

Colorful Kite Tales



Organized by the
Smithsonian Institution Traveling
Exhibition Service.

Throughout time people have wanted to fly, and from this dream the kite was born. History does not reveal who built the first kite but ancient China is considered the place of origin.

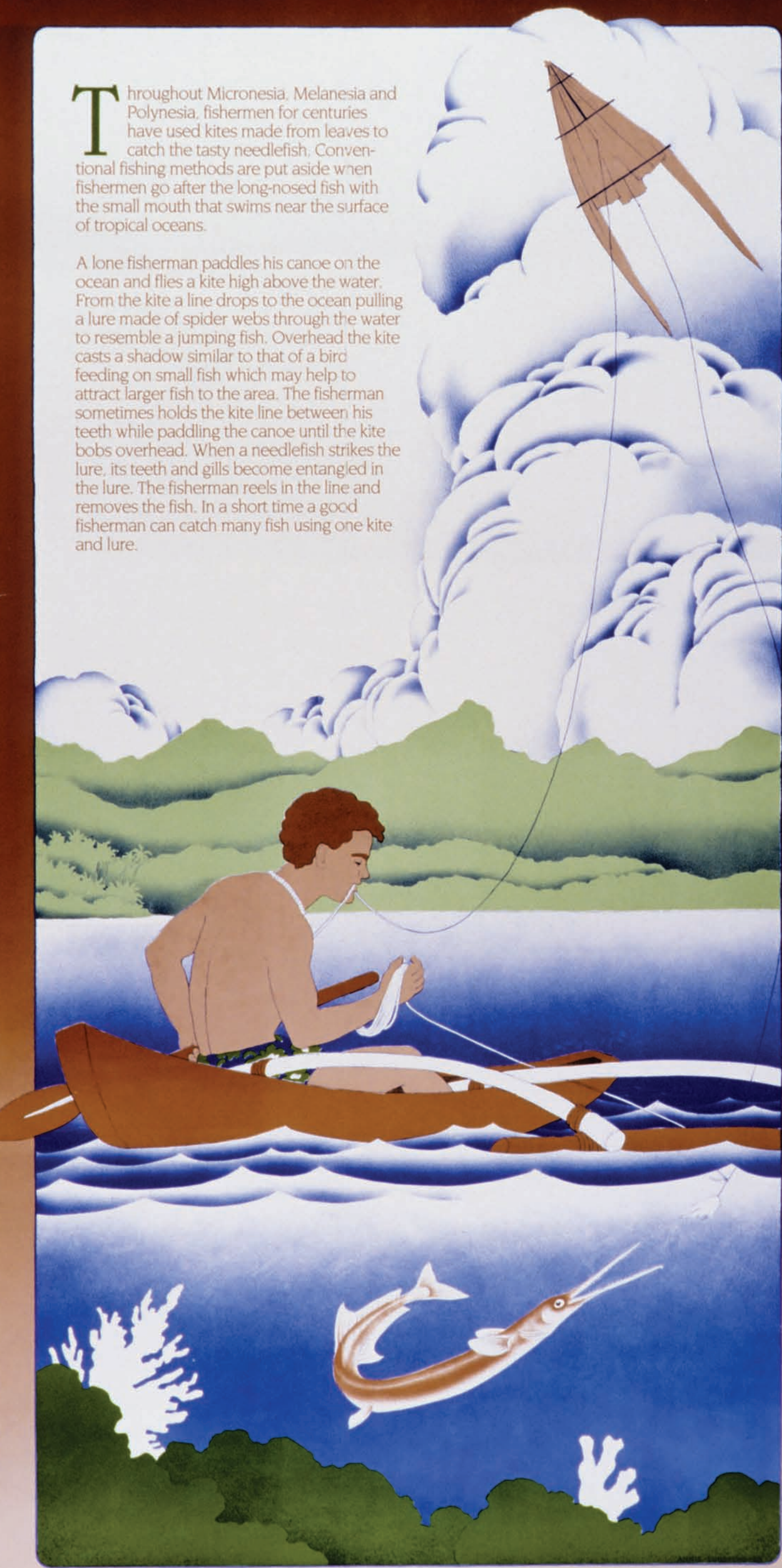
In one of the oldest kite legends, a kite helped to establish the Han Dynasty as one of the strongest in Chinese history. In 206 B.C. General Han Hsin and a small band of soldiers camped outside the walls of a powerful palace

controlled by the enemy. The problem facing Han Hsin was how to conquer the well-fortified palace with only a few soldiers. The general built a kite and sent it aloft until it flew over the palace walls. Carefully he marked the line and reeled in the kite. His soldiers dug a tunnel using the kite line to measure distance. General Han Hsin and his forces surprised the enemy by suddenly appearing within the palace walls. The battle was won and the kite victoriously entered recorded history.



