is highly discouraged.

20. It is recommended contestants "show class" by acknowledging they have been scored upon.

20. All point calls issued by head judge are final.

DEFINITIONS

1. To assure a safe, fun and smooth running contest, it is recommended the event coordinator and/or head judge divide responsibility as necessary. They may organize and deputize referees, assistants and spotters as needed. The event coordinator and/or head judge monitor all safety issues.

The primary function of the **head judge** is to monitor the actual contest and make point calls. The head judge may confer with referees but head judge makes all calls.

The primary function of the **referce**(s) is to assist the head judge in making point calls. They may vocally or silently signal head judge in the event of pilot area violations.

The primary function of the **assistant**(s) is to lend help where needed. They may be used as score keepers, prompt the next pair of contestants to the box, safety monitors or for any odd jobs.

The primary function of the **spotter**(s) is to collect, clean, untangle bridles and re-launch downed kites. They may also serve as safety monitors. Spotters will not handle kites unless prompted to do so by the pilot.

2. Fighter kite competition is a **line touch contest**. Pairs of contestants maneuver kites to cross and touch flying line from below or above in a predetermined manner.

3. The **box** is a clearly marked partition that may assume any one of a number of forms.

Box forms vary from a simple back line, a sideways "H", an upside down "T" to circular or square contained areas.

It is recommended a simple back line not be used to avoid bodily contact by contestants. A sideways "H"

or upside down "T" allow freedom of movement to contestants while restricting bodily contact.

Contained areas allow for separation of contestants and should measure 10 to 20 feet in diameter and be separated by a distance of 10 to 30 feet.

It is recommended the box be mobile to accommodate alignment/adjustment with down wind line indicator.

4. After kites are in **"ready"** position as determined by pilots, a tangle begins when head judge gives the signal **"fight"**.

A tangle ends when a contestant's line has been touched in the predetermined manner or a grounding has occurred. When a tangle ends the head judge hand signals in the direction of the winner and vocally announces point right/left accordingly. At the end of last tangle head judge hand signals in the direction of the winner and vocally announces point right/left accordingly and match.

5. The **bottom touch boundary** extends from between the tow point of the bridle to the hands and from the ground down wind to the top of the line up wind.

The **top touch boundary** extends from between the tow point of the bridle to the hands and from the ground up wind to the top of the line down wind.

6. A **"tangle"** is the term to identify the battle a line touch point.

- **7.** A "match" is combination of tangles established for the event. Such as; 2 out of 3, 3 out of 5 etc.
- **8. Difficult flying conditions** due to increment weather describes zero to high wind, heat, cold, rain, snow and other uncomfortable situations.

Extreme weather or **acts of god** describes large hail stones, proximate lightning, tornado, flood, earthquake and other hazardous situations.

Encroachment of flying field and air space usually describes onlookers/passers by wandering onto the flying field or kites descending onto the flying field.

It is highly recommended tangles and matches be flown to completion whenever possible. Dramatic distractions do not constitute interruption of contest so long as safety is not an issue. the end.
see you on the fields.
we'll fly 'til our grins
get pasted to our
faces for life.