



American Kitefliers Association

HOW TO FLY A KITE

REVISED EDITION
by Glenn Davison

First edition
by Miller Makey, Robert Ingraham, Jeff Reed

Especially for those who say,
"I could never get a kite to fly."



Thanks to Peigi Cleminshaw, Phil Broder, David Gomberg, Hank Manseau, Sharon Musto, Archie Stewart and my wife Misao.



For AKA membership information, including a subscription to the journal, *Kiting*, write to the American Kitefliers Association P.O. Box 1614, Walla Walla, WA 99362, USA

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Scope

This manual addresses the many styles of single-line kites that have been flown worldwide for the past two millennia. Within the last thirty years, two-line and four-line sport kites have evolved into a new category. To keep this manual small and concise, the details of multi-line sport kites have been omitted from this manual. Multi-line sport kites are covered in depth in other publications.

Disclaimer

Because it is rare for any two kites or kitefliers to behave alike, exceptions exist to all general observations, instructions and guidelines in this or any other book on kite flying. Neither the authors nor the publishers express or imply any warranty regarding the use of any of the observations or information in this manual. Please be careful!

First Edition

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Kite: a tethered aircraft that generates *lift* to overcome gravity. It does this through the action of air moving across its surface. Kites were named for the graceful hawk called a kite.

Note: Definitions for words in italics can be found in the glossary.

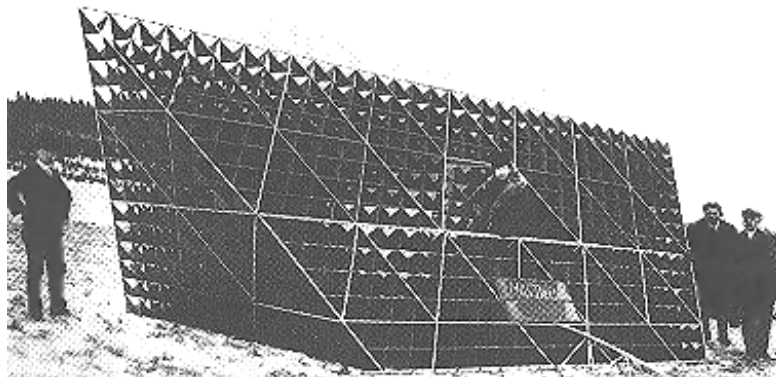
It is not necessary to study *aerodynamics* to fly a kite. However, some basic knowledge will help to change the experience from frustrating to enjoyable.

This manual will help you make the most of your kiting adventures, regardless of your age or kiting experience. It will help you launch both your kite and your spirit into the sky and send them soaring together like a bird in flight.

Historical Overview

Just who invented kites or how, no one really knows, but most investigators have traced their origin back 2,500 years to China and Indonesia. From there, kites and kite flying spread across Asia and the rest of the world along land and sea trade routes.

Since then, many inventive individuals fascinated with the flight of birds have discovered practical uses for kites. In the late 1800s, kiting enjoyed its golden age as a national pastime for adults and children alike in the United States. Many of the leading kitefliers of the day were the aviation pioneers who would develop powered flight, thanks, in part, to their research with kites.



Early experimental kite by Alexander Graham Bell

Yet, from its height at the turn of the century to the early 1960s, kiting diminished in popularity as an adult sport and entertainment in this country. It became regarded as child's play. Nevertheless, many adults continued to fly their kites, often away from public view.

Kite flying experienced a renaissance in 1964, when a group of nine kiting aficionados, led by Bob Ingraham, founded the American Kitefliers Association. AKA's publicity efforts captured the attention of the American public, and kiting slowly swelled to a national craze among thousands of would-be and once-had-been kitefliers.

Along with its newfound popularity, kiting has gone high tech, using the latest technology and modern materials, including rip-stop nylon, rip-stop polyester, Mylar, plastics, Tyvek®, polyethylene film and fiberglass or graphite. Even *flying lines*, once made of cotton and easily broken, have given way to twisted and braided synthetics of nylon, polyester and Spectra which are all available in various weights and strengths.

Technological advances contributed to a proliferation in sizes and styles of kites. Kites now range in size from smaller than a postage stamp...



...to giant kites with hundreds of square feet of surface area.

Kites are limited only by your imagination. Today it's possible to build kites using traditional or contemporary designs or a hybrid of both.



Kites Have Been Used in Many Ways

When people think of kites they usually think of kite making, kite flying and lazy summer days. But did you know there are many other uses for kites?

Art - Kites have been used as objects of spectacular design, indoor decoration and sky sculpture.

Carry a load across a river - In the 1840s, a kite flown across the Niagara River Gorge provided a line that was then used to pull a heavier line across followed by a rope, then a cable to begin constructing a bridge.

Develop manned flight - The Wright Brothers converted a kite into a glider, then into a powered airplane.

Electricity theory - Ben Franklin theorized about electricity in the air during a thunderstorm.

Fish - Kites have been used to carry fishing line to an area difficult to reach by boat or by wading.

Lift - Kites have hoisted everything from people to building materials and logs. Kites have moved cargo and motor vehicles to and from a transport ship.

Measure distance - A Chinese general, while laying siege to a castle, flew a kite from his position to the wall of the castle to determine the length of a tunnel needed to breach the fortress.

Meteorology - Kites have lifted instruments for measuring humidity, temperature and barometric pressure at different elevations and wind speeds. From 1893 to 1933 the National Weather Service operated kite (weather) stations.

Military - Kites have been used for reconnaissance, antiaircraft targets, signaling, mail transfer, sea rescue, observation, artillery spotting and to raise radio antennae.

Photography - Interesting photographs can be taken from the sky by mounting a camera on a kite's flying line. The shutter is triggered by radio, by a timer or by a string.

Radar interference - Kites carrying wire mesh have been used to disrupt enemy radar signals.

Radio antennae - Kites have been used to raise and support radio antennae.

Religious symbolism - Kites have been used as part of worship programs.

Rescue - Kites have been used for rescue at sea, ship to shore or on a ski slope.

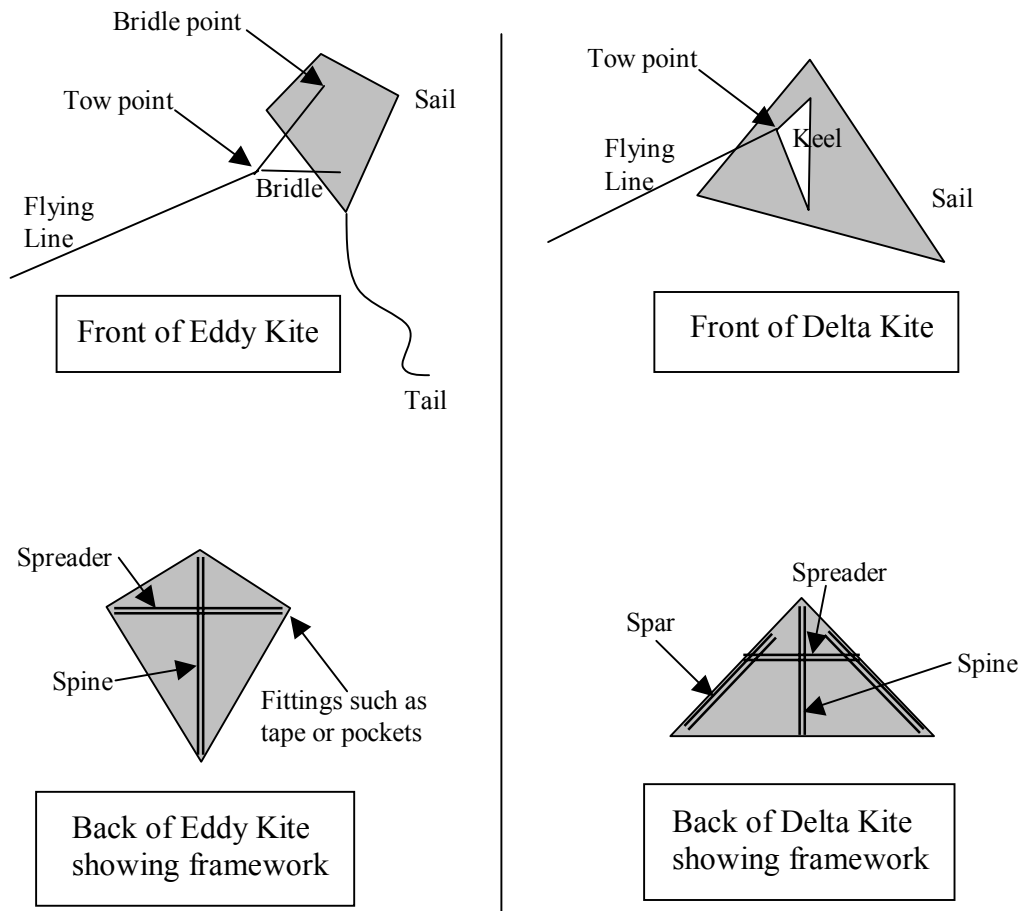
Scare enemy soldiers - Kites have been used for routing troops from their nighttime battle positions with eerie-sounding noisemakers attached to kites.