Throughout Micronesia, Melanesia and Polynesia, fishermen for centuries have used kites made from leaves to catch the tasty needlefish. Conventional fishing methods are put aside when fishermen go after the long-nosed fish with the small mouth that swims near the surface of tropical oceans.

A lone fisherman paddles his canoe on the ocean and flies a kite high above the water. From the kite a line drops to the ocean pulling a lure made of spider webs through the water to resemble a jumping fish. Overhead the kite casts a shadow similar to that of a bird feeding on small fish which may help to attract larger fish to the area. The fisherman sometimes holds the kite line between his teeth while paddling the canoe until the kite bobs overhead. When a needlefish strikes the lure, its teeth and gills become entangled in the lure. The fisherman reels in the line and removes the fish. In a short time a good fisherman can catch many fish using one kite and lure.



大風祭 大風祭 大風祭

Through the centuries, no nation has been as enthusiastic about very large kites as Japan. The largest kites flown as a regular tradition are part of annual Children's Day festivities in the tiny village of Hoshubana. Two giant kites, *o-dakos*, are made each year. The strongest bamboo spars are saved from year to year to make the kite frames. About fifteen hundred small sheets of handmade paper are pasted together to cover the 48' x 36' frames. Two hundred bridle lines are attached to the face of each kite.

Great community effort is required to make and fly the *o-dakos*. Teams of fifty people fly the kites side by side. Calligraphy on the two kites completes one message selected by the official *o-dako* association. After all the weeks of preparation and group effort, the kites fly for about one hour at sunset. If there are truly things one must see to believe, the Hoshubana *o-dakos* are one of them.



Though kite fighting is a favorite sport in several Asian countries, the Indian fighter kite is recognized as the fastest, most responsive flier of all. In India, the Utran holiday is celebrated on January 14 from sunrise to sunset. People of all ages

crowd onto roofs and terraces to engage in kite fighting. The sky glitters with thousands of kites forming what are known as "kite clouds."

The diamond-shaped fighter kite is carefully crafted. Smooth, tapered bamboo sticks provide the delicate balance necessary for swift dives, twists and turns in flight. Contestants

coat the kite strings with a paste of powdered glass, cooked rice and tree gum. The object of the contest is to send an opponent's kite crashing to the ground by severing the string. As soon as a kite falls, the flier quickly rejoins the fray with another kite since hundreds of bouts occur simultaneously.





Schoolmaster George Pocock of England liked to play with words and ideas. In 1826 he patented a lightweight carriage pulled by kites. He called his invention the *char-volant*, combining the French for kite, *cerf-volant* with the word for carriage, *char*. The carriage transported four or five passengers at speeds up to twenty miles per hour when drawn by two large kites.

Three of Pocock's *char-volants* traveled more than one hundred miles across English countryside. During the adventure the *char-volants* overtook and passed the stagecoach that ran between Bristol and Marlborough, and they dispensed with etiquette when they passed the royal coach of the Duke of Gloucester. Farther along they greatly confused the tollkeeper who could not find in her instructions the fare for a kite-drawn carriage!

Although some scientists question the authenticity of his experiment, Benjamin Franklin is probably the most famous American kite flier. In 1752 he tried to prove that man-made electricity generated by friction and electricity from lightning have a similar discharge. Standing on dry ground inside a shed, Franklin flew a silk kite into an approaching storm over Philadelphia. He held the kite by a silk ribbon tied to the end of a long hemp string. A brass key was fastened where the ribbon joined the twine; a metal rod or wire was attached to the top of the kite. At first nothing happened. Then as lightning flashed in the distance and the rain wet the twine, loose filaments began to extend outward.

