

Alexander Graham Bell's Historic Tetra-

plex Aeronautical Kite

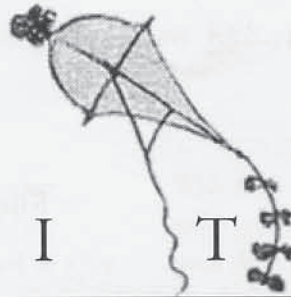
by Scott

totalized several

and it is well

to be

K I T E



THE DRACHEN FOUNDATION

J O U R N A L



Kites: Ars Poetica

*The innocents have come to make their cast
in the sky, fishing upside-down
and flying heraldic signs, Chinese,
or Euclidean with parallel squares
and dotted balsam lines
in vanishing tissue paper—
heart-shapes, shields,
or whatever their breath
can bend to a crossbow of twine
or cut in armorial fields*

*and make fly
like that other caster of lightning
paying out bamboo, watching the reel and the spinner
break electrical water,
touch a key in the creel
and blaze for the Philadelphian
with the shock of the trout's phosphorescence—*

*till, somewhere between the helicopter's star
and a vanishing point in the sea,
I feel myself go,
unreeling aerial rigging out of my side
and shedding a helix of thread,
an invisible top in the air,*

a spider climbing the light—

till the whole web bells, and goes tight—

and I am flown by the kite.

—Ben Bellitt, The Double Witness, 1977

The Drachen Foundation:
Kite Archives, Science & Culture

is a 501(c)(3) private non-profit foundation

STUDY CENTER LOCATION
(as of October 31, 1999)

1905 Queen Anne Avenue North
Seattle, WA 98109-2549

OFFICE HOURS
Monday–Friday 9am-5pm

VOLUNTEER OPPORTUNITIES
Call 206-282-4349

RESEARCH LIBRARY
By appointment only, 206-282-4349

THE FOUNDATION STORE
Items for sale by mail order.

EDITORIAL STAFF
Ali Fujino
Ben Ruhe
Scott Skinner
Elizabeth Snodgrass

GRAPHICS
Verna Yee

PRINTING
Color Printing Systems

Cover: Kite illustration taken from Goethe's *Ballads and Romances* by Eugen Neureuther, 1829.



Alexander Graham Bell's Historic Tetras

Huge 3-Dimensional Triangles Flew Efficiently, Safely

By Ben Ruhe

In the late 19th century, dozens of clever scientists around the world sensed that the invention of the airplane was approaching and that kites would be a key element on the road to discovery. Among them was Alexander Graham Bell, rich and famous since the age of 29, after inventing the telephone in 1876.

Having established an elaborate headquarters in Nova Scotia with full complement of assistants and laboratories, Bell began by exploring gliders, one of them rocket-propelled; propellers; hand-launched rotors; ornithoptors; and even a steam-powered wingpiece. He turned inevitably to kites.

His original notebook entry reveals the moment of inspired enlightenment on Monday, August 25, 1902. After having worked with rectangles extensively, he sketches a tetrahedron, or pyramid, which will from then on become his kite building block, and complains beside it, "Can't draw it." On the next page he outlines a kite built from tetrahedral cells linked together. He is on his way.

Bell set up an assembly line employing village women to create tetrahedrons of spruce wood with red silk sails sewn to two sides, then joined these small structures into kites of wildly different shapes. Because of the nature of the "tetras," the resulting kites were not only amazingly strong and light, but also stable in the air. Safety was from the first a major consideration with the humanitarian Bell.

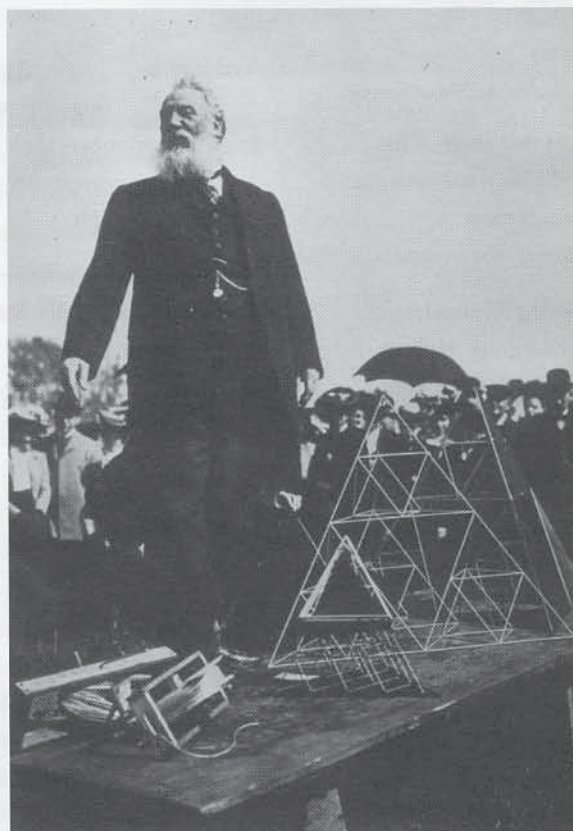
With more or less unlimited funds, Bell kept building his tinker toy kites bigger and bigger until they easily carried a man. Although the Wrights had already flown at Kitty Hawk, Bell aimed for safety and efficiency in his own experiments. His Frost King of 1905 lifted a man off the ground and his majestic Cygnet of 1907 constructed of some 3,400 cells flew perfectly well with a pilot aboard. All