Traction - In the sports called Kiteboarding (including Kitesurfing and Snow Kiteboarding), Kite Buggy and Kite Skating, kites provide the power for vehicles capable of speeding across land, water, ice, snow.

Anatomy of a Kite

Okay, enough history. Let's move on to flying. To fly your kite we have to discuss kite parts so here's the anatomy of a kite.

There are many different styles of kites but they all have some common features:



Sail: Regardless of its shape or size, every kite has a lifting surface called a kite *sail*. The sail resists the force of the wind and the kite is therefore pushed into the sky. A sail needs to be both strong and light, relative to its size.

A sail can serve as a canvas for beautiful art. It can be made of many different materials including:

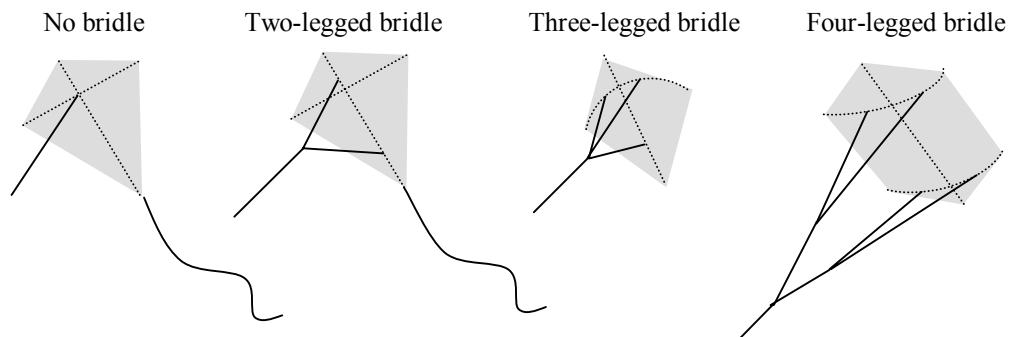
- Paper — rice, construction, letter, tissue, newsprint
- Plastic — trash bags, Mylar, vinyl, polyethylene, Tyvek®
- Synthetic Fabric — nylon, polyester
- Natural Fabric — cotton, silk, linen

Spars: The sail is usually supported by *spars*. The spars form the framework or skeleton of a kite. The spars may be formed from wood (such as bamboo, spruce, or pine), plastic, fiberglass or graphite. Depending on the kite style and the location of the spars, they may be rigid or flexible.

Bridles: Most kites have a *bridle*, made from a line or a set of lines that are attached to the kite. The bridle is possibly the most important part of a kite — its proper position and adjustment is essential for obtaining the most suitable *flight angle* (or *angle of attack* or *attitude*) into the wind.

The bridle line is usually the same strength as the flying line. Adjusting the bridle establishes the flight angle of a kite. Some kites are supported by more than 50 bridle lines, while others fly well with the flying line attached directly to their framework.

Kinds of bridles

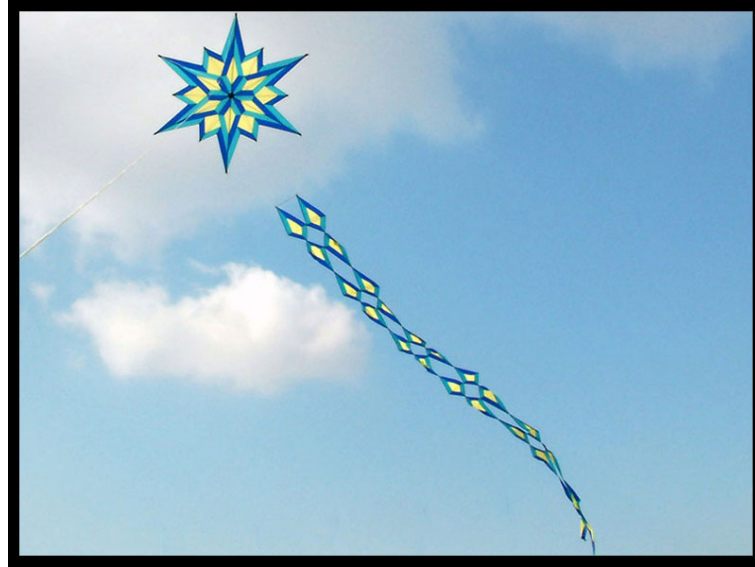


Commercially produced kites usually have fixed flight angles. The flying line is connected to a certain point on the bridle called the *tow point*. The bridle is connected to the kite at the *bridle point*.

Keels: A *keel* is a piece of material that is a substitute for a bridle. Attached to the sail over the *spine* (on kites that have a spine), a keel evenly distributes pressure on the spine so that the kite will not bend or lose its shape in a strong wind. Some kite makers believe a keel also helps stabilize a kite when it slips sideways. A keel often has a number of fixed points where a flying line can be fastened to make adjustments for light or strong winds.

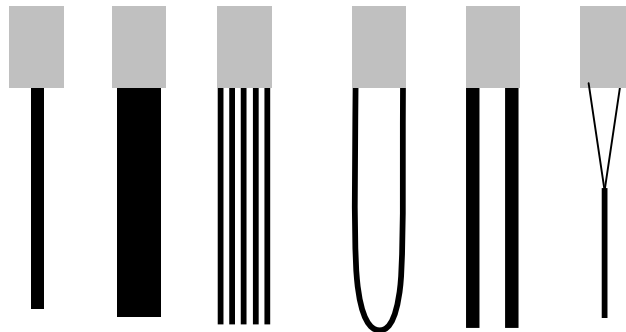
Tails:

Tails help stabilize kites. Some kites do not need a tail since they are designed to be stable. That supports a saying among Japanese kite makers: "A good kite needs no tail." Even when tails are unnecessary, they may be added for artistic or visual effect.



Kite tails can add to the beauty and stability of a kite.

There are many possible tail configurations: thin, thick, multiple, u-shaped, balanced, Y-shaped, twisting, drogues and combinations. Here are a few ideas for your next kite:



In the early 1900s, William Eddy devised a way to construct a kite that could fly without a tail. He modified a diamond-shaped, two-stick kite made by natives of the Malaysian Peninsula by bowing the horizontal spar. The bowed spar created a *dihedral*, a flexed position for the wings, which continues to stabilize the ever-popular tailless Eddy kites today.