Franklin cautiously touched his knuckles to the key and felt an electrical shock. He then charged a Leyden jar with electricity that traveled down the kite line. A Leyden jar is a metal-coated glass jar with a conducting rod passing through an insulated lid; the jar stores electricity like a battery does. With the stored charge from the air, Franklin conducted experiments previously done with electricity generated by friction. His hypothesis was true!

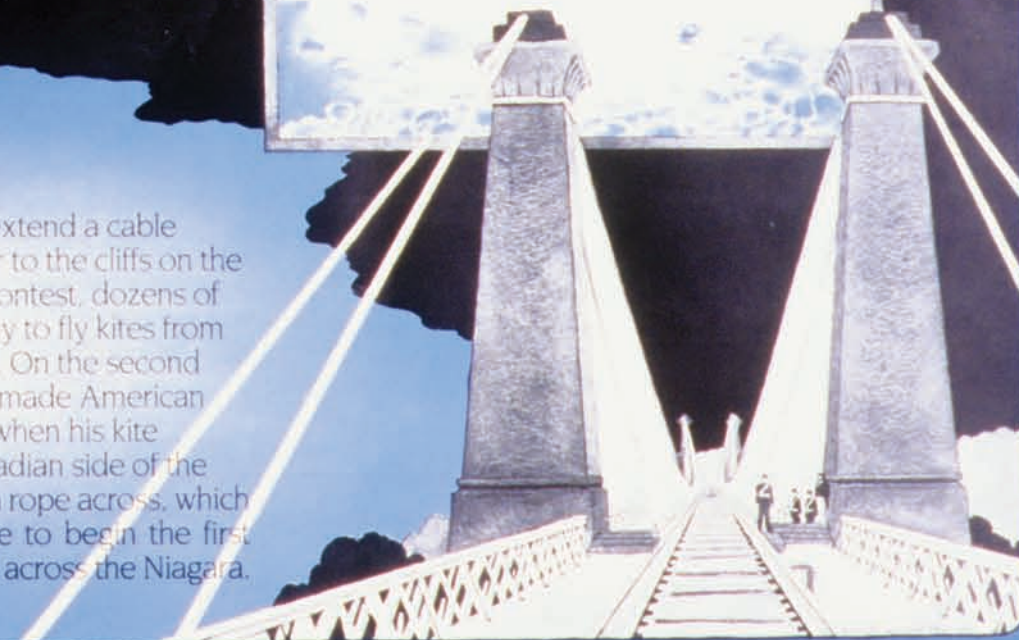
If a bolt of lightning had struck the kite, Franklin could have been killed. From his experiment we also learned a basic rule for kite flying: never fly a kite in a storm!