that was required was a powerful engine and frozen lake as launch site and Bell would have a flyable, manned aircraft.

But the Cygnet was accidentally destroyed and Bell did not continue his development of tetrahedral kites, although he correctly predicted the space frame technology they represented would be used in the building of bridges and for roofs. (Buckminster Fuller later took the three-dimensional truss idea a step further with his geodesic domes.) Bell himself had a dramatic three-legged, 70-foot tetrahedral lookout tower constructed on the summit of the mountain he owned, demonstrating the structural virtues of linked triangles.

Bell next turned to winged aircraft with a small corps of

brilliant young engineers as aides, including Glenn Curtiss who was an expert at making engines. After detailed experimentation, he constructed several airplanes of which the Silver Dart was the star. Its flight of more than one kilometer in 1909 made it the first successful manned aircraft in the British Empire. (Samuel Franklin Cody flew the first airplane in Great Britain in 1908.) It had a tricycle landing gear and ailerons, both important aviation firsts.



Bell gives kite demonstration at Columbia, Va. in 1904.

Photo courtesy of The Bell National Historic Site

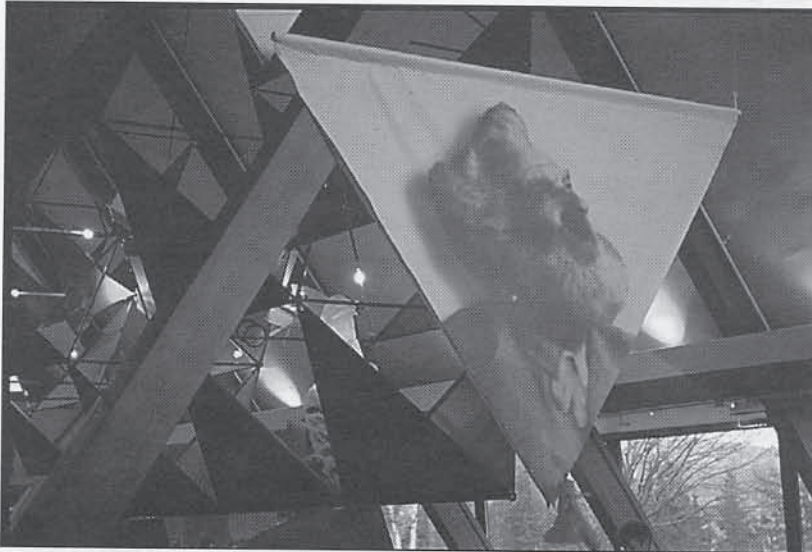


Photo: A. Fujino

Banner and kites at Bell Museum in Baddeck, Nova Scotia.

Bell's aviation contributions became just two more of his many achievements, but they were hardly on a par with the telephone, which has led directly to today's most revolutionary global scientific development, the internet.

The entire Bell saga is brilliantly told at the Alexander Graham Bell National Historic Site, a charming medium-sized museum in the village of Baddeck, on Cape Breton Island in Nova Scotia, where Bell set up his permanent summer home. The museum is part of the Canadian Heritage Parks system.

It documents not only his epochal invention of the telephone, but goes on to show the range of Bell's mind and his achievements over a very long and unusually fruitful career. Having battled patent infringements, Bell learned early on to document everything he did and the quantity of records and artifacts he produced is amazing. Few men can have so meticulously recorded their professional lives in the day-to-day detail Bell did.

After an introductory A-frame hall from which dramatically large, red tetrahedral kites hang as an echo of the architecture, museum displays show the profound, the mundane, even the comical. They range from an apparatus to show deaf the shape of sound, toy soldiers operated by jets of air, solar stills, and a device to provide drinking water from human breath. There are devices for the transmission and reception of underwater sound, a bicycle designed to

operate on the surface of the water, a vacuum jacket (a forerunner of the iron lung) invented after his infant son died from respiratory failure, and a metal detector developed to find the assassin's bullet deeply lodged in the body of President Garfield, from which he eventually died.