Step 1: Choosing a Kite and Line

When you walk into a kite store or view kites on the web you'll be amazed at the wide variety of kites that are available in all shapes and sizes. Some things you should keep in mind while you choose a kite are:

- Some kites use materials that are more durable than others. Paper sails are inexpensive but fragile whereas sails made from ripstop nylon or ripstop polyester are much stronger and water-resistant. A frame of fiberglass rods or carbon tubes will outlast wood.
- Kites that are lightweight for their size usually fly best. The relationship of size to weight is very important for flying well.
- You don't have to spend a lot of money to buy a kite that flies well - The most affordable kites usually have a plastic sail and a framework made of wood or plastic. These materials are lightweight, but not as durable as nylon and fiberglass.
- The size of the kite is important. Often, larger kites fly better than small ones, but they pull more and require a stronger kite line.
- The shape of the kite contributes to how well it flies. Some kites resemble bugs, birds, butterflies, fish or people, while others display abstract geometric patterns. Whatever the style, shape or theme, the final product must be balanced and able to withstand the force of the wind. Some kites are designed to be attractive so that they sell quickly rather than fly well.
- Each kite will have a specific wind range in which it will fly best. Lightweight kites usually fly best in light winds whereas strong winds require strong sail material and strong kite line.



Kite store showing a wide variety of kites.

Tip: In many cases a simple kite is better for a novice than a complicated kite. Nylon delta kites, Eddy kites and sled kites are easy to set up and fly.

Tip: When you choose a kite, you may wish to choose a tail to go with it. Adding a tail to your kite will help it to remain stable in heavy wind and add a dramatic flair.

Tip: Ask for advice. Your Kite Retailer will be glad to make suggestions based on your price range, your wind range, your experience, the age of the flier and your style preferences.

Choosing a Kite Style

When you buy a kite, there are many styles of kites to choose from and the skills needed to fly them vary dramatically. Here are the major categories of single-line kites:

Flat: Most of the earliest known kites were flat and rigid (not bent by the wind in flight). A flat kite usually requires one or more tails, some *vents* or special construction to achieve an even spilling of air for stability. Many examples of flat kites still appear among traditional Asian and Caribbean kites. The kite to the right is a Japanese style Edo kite.



Bowed: Many kites face the wind with a curve. This curve creates dihedral for stability. They may be bowed by their construction or by the wind. Shortening the tension line on back will allow the kite to bow. This design is just like the front of a boat that parts the water as it moves. Bowed kites like Eddys seldom need tails.

Figure: Figure kites can take many shapes. Butterflies, birds, bats, bees, fish, dragons and dragonflies are all popular. Representations of people, animals and cartoon figures are also common. They are often made from traditional materials such as paper or silk with a bamboo frame. Modern materials such as fiberglass and nylon are also used.



Rokkaku: Rokkaku is a Japanese word that means that this kite has six corners. The size of the kite varies from about 4' to 7' and they usually have a four-legged bridle.

This style of kite is bowed by two tension lines and is popular because it flies well without tails and provides a nice shape to carry artwork. Similar to a demolition derby, a game called a Rokkaku Challenge is played with this style of kite. All at once, many of these kites are launched and players try to cut or knock each other out of the sky.



Cellular and Dimensional: Box kites and their derivatives comprise this three-dimensional style. The many variants include the Hargrave, the triangular box kite with wings and the Cody, a full box with upturned wings. Some cellular kites are elaborate in their cell structures and sometimes have wings, fins and/or *vanes*. A number of cellular kites flown together on a line have the strength to lift heavy payloads.

Soft and Flexible: These kites do not have a frame but they become semi-rigid when their multiple cells fill with air. To maintain their form, they frequently have many bridle lines. Some large soft kites develop enough pull to lift heavy objects, including motor vehicles.



Delta: This triangular-shaped kite is named for and resembles the fourth letter of the Greek alphabet. Invented by NASA, a delta kite can flex and adjust to changes in the wind. The keel holds the spine straight and rigid. The ability to automatically adjust to changes in wind force and direction makes a delta a good beginner's kite as well as a favorite of experienced fliers.

Fighter: Fighter kites are flown for sport in various parts of Asia. Indian fighter kites are diamond shaped, have a two- or three-point bridle and are made of tissue paper and bamboo. Flown and controlled with one flying line, fighter kites are considered by many to be the kites that require the greatest amount of skill to fly. Pulling on the line allows the spreader to flex causing the kite to fly in the direction it's pointed. Releasing tension on the line returns the kite to a flat, unstable shape causing it to spin. The skillful combination of pulling and releasing allows the pilot to direct the kite.



Sled: When this style of simple, flexible kite made its maiden flight in the early 1950s, its inventor, William Allison, noted what a great "flexible flier" it was. Since that also happened to be the name of a popular snow sled, he dubbed his kite a "sled kite." A sled kite flies so well that it is a good project for kite workshops. It can be constructed of paper, fabric or plastic and in various sizes and configurations.

Arch: Kites can be attached side-by-side to create an arch of kites where each end is *anchored* to the ground. Some arches have a theme, others have each kite display a letter in a word or phrase. Whether they have a few sails or hundreds of sails, arches are a very dramatic way to display kites.



Trains and Centipedes: Just like boxcars on a train, any number of kites can be flown together, one behind the other, to form a train of kites. The flying line connects one kite to the next so they appear to be flying on a common line. Trains can generate an enormous amount of pull since each kite adds a little bit to the pull of the group.

Choosing Kite Flying Line

Good flying line is so strong it can be used for many years and attached to many kites. Braided, synthetic flying lines are the lines of choice today. Kites fly well when using synthetic lines such as Dacron polyester because of their low weight, smoothness and small diameter. Smooth line makes it comfortable to handle. When slackened, twisted line will kink, knot and tangle much more than braided line.

The diameter of the flying line needs to be as small as possible to create a minimum of *drag* from wind resistance. This is especially true for small, lightweight kites. At the same time, the flying line must be strong enough to hold a kite in a variety of wind conditions.

Learn the best strength line to use with each of your kites. Kite line is available in strengths of 20, 30, 50, 80 pounds and more. A 30-pound line, for example, will break with a strain on it of more than 30 pounds. In addition, make certain the *break strength* is sufficient for the winds your kite will be up against on a given day.

Tip: Every knot tied in flying line creates a weak spot and reduces the break strength by 15 to 50 percent. Line that has been exposed to the sun for extended periods of time may no longer be reliable at its rated break strength.

Tip: Check the flying line for wear, knots or damage, especially near swivels where the greatest wear occurs. Replace badly soiled lines; particularly those damaged by oil or grease, as well as any worn swivels. Ensure that all connections are tight and secure.

Tip: Monofilament fishing line is a poor choice because it's hard to see, it can cut your hands, it doesn't hold a knot well, it stretches and it's prone to tangles. Never use metal wire because it conducts electricity.

Tip: A spool, *reel*, or *winder* makes it easy to let out the line and take it in. It's also a convenient way to store flying line and keep it free from tangles. Some people who use a spool, reel or winder say they enjoy added control and efficiency in handling the line when launching and recovering their kites. Some of these devices are simple to make, using everyday materials, from sticks, two pieces of wood or cardboard.

Regardless of what you wrap your flying line around, the more line taken up in a single turn, the faster you can take line in or let it out. This maximizes your control over the kite when making quick and

necessary flying adjustments or retrieving it from the sky.