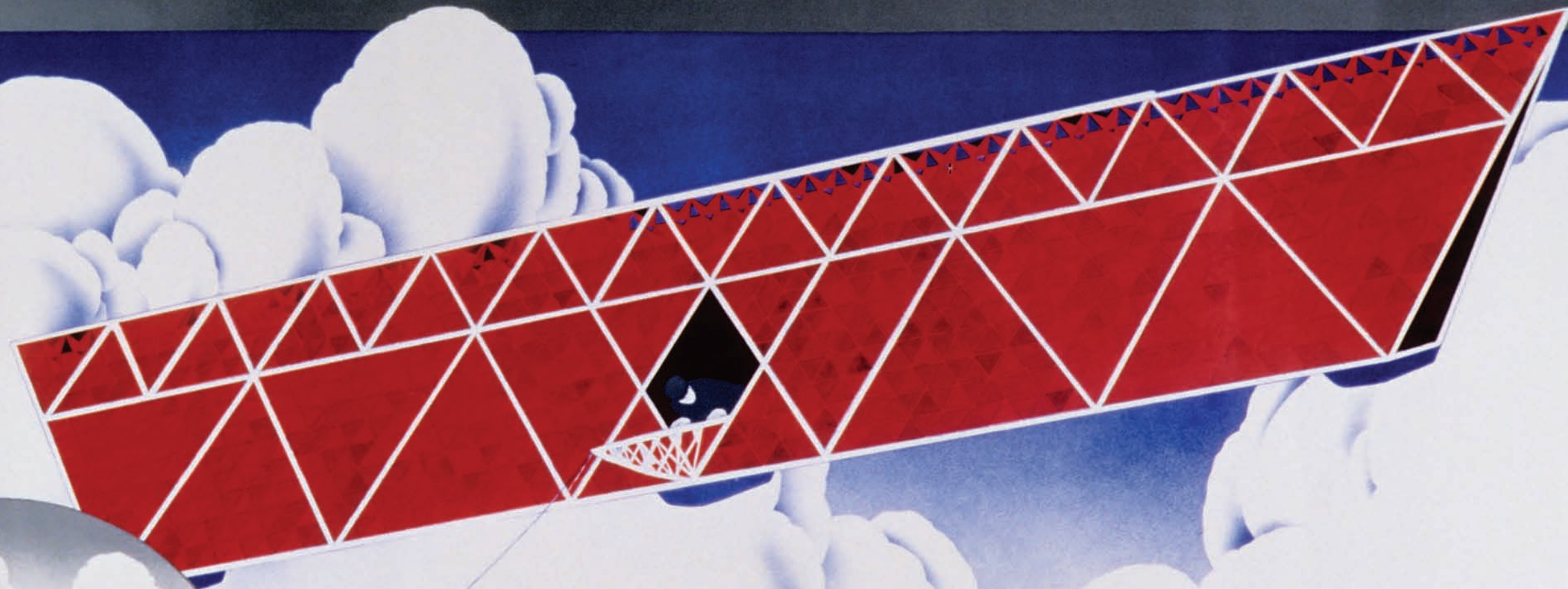




When a daring new bridge was to be built at Niagara Falls, a kite played an important role. In 1846 engineers from around the world were invited to submit plans to build a railroad bridge across the Niagara River at Whirlpool Rapids. At that time only a few small suspension bridges had been built that could support pedestrian and wagon traffic. The proposed bridge would have to bear the weight of an entire train.

The first challenge was to extend a cable across the tumultuous river to the cliffs on the other side. In a kite flying contest, dozens of children tried unsuccessfully to fly kites from New York State to Canada. On the second day, young Homan Walsh made American history and won the prize when his kite snagged a tree on the Canadian side of the gorge. His kite line pulled a rope across, which in turn pulled a wire cable to begin the first railroad suspension bridge across the Niagara.





Alexander Graham Bell had a diverse curiosity that led him to inventions in addition to the telephone and gramophone. As one of the pioneers of aviation, he made very unusual kites. He discovered that he could combine a number of tetrahedral cells to make a large compound kite. A tetrahedral cell is formed by joining

four triangles and covering two of the sides with fabric. Bell made many different multi-cellular kites and kept a battery of seamstresses busy sewing silken covers for the tetrahedral cells.

These large kites were very stable in flight and had an amazing ratio of strength to lightness. In 1907 Bell's *Cygnets* kite, made of 3,393 cells, flew for seven minutes, lofting a man 168 feet

into the air over Baddeck Bay in Nova Scotia. After the flight, Mabel Hubbard Bell assisted her husband in founding the Aerial Experiment Association whose purpose was "to get into the air." Eventually the group abandoned tetrahedral kites for more conventional airplane forms.



The kite's greatest contribution to technology has been its role in the development of the airplane. Wilbur and Orville Wright were avid kite fliers as children. In later years their interest in mechanical flight led them to experiment with kites and gliders.



In 1900 the Wright brothers moved their experiments from their home in Ohio to the windy treeless sand dunes near Kitty Hawk, North Carolina. There they flew gliders tethered on lines like kites, and they piloted gliders to study aerodynamic questions related to strength, lightness, three-axial

control and propulsion. On December 17, 1903, Wilbur and Orville Wright piloted the first heavier-than-air craft to accomplish powered, sustained and controlled flight. The kite evolved into the airplane of the twentieth century.

Since kites first took to the air, many countries have used them for a variety of military purposes. During World War II, Paul Garber, historian emeritus at the Smithsonian Institution, was commissioned by the U.S. Navy to teach aircraft gunners to identify enemy planes. Garber observed that the targets used to teach ship-to-air gunnery were not realistic. Also, when airplane-towed targets were not available, the gunners were instructed to shoot at clouds. Garber decided he could develop a better system.