A 30-year study of sheep genetics undertaken to improve breeding stock shows a surprising facet of Bell's thinking, which was mainly concerned with machines.

There are devices for weighing letters, a toy wagon propelled by compressed air, unknown instruments the viewer is challenged to identify as to use, and a graphophone—a radical improvement on Edison's phonograph.

Bell's self-declared greatest invention, the photophone, a telephone without wires, is a strange marvel. This device reflected a beam of sunlight onto the flexible diaphragm of the photophone transmitter. It caused Bell to wax poetic: "I have heard a ray of sunlight laugh and cough and sing." Like most of his other inventions, Bell pretty much lost interest when it came to their exploitation, so the photophone was never developed by him. The closest modern equivalent to the concept is fiber optics.

As one of his last major inventions, Bell and his young engineers learned about the hydrofoil, conceived in Italy, and decided to develop the idea. Bell initially envisioned it as an aid to aircraft taking off from water. The final result of these experiments was the HD-4, a huge hull powered by two 350 horsepower engines and with a series of winglike foils descending into the water, upon which the boat planed when it got up speed. With this monster—the showpiece of the museum—Bell set the world's water speed record of 70 mph in 1919. Again he left it to others to commercially exploit a type of boat now used as a high speed ferry on inland waterways the world over.

Born in Scotland, Bell had come with his family to Canada as a young man. Relocating to Boston, Bell made his name

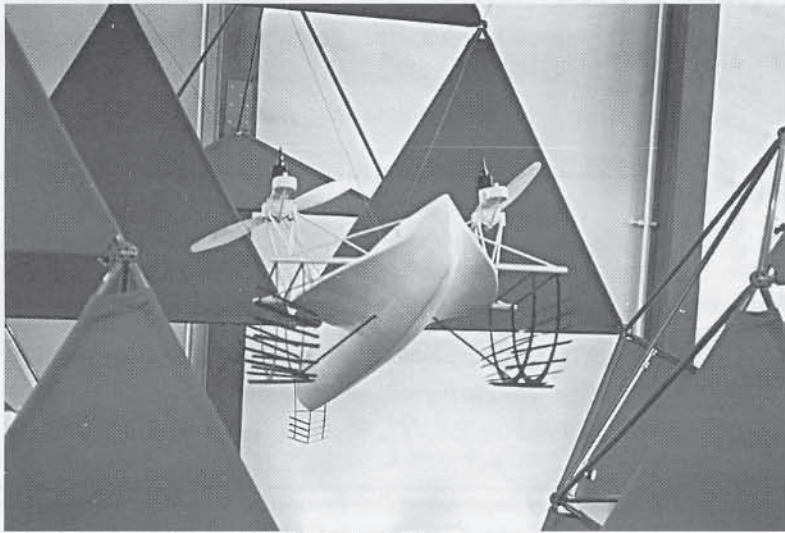


Photo: B. Ruhle

Model of Bell's 70 mph HD-4 hydrofoil.

originally as a teacher of the deaf, an interest derived from his grandfather and father. It was knowledge he gained through his early experiments with sound that led Bell to invent the telephone. It also brought him a student, Mabel Hubbard, deaf since the age of 5 from scarlet fever, who became his devoted wife and astute life-long business manager.

After inventing the telephone, Bell was one of the most famous men in the world and able to live as he liked. On summer holiday, Bell happened upon Cape Breton Island in Nova Scotia and was delighted with its wild beauty and invigorating climate. He soon bought an entire peninsula across the water from the village of Baddeck which he named Beinn Bhreagh ("beautiful mountain" in Scottish Gaelic, pronounced "Ben Vrree-ah") and on which he built a 37-room house and the many laboratories which his range of interests required. Bell reigned there as a patriarch, noted not only for his scientific achievements but also his humanitarian qualities. A large, handsome man with great presence, he easily dominated any room he entered.

Gardner Greene Hubbard, Mabel Bell's father, was a founding member of the

National Geographic Society in Washington, D.C., and its first president. Alexander Graham Bell became the society's second president and is credited with instituting the wide use of photographs in the society's soon to be famous magazine. One of Bell's two daughters, Elsie, married Gilbert Grosvenor, a teacher, who became the society's first full-time employee and editor of the magazine.

Bell died at age 75 in 1922 and was buried atop Beinn Bhreagh. This final resting place was chosen by Bell himself, and is shared by his wife, who followed him in death just five months later. ♦