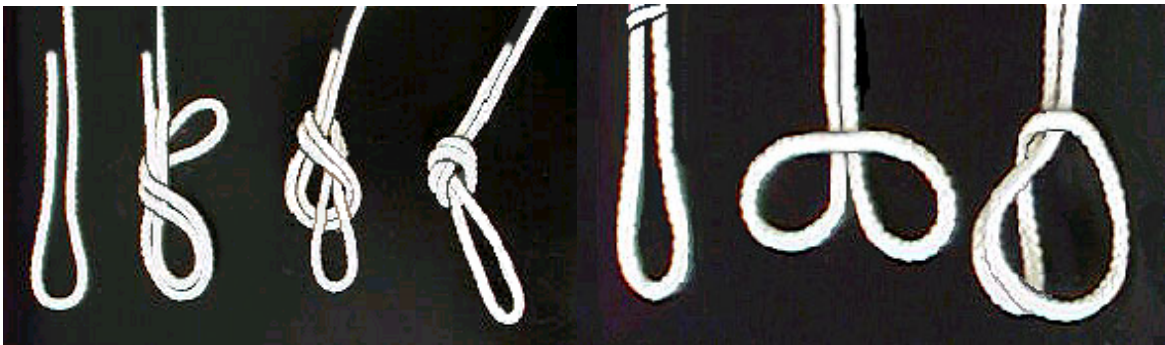


Spools, reels and winders come in many shapes and sizes.

Step 2: Setting Up Your Kite

When you buy a new kite, you should open it and look at the parts. If there are many pieces, try putting the kite together in your living room where you are out of the wind and have time to read the instructions without the pieces blowing away. Follow the manufacturer's instructions and remember to put the bridles on the front, sticks on the back and tails at the bottom. Follow the instructions carefully or your kite may not fly.

Here are two knots you'll need to attach the end of the flying line to the kite's bridle. With these knots, you can easily undo the connection and use the flying line on another kite.

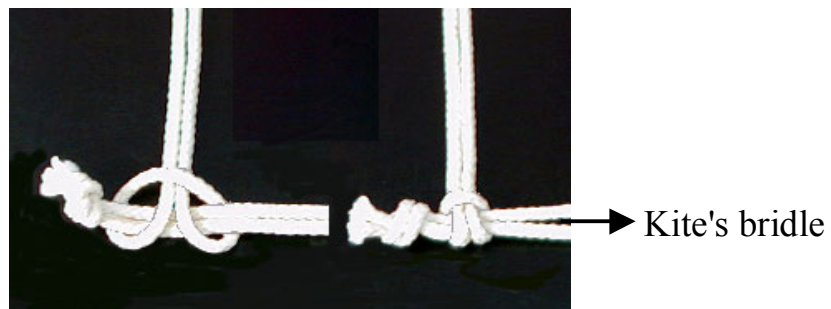


Overhand knot:

Use these four steps to make a loop at the end of your spool of line. Most people know how to make this knot. It's just "around and through."

Lark's head knot:

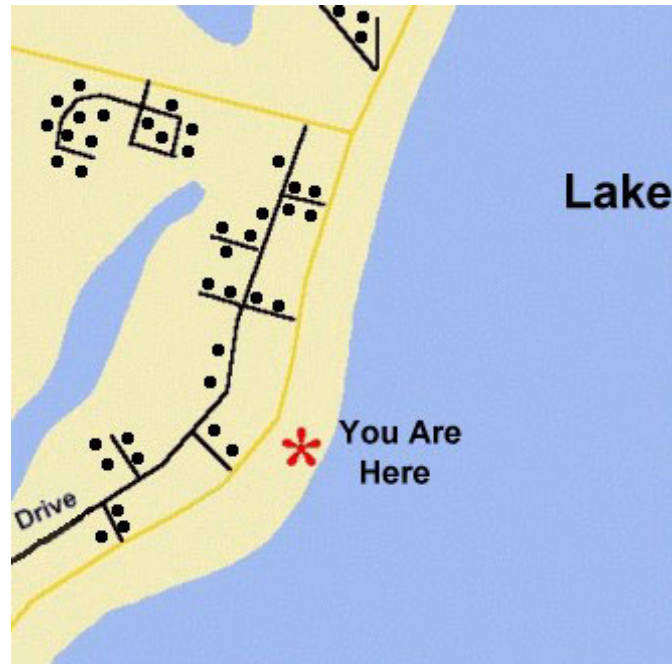
Use the loop to start this knot. This removeable knot will allow you to attach your line to different kites.



Slip the lark's head loop over the knot at the end of the kite's bridle and pull it tight.

Step 3: Choosing a Kite Flying Field

A good location is free from obstructions with no trees, power lines, airports, cars, buildings, cyclists, skaters or pedestrians. The best places include large open fields, parks, hilltops and beaches.



Parks, fields and beaches such as this one have clear access to the wind with few obstacles.

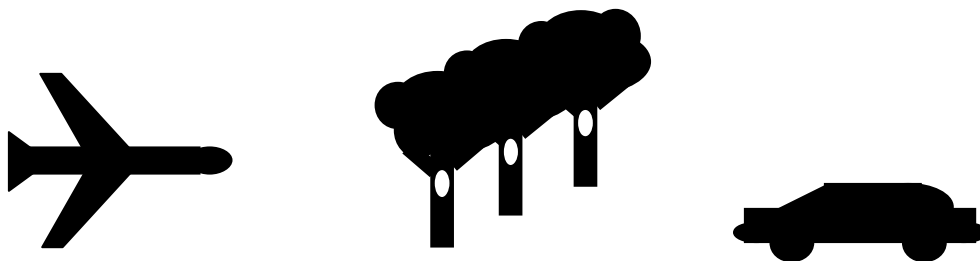
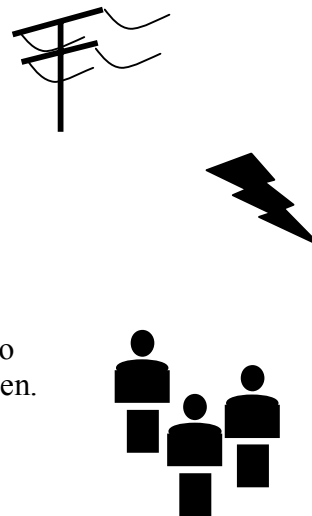
Kite Safety

If we are courteous and use common sense, everyone can enjoy the sport and art of kiting while avoiding damage and injury. Fly your kite where it will not cause a hazard to yourself or others. Kites should be flown in an open area, away from people, roads, and obstructions.

Since kites and kite lines can be dangerous, safety should always be your primary concern. Be aware of the wind and your environment. If there is ever any question of safety, fly the kite in another location or on another day.

To fly safely, remember these important points:

- Never fly your kite near power lines. If your kite becomes tangled in power lines, *leave it there* and notify your electric company of the situation
- Never fly near cars
- Never fly near an airport
- Avoid flying your kite too high or allow it near air traffic
- Never fly in stormy weather or when a storm is approaching
- Never fly over people
- Avoid trees (they eat kites!)
- Always keep a safe distance from other people
- Keep your kite under control, never unattended
- The most frequent injury during kite flying is sunburn. Be sure to protect yourself from the sun with a hat, sunglasses, and sunscreen.



Tip: You can prevent problems by restricting the length of the flying line. Make it shorter than the distance to the nearest obstacle!

Tip: If your kite line gets stuck in a tree, release the tension and disconnect the line from the kite and remove them separately. Do not climb the tree.

Note: A frequent injury during kite flying is a cut or burn from the kite line. Do not allow the line to zip through your fingers. Protect your hands by wearing gloves.

Step 4: Evaluating the Wind

Now that you have a kite and a good place to fly it, now you need wind!

The best conditions are smooth, steady winds without changes in direction or speed.

Is There Enough Wind?

Most kites fly when the wind speed is between 4 and 15 MPH. Choose a day to fly kites based on the wind. Don't expect the wind will fit your schedule! It is important to know your kite and to know the current conditions because some kites are designed for low winds or no wind (indoors) while others are designed for high winds.

How can I tell if the wind is right?

Wind Speed					
MPH	Km/H	Knots	Characteristics	Name	Good Conditions?
0	0	0	Smoke rises vertically	Calm	Too little
1-3	2-5	1-3	Smoke drifts	Calm	Too little
4-7	6-11	4-6	Leaves rustle	Light	Yes!
8-12	12-19	7-10	Leaves dance	Gentle	Yes!
13-18	20-29	11-16	Trees toss, dust flies	Moderate	Yes!
19-24	30-39	17-21	Small trees sway	Fresh	Too much
25-31	40-50	22-27	Large branches sway	Strong	Too much

Remember that the wind speed changes with altitude. Higher winds are often found at higher altitudes.