Garber discovered that by flying a kite with two lines and a rudder, he could steer the kite through loops, dives, figure-eights and recoveries. The kite could perform acrobatics and dodge bullets just as a fighter plane could. Thousands of Garber's kites were made and distributed to ship and shore stations to train U.S. Navy and Army aircraft gunners. The target kites are now collector's items.

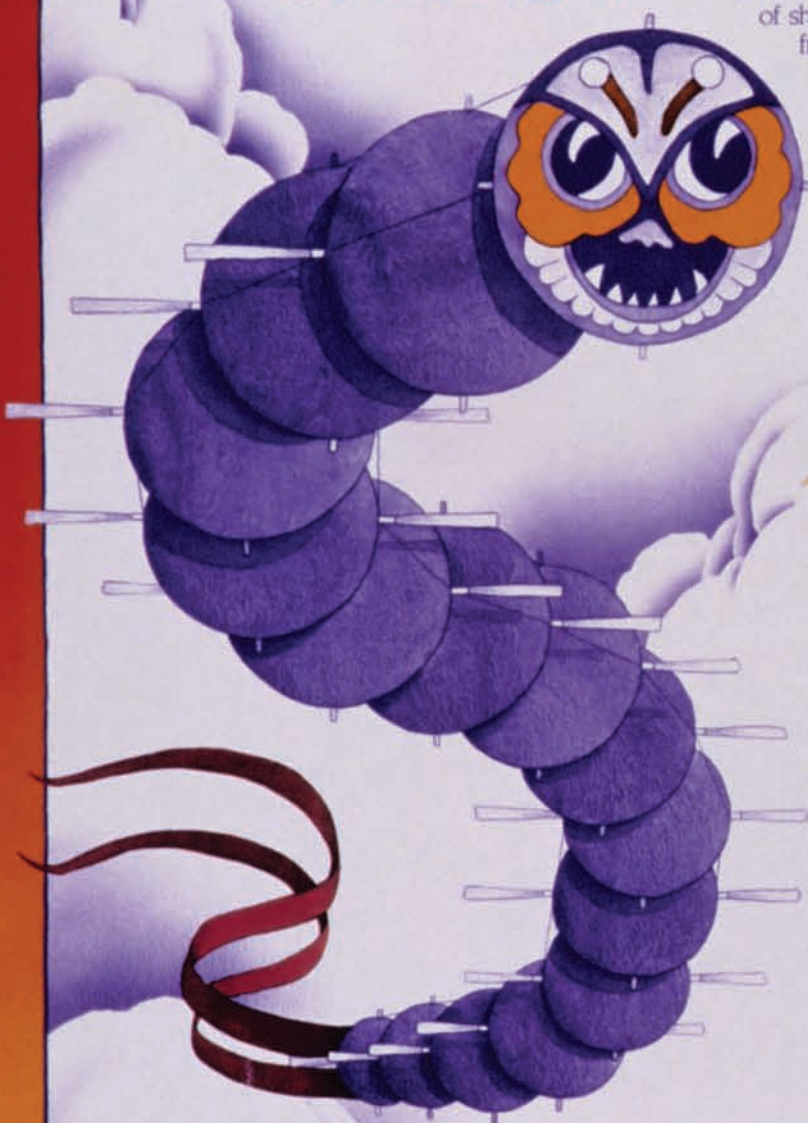


What is a Kite?

A kite is a heavier-than-air craft that depends on the wind to overcome gravity to fly. All kites have:

- one or more surfaces to be acted upon by the wind
- a bridle to hold the kite at an efficient angle into the wind
- a flying line to keep the kite from blowing away.

Kites can be large or small and of an unlimited variety of shapes. Early kites were made with wooden frames covered with leaves, silk or paper while many modern kites are made of space-age plastics or synthetic fabrics. Although kite classification is not rigidly defined, you may try to identify kites by these categories:



Flat Kites

The oldest form of kites is easily identified because the face of the kite is always flat. Although there are many variations among flat kites, most need tails for balance and stability.



Bowed Kites

Bowed kites may be similar in appearance to flat kites except for the dihedral angle formed by bending one or more of the frame sticks. Most bowed kites do not need tails because the bowed curve functions like the wings of a soaring bird to maintain balance. William Eddy patented the first American bowed kite in 1900. It was similar to bowed kites flown in Malaya.