Changes in wind speed are worse than changes in direction. A sudden increase in speed, called a gust, can snap a flying line that would otherwise work well. A drop in speed can quickly ground a kite and if you are not careful the kite can land on a road, in a tree or in the water.

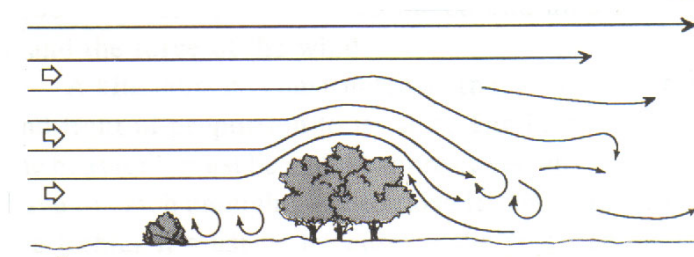
Smooth Wind - Not Strong Wind

Many people believe that strong winds provide ideal conditions for kites. This is not true! Wind flows in waves of varying speed and direction. That means, depending upon where you try to fly your kite, you may not find enough wind or the *turbulence* may be too great for your kite to fly well.

Turbulence results in a bumpy flight and decreases the speed of the wind, which often hinders the launching of a kite.

Scout the lay of the land before you launch your kite. A *ground obstruction* blocks smooth wind from the kite. When the wind reaches an obstruction, it flows over and around it, causing turbulence on the downwind side for a considerable distance. Trees, shrubbery, a hill or a building cause turbulence far downwind by as much as seven times the height of the obstruction.

If your kite is held too close, even your body could block the wind.



Obstacles create turbulence downwind.

Tip: To find smooth wind you must find a large flat area without obstructions or fly your kite high enough to avoid turbulence.

Evaluating the Wind Direction

In preparation for launch you should always determine the wind direction. This will help you to choose an appropriate *anchor position*, launch your kite successfully and fly the kite safely. The wind direction is important because many flying locations get smooth wind from one direction and turbulent wind from another.

There are many signals that will tell you the wind direction. The obvious ones are flags, banners, weather vanes, other kites, smoke and streamers. Another method is to feel the wind on your face and hands. Turn your face in the wind till the sound of the wind is equally strong in both your ears.

Some less obvious methods include carefully watching hair, the leaves on a tree or swaying grass. Some people drop a few grains of sand or a few blades of grass to see which way they blow.



Tip: When people describe the wind direction, they state the direction of the source of the wind. For example, some people say "From the North" or they just call it "North wind."

Tip: AKA member Archie Stewart says, "If the wind's in your face, you're in the wrong place!" You should have your back to the wind when flying a kite.

Tip: Keep in mind that the wind changes direction and intensity. The local weather forecast may give you an idea of what to expect. Some days there are only minor changes; occasionally there are 180-degree wind shifts!



Here, the flag indicates the wind direction lifting the bird kite

Selecting the Right Kite for Current Conditions

Judging the strength of the wind will help you to select the right kites to fly on a given day. Since the wind speed and direction may change abruptly, experienced kite fliers have a number of kites and know which ones are better suited for winds of different forces. Just the way you change your clothing to match the weather, kite fliers will switch kites to match the wind speed.

In heavier wind you might choose kites with:

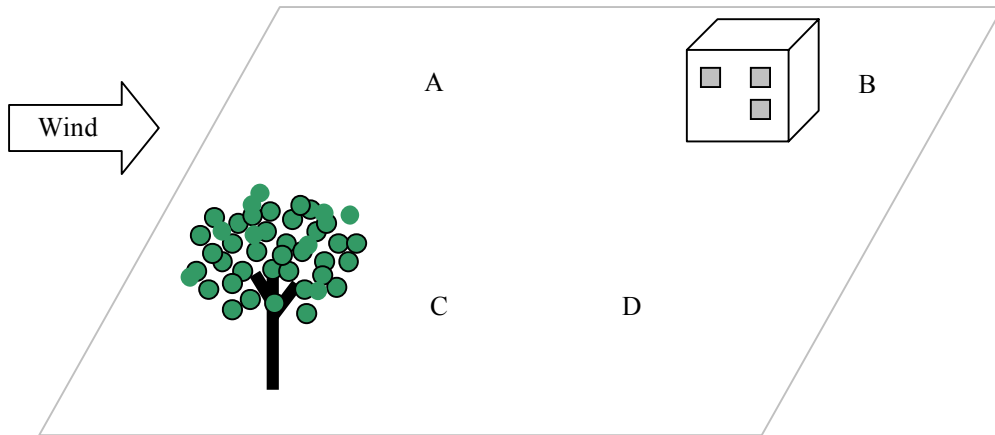
- long tails
- extra bow, extra flex or extra dihedral
- a small sail area or vented sails
- higher bridle adjustment

In light wind you might choose kites with:

- no tails
- a lightweight frame with less dihedral
- a large sail area
- lower bridle adjustment

Step 5: Choosing a Spot to Stand

Once you step onto the flying field, you may begin to wonder if one spot is better than another. Often, the center of the field is best but there are three factors to consider: safety, turbulence and the wind direction. You may have to arrive early to claim the spot you want.

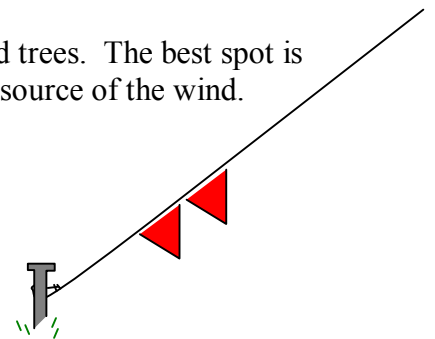


In this example, location "A" might be the furthest walk, but it offers better access to the wind than locations "B," "C" or "D."

If you fly your kite over the center of the field or the middle of the beach you may be flying dangerously close to people as they walk by. If you choose to anchor your kite at the edge of the field you may be flying over trees, water or a parking lot.

To avoid turbulence and dead air, stay far away from buildings and trees. The best spot is the one where there are no obstructions between your kite and the source of the wind.

You can anchor your kite to an immovable object such as a fence post or a stake in the ground. Mark your lines with a flag at eye level and never leave anchored kites unattended.



Tip: A 6-foot loop of rope can be used to anchor your kite in many situations. It's easy to knot it onto an anchor such as a strong post, hydrant, rail, tree trunk, fence post, etc. Attach your flying line to this rope to protect your kite line from abrasion

Tip: Find a spot at least 20 feet from other kitefliers to minimize the risk of your line snaring, crossing or cutting another flying line.

Step 6: Launching a Kite

The challenge is to fly your kite through the poor and disturbed wind near the ground and into the better wind above. The trick is to do it without changing the bridle and altering the angle of attack, if possible, since a change may be unsuitable for the winds at the higher elevation.

Many people believe you must run with a kite to launch it. This is not true. If the wind is steady and strong enough for your kite at ground level, you may launch your kite without taking a single step.

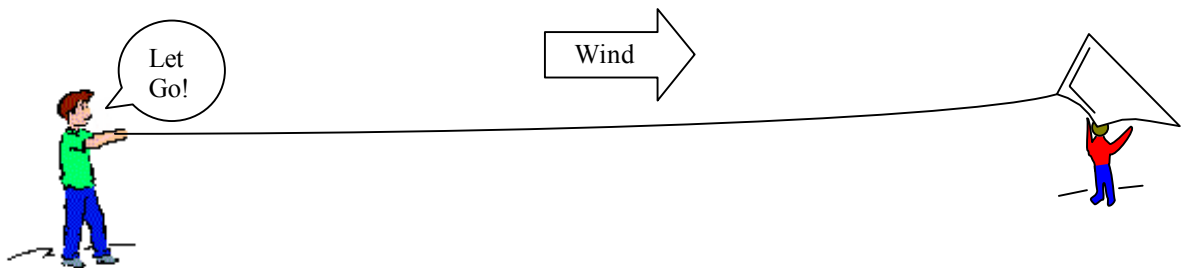
Those who run usually ignore the wind direction! Since airplanes take off into the wind, your kite should too.

Many accidents are caused by people who run with a kite while trying to keep an eye on it instead of watching where they are going. These runners may stumble, fall, or slam into something like a tree or a fellow kiteflier — an encounter that is humiliating and painful. Even if the runner succeeds in pulling a kite into the sky, it will fall once they stop running unless the kite rises high enough to find stronger wind.

The best way to launch your kite is to determine if the wind is light, moderate, or heavy, then use one of the methods below. Once a kite is launched, it will seek out the correct angle to the wind.

Light Wind Launch

On days when the wind at ground level is too calm to launch a kite, a steady stream of air often flows above the trees and buildings. If you can place your kite into this upper layer of air, it could continue to fly for hours, even when the wind dies down late in the afternoon. Achieve this by using a favorite trick of expert kitefliers called a *long line launch*.



One method of achieving a long line launch is to let out 100 to 200 feet (30-60 meters) of line. Have a helper hold the kite or prop it up against something so that it is facing you and facing the wind. Signal your helper to let go of the kite, so it can rise naturally from their hands. The helper should not throw the kite into the wind. As they release the kite, stand still and pull in line quickly.

Another method is to pull the line in rapidly while doing a short sprint into the wind. In most cases, this burst of energy will force the kite to rise quickly and possibly climb into an upper air stream swift enough to sustain its flight.

Tip: Make sure your helper stands behind the kite. That way your helper doesn't get hit by the kite or tangled in the bridles. Also, make sure your helper knows which end is up!

Moderate Wind Launch

On days when the wind at ground level is strong enough to launch a kite you will find it easy to launch the kite directly from your hands. Stand with your back to the wind. Hold the kite aloft so that it is facing you and catching the full force of the wind. Release the kite and pay out line steadily until the kite reaches a stable altitude. If the wind does not carry the kite up immediately, the kiteflier can take one or two steps backward and, at the same time, pull steadily on the line.



Heavy Wind Launch

On days when the wind at ground level is very strong you will find it easy to launch the kite directly from your hands. For larger kites it's extremely important to anchor your kite line. You may need gloves to protect your hands.

It's important to watch your kite closely. Your kite may fly well at a low altitude, but as it rises it may be overpowered by stronger or gusty wind. You can tell it's overpowered when it spins, loops and dives. It may be necessary to add a longer tail and adjust the bridle by moving the tow point toward the top of the kite 1/4" at a time.



Position the bridle to compensate for the force of the wind.

Step 7: Launch Trouble-Shooting

If the kite will not rise:

- a. The wind may be **too weak** to achieve the lift required to support the weight of the kite. Eat lunch then try again.
- b. The wind may have **shifted direction** while you were setting up. Change your position to assure you have your back to the wind.
- c. A hill, a tree or a structure could **obstruct** the wind. You also could be holding the kite too closely and your body may be blocking the wind. Do not throw the kite. Try the **long line launch** and allow the kite to rise smoothly.
- d. The **bridle** may need to be changed because the **angle of attack** may be too great or too small. If the kite does not climb, move the bridle point slightly higher. To steady the kite, move the bridle point slightly lower. Move it only one quarter of an inch at a time. When you dangle the kite from the bridle point usually the kite will have the nose slightly up instead of horizontal.
- e. The kite must be **symmetric**. That means that the size and weight and flexibility of the left side must equal that of the right. Check it by flexing the frame and dangle the kite from the bridle to see if it is balanced.
- f. The kite may have **too much drag** because of too much tail or the tail is too heavy. Very often a kite will need a longer tail to fly in stronger winds. Try 7 times the length of the kite to start. If you need to improvise, strips of plastic garbage bags work well.
- g. The line may be **too heavy**. In flight, this is usually indicated by a sag in the line. Switch to thinner line or wait for stronger wind.
- h. If a kite **swings** from side to side, consider bowing the kite more and/or adding a longer tail.

Step 8: Flying Your Kite

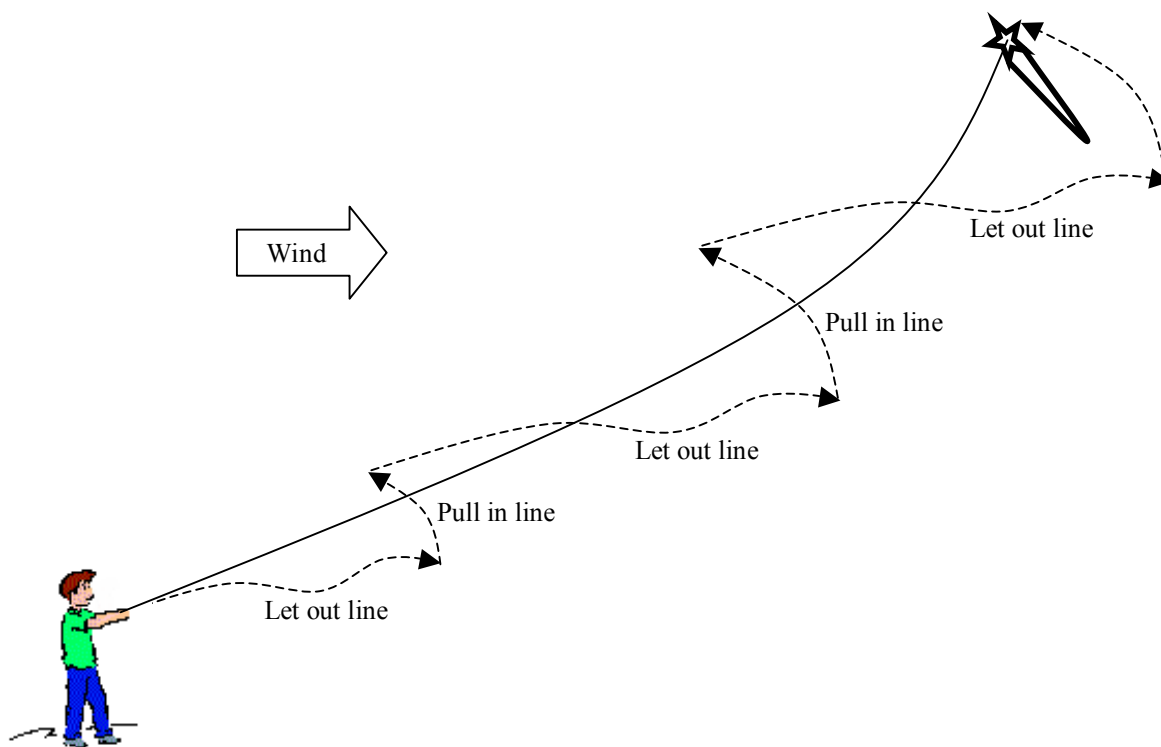
This is the part to enjoy! Some kites will fly steadily, others may require constant attention.

The Basics

As your kite begins to rise steadily pay out line to gain altitude. If the line slackens, take in line. Letting out line will allow the kite to go lower and further away. Taking in line will bring your kite higher and closer.

Gaining Altitude with a Combination of Release and Pull

To coax your kite higher, try a combination of long pulls with letting out line. Each time, try to let out more than you pull in. After doing a few of them, check their effect. You may need to try another series to achieve your desired altitude. The higher altitude may provide faster flowing air that may sustain flight. The amount of line you can pull in and release depends on the stability of the kite.