Box Kites

Box or cellular kites are easy to identify because they are three-dimensional. Invented in 1893 by an Australian, Lawrence Hargrave, the box kite has a rigid frame that combines circular, triangular, rectangular or other polyhedral cells. Box kites, when properly balanced and constructed, have greater lift and stability than flat or bowed kites of equal area.





Parawings and Delta Kites

In 1948 Francis and Gertrude Rogallo patented the first flexible kite. Their designs are the basis for parawings and delta kites that look like birds in flight. Wind, rather than frame structure, stiffens these kites into shape. Parawings are made from a square shape and deltas are triangular.

Parafoil Kites

Developed in 1953 by Domina Jalbert, the parafoil is shaped by air pressing inside fabric cells. It looks like a flying air mattress. The inflated cells create a form similar to that of an airplane wing. A system of lines like those of a parachute connects the kite to its flying line. An enlarged modification of the parafoil kite is used by parachutists who can steer the parafoil to alight on a specific location.

Canopy Kites

There are two types of canopy kites: the circular parachute and the rectangular sled. These flexible kites fly when filled with air from underneath.

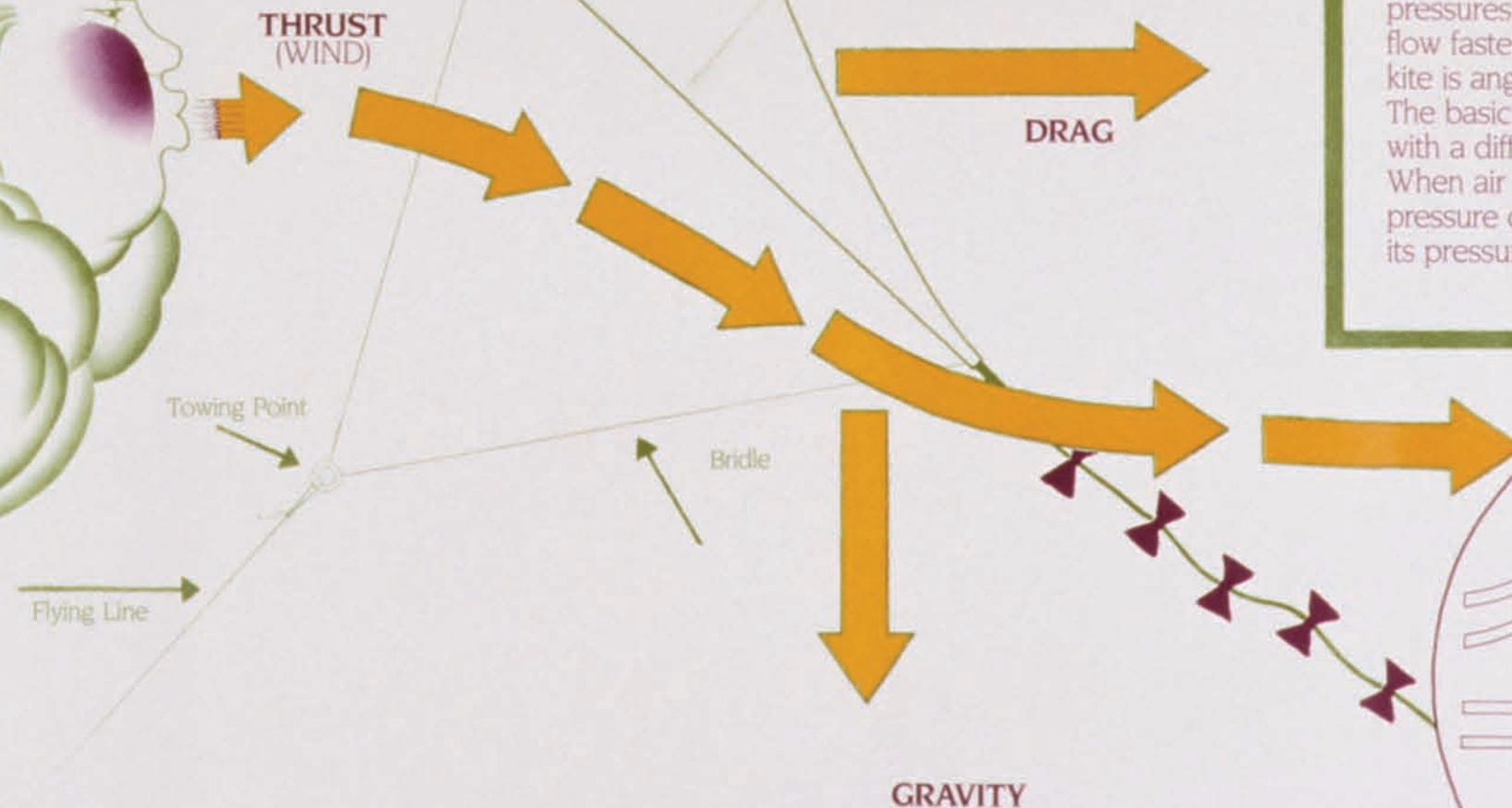
Parachutes are generally used to reduce the speed of falling objects. However, they can also be rigged with flying lines and flown as kites.

The sled is a very simple kite form. It has two or three longitudinal sticks but no horizontal spars. The wind forms its lateral shape. It was patented in 1956 by William Allison and popularized by Frank Scott.

Do not despair if you see a kite that does not fit into these categories. You may have spotted the latest kite invention.

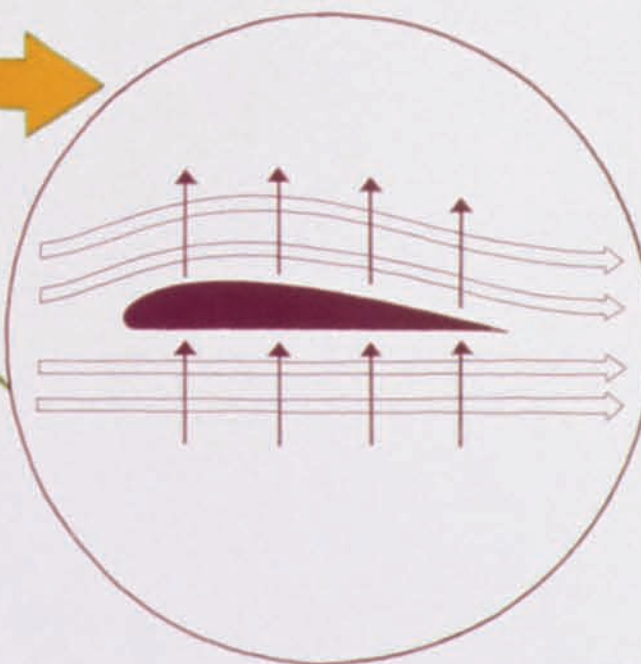
The Forces

Thrust and *lift* are the forces that enable a kite to defy gravity. Thrust is created by wind; the velocity of the wind affects how well a kite flies. Lift is produced when bridle and line hold a kite at an angle into the wind. The correct angle causes air to move more slowly across the face of the kite to push upward. At the same time air moves across the back of the kite more quickly to reduce pressure and create additional lift. *Drag* and *gravity* pull downward on a kite. Drag is determined by the weight of the kite, its design and the flying angle set by line and bridle. A kite must have more lift than drag to fly. However, some drag is necessary to give a kite stability.



How Kites Fly

All heavier-than-air objects must overcome gravity to fly. To stay aloft a kite must be supported by uplifting forces. Most kites make use of an airfoil, a shape or surface that deflects airflow to produce different air pressures. The shape of a kite causes air to flow faster over the top surface when the kite is angled into the wind. The basic principle of kite flying has to do with a difference in air pressure: When air moves quickly over a surface, its pressure decreases; when air moves slowly, its pressure increases.



KITES MAKE THE WORLD SEEM SMALLER AND THE SKY SEEM BIGGER.



Frances Beth Kent, Curator
Annie Lunsford, Churchmouse Graphics, Illustrator

Designed by Grafik Communications, Ltd.
Printed by Virginia Lithograph
Organized by the Smithsonian Institution Traveling Exhibition Service
Developed by SITEs with Education Outreach Funds from the Smithsonian
Institution Office of Public Service.