To coax a kite higher into the sky, try a series of pull-ups by letting out and taking in line.

Gaining Altitude by Pumping the Line

Another effective way of raising a kite higher into the sky involves pumping the line. This is helpful when winds at the surface are minimal. A series of sharp pulls on the flying line increases the speed of the airflow across the sail that will increase the lift and raise the kite to a higher elevation. A series of sharp pulls separated by short periods of little or no line movement is more effective than steady movement. Larger kites require longer pulls. The actual speed and the length of the pull depend on the wind, the size of the kite and the style of the kite so the proper rhythm is best determined by feel.

Note: The highest kite is not the best kite. As kites get higher they look smaller to spectators and take more work to reel in at the end of the day!

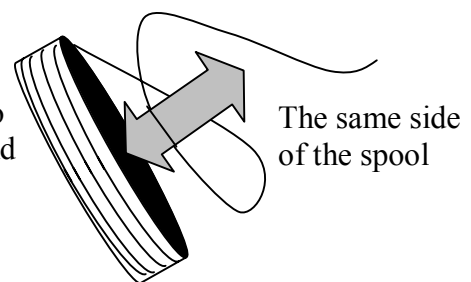
Reacting to Wind Drops

A kite will stay aloft as long as the wind is sufficient and the kite remains stable. Should it begin to fall or glide toward you, the wind is insufficient. If the kite begins to fall, pull in the line! If it continues falling or gets closer to the ground, pull in line quickly using the hand-over-hand method.

When the wind gives out, kites will vary in the rate they will sink to the ground. This is usually determined by their shape and weight. For instance, box kites sink rapidly yet they respond to a long line launch as well as any other kite. Whether or not a kite stays up depends upon the wind speed at their flying altitude. In general, the lighter the kite, the easier it will be to fly when the wind is less than optimum.

Managing Your Line

When flying your kite, you'll be handling your line much more than the kite. You'll have to release and take in line to avoid knots, twists and tangles. During periods of light wind your line may droop toward the ground. Reel it in. When the wind picks up, you may want to release line quickly to take advantage of better wind at higher elevations.



A spool will help. When using a spool, always take line off the spool from the same side from which the line was put on the spool. As you wrap the line on the spool you put a twist into the line but as you remove the line the twist comes back out of the line. If you remove the line from the wrong side you will accidentally double the twists in the line.

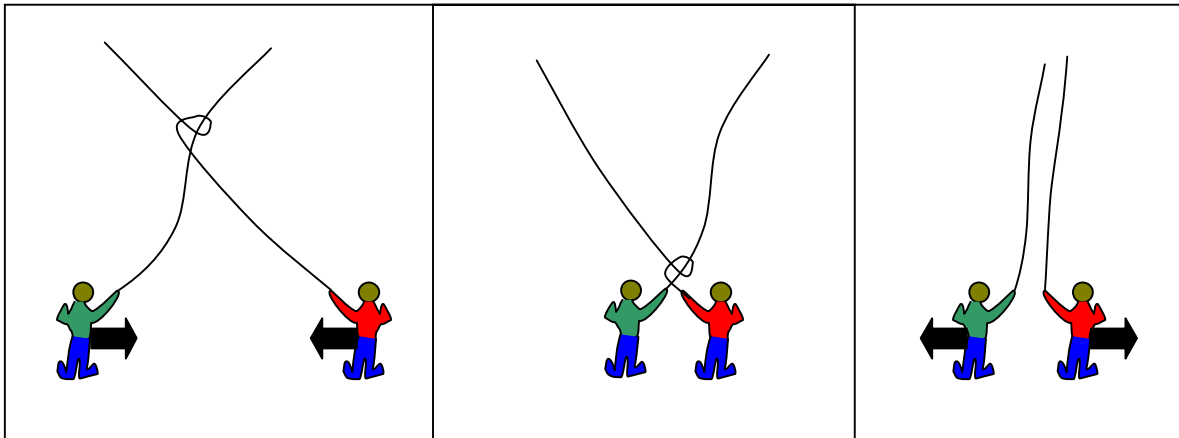
Tip: Experienced kite fliers usually pull in kite line hand-over-hand laying the line on the ground in a zig-zag pattern. Once the kite is disconnected from the line it can be easily wound onto a reel or spool under little or no tension.

Tip: If you pile kite line on the ground, many small piles are better than one big one.

Tip: If you try to pull the line out from the bottom of the pile you'll create amazing knots. Instead, always remove the line from the top of the pile.

Tip: When your line gets tangled, don't pull on it. That will only tighten the knots. Instead, carefully loosen the tangle and pull out the loops.

Untangling Wrapped Lines



Quickly move together and the tangle will slide down the line. Unwrap and move further apart.

If two kite lines become wrapped around each other, they should be quickly unwrapped. The correct actions will prevent one line from cutting the other. To bring the tangle down to your hands, walk quickly to the side of the other kiteflier and hold your lines together. The wrap will slide down the lines to where you can reach it. Unwrap the lines until you're free then move quickly away from the other flier. You may want to move further away than before to prevent a future tangle.

Tip: Add tails to fly in heavier winds. Tails help to stabilize kites by creating drag below and in-line with the kite. To do this, tails are often attached at the bottom of the spine. Drag can compensate for the instability created by higher wind or by intentional or unintentional design features of a given kite. Bear in mind, the lighter the tail, the better because tails should add drag, not weight.

Step 9: Pulling a Kite Down

When it's time to pull a kite down, Fliers first check the tension on the line, then use one of the following techniques:

No tension - If your kite is falling, take in the line quickly enough to keep the line taut. That enables you to maintain control of the kite. If your kite is falling fast, drop your winder (if you're using one) and pull in the line quickly using hand-over-hand motions. Leave the line on the ground until your kite is safe.

Light Tension - Pull in the flying line slowly and smoothly.

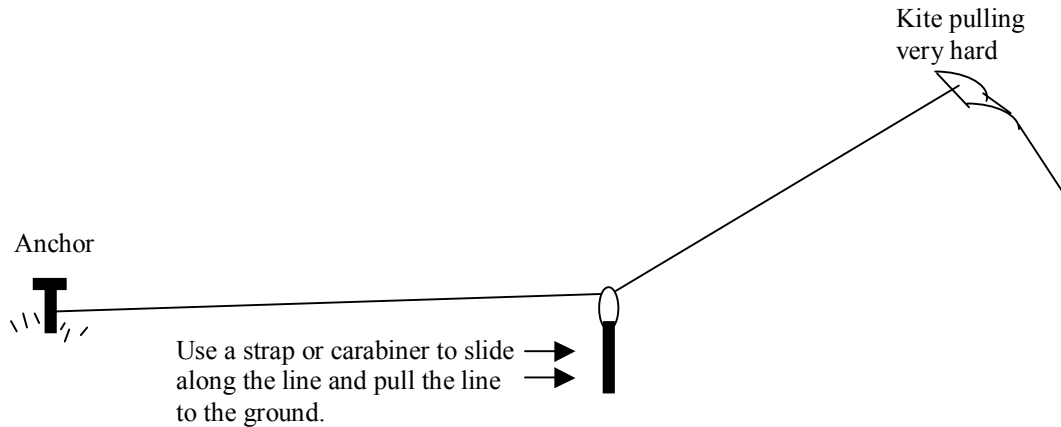
Moderate Tension - When you take in kite line, you are adding 1 to 3 MPH to the wind speed acting on the kite. It is important, therefore, not to take in line so fast that you create excessive wind force on the kite and cause it to overfly.

Tip: Overflying happens when you take in line too fast. You will see the kite fly up overhead, even upwind from you and past a point directly above the anchor or kiteflier. If you fail to correct for an overfly, the kite may dive and crash. If the kite should overfly, slacken the line and allow the wind to carry the kite back downwind from you. Then, you can continue winding it in again.

Strong Tension - One way to retrieve a hard-pulling kite is to walk *toward* the kite while reeling in the line. This will reduce the tension on the line. If you run out of space, stop reeling and walk slowly back into the wind, pulling the kite behind you. Once you have enough room to walk toward the kite again, do so and resume reeling it in. Repeat this procedure until the kite is back in your hands.

Sometimes when the wind speed increases during a flight, a kite will become overpowered. These excessive winds distort the kite's shape and destabilize it. The kite will swing from side to side until the pressure is lowered by a reduction in the wind's force or by slackening the flying line. You will see the kite move from side to side, and then it will spin or dive. If you let out some line that will halt these dives temporarily, but that will allow your kite to go higher instead of lower! One method is to wait until a dive takes the kite close to the ground, then quickly release a lot of slack line. The kite then will float gently down to the ground.

Extreme Tension - To land a kite that is pulling so hard you cannot reel or pull it in, wrap the flying line around an anchor then tie it in place. Walk toward the kite, reach up and pull the line down, hand over hand, as you go. You can use a gadget called a "pull-down strap" to slide or roll along the line while you approach the kite. The strap reduces the friction and makes it easier to pull the line to the ground. You also will be less likely to cut or burn your hands from the friction of the line.



Tip: To prevent your hands from getting cut by the line, wear gloves. This is especially important on windy days when there is strong or extremely strong tension on the flying line.

Tip: Don't spool the kite line when there is tension. That could crush your winder. Pile the line loosely on the ground then spool it later.

Kite Activities to Try

Kite flying is an enjoyable and varied activity. There are many activities to try. Here are a few suggestions:

Flying Kites:

- Add tails to your kite, vary their number and length
- Anchor your kite so it flies while you watch
- Fly a kite style that you've never tried before such as a cellular kite, fighter kite, miniature kite, bird kite or box kite
- Fly an arch, or a train of kites
- Learn to fly a dual-line kite
- Learn to fly a quad-line kite
- Fly a kite at night with lights
- Practice stunt kite tricks
- Try flying a sport kite in time to your favorite music
- Try synchronized stunt kite flying with a friend and two matching kites
- Fly a kite with a friend
- *Trim* your kite to improve the quality of its flight
- Attach decorations (nicknamed "line laundry") to the flying line
- Send a paper messenger up to your kite (this is called a line-climber)
- Teach someone how to fly a kite

Building Kites:

- Build a paper kite and decorate it
- Sew a kite with ripstop nylon
- Teach someone how to build a kite

Join a local kite club:

One of the best ways to learn more about kiting is to become a member of the American Kitefliers Association (AKA) and read the magazine called *Kiting, The Journal of the American Kitefliers Association*.

Summary

Kite flying is a great individual or family activity for people of all ages.

When flying kites:

- Buy a beginner's kite in a moderate size
- Buy good quality kite line
- Learn to judge wind direction, speed and turbulence
- Fly when and where the wind is smooth and moderate
- Choose places to fly that are free from obstructions and obstacles
- Learn a few different methods of launching and landing your kite
- Always follow safety rules
- Have fun!



Glossary

The terms that appear in italics throughout the text are explained in this glossary.

Aerodynamics: the branch of physics that deals with the motion of air and the forces that act on bodies in motion.

Anchor: a kiteflier and/or something that holds a kite line such as a tree, stake or post.

Anchor position: the place where a kite is tied down or being held.

Angle of attack: also known as pitch or attitude, this is the angle between the sail and the horizontal wind. A slight change of the attack angle can make a significant change in the altitude the kite will reach and the pull on the line.

Break strength: the strength (pounds of tension) a given line will withstand before breaking.

Bridle: the line or lines connected to a kite that determine the angle of attack and help the kite to maintain its shape. The flying line is tied to the bridle. The bridle adjustment and wind force establish the angle of attack of a kite. Some kites do not have bridles, instead, the flying line may be attached directly to the frame or keel at points that are selected based on the wind speed.

Bridle point: the selected point on a bridle where the flying line is or can be attached for efficient flight.

Dihedral: the angle between the left and right sides of a wind-receiving plane (the sail, surface or cover), created by building it into the kite's structure, bowing the lateral spar(s) with string or the bending of the lateral spar(s) by wind pressure.

Drag: the force created by the friction between the airflow and a sail, flying line, tail and spars.

Flight angle: see **Angle of attack**

Flying line: this is the term that kite fliers use for string. One end is connected to a kite, bridle or keel, while the other is held in the hand of a kiteflier or attached to an anchor.

Ground obstruction: a ground-level obstacle that blocks the wind a kite needs for launching. Tall grass, bushes, trees, structures, a hill, or a kiteflier's body all can cut off the wind from a kite.

Long line launch: a method of using 100' or more of flying line to raise a kite above turbulent winds near the ground caused by ground obstructions.

Keel: an alternative to a bridle that holds the spine rigid by an even distribution of pressure, which keeps the spine from bending in a strong wind. A keel fastens to the sail over the spine and allows for the use of a lighter spine, which makes for a lighter kite — one of the primary goals of kite design.

Lift: the component of force perpendicular to the direction of the wind, which pushes a kite into the sky.

Line: see **Flying line**

Reel: see **Winder**

Sail: the material that covers the framework of a kite. The surface of a kite that receives the force of the wind. Also called the skin or cover.

Spar: a rod, stick, strut or tube used in making the framework or skeleton of a kite.

Spine: a stiff vertical spar that often acts as the chief support in the center of a kite.

Tail: a long piece of material fastened to a kite that adds drag and weight, as well as beauty and grace.

Tow Point: the point on the bridle where the flying line is attached.

Train: kites flown together, one behind the other, to form a chain of kites. The flying line connects one kite to the next so they appear to be flying on a common line.

Trim: the adjustment of the bridle, as well as shape and weight distribution, so the kite will fly efficiently in the winds of the moment. This adjustment can be made by increasing or decreasing the bow or dihedral, adding tail or weight and/or moving the bridle point up or down to change the kite's center of gravity.

Turbulence: airflow that is irregular and erratic in its speed and direction. It is caused by ground obstructions.

Vane: a thin, flat or curved surface that directs airflow -- such as the feathers on the shaft of an arrow. Vanes sometimes are used to help stabilize a kite in the same way that a rudder stabilizes a boat.

Vents: openings in the sail that permits air to escape to relieve pressure.

Winder: a cylinder, spool or frame upon which line is wound and stored. It also facilitates letting out and taking in flying line.

Wing: a body or airfoil (such as an airplane wing) designed to provide a major part of the lift that supports a heavier-than-air aircraft, including kites.

Resources

Periodicals:

KITING, The Journal of the American Kitefliers Association

P. O. Box 1614, Walla Walla, WA 99362, USA

Quarterly publication included with association membership (\$30 a year)

Books:

KITES

By David Pelham; The Overlook Press

Lewis Hollow Road, Woodstock, NY, 2000

KITEWORKS

By Maxwell Eden

Sterling Publishing Co., 1990

KITES, AN HISTORICAL SURVEY

By Clive Hart; Paul P. Appeal

Mount Vernon, NY, 1982

KITES FOR EVERYONE

By Margaret Gregor

1425 Marshall, Richland, WV 99352, 1984

THE COMPLETE BOOK OF KITES AND KITE FLYING

By Will Yolen; Simon and Schuster

New York, 1976

THE TAO OF KITEFLYING: THE DYNAMICS OF TETHERED FLIGHT

By Harm van Veen; Aeolus Press, Inc.

8807 Liberty Road, Randallstown, Maryland 21133-0466, 1997

Internet Resources:

<http://www.aka.kite.org/>

<http://www.drachen.org/>

<http://www.nationalkitemonth.org/>

<http://www.worldkitemuseum.com/>

Or use a search engine to search for "Kite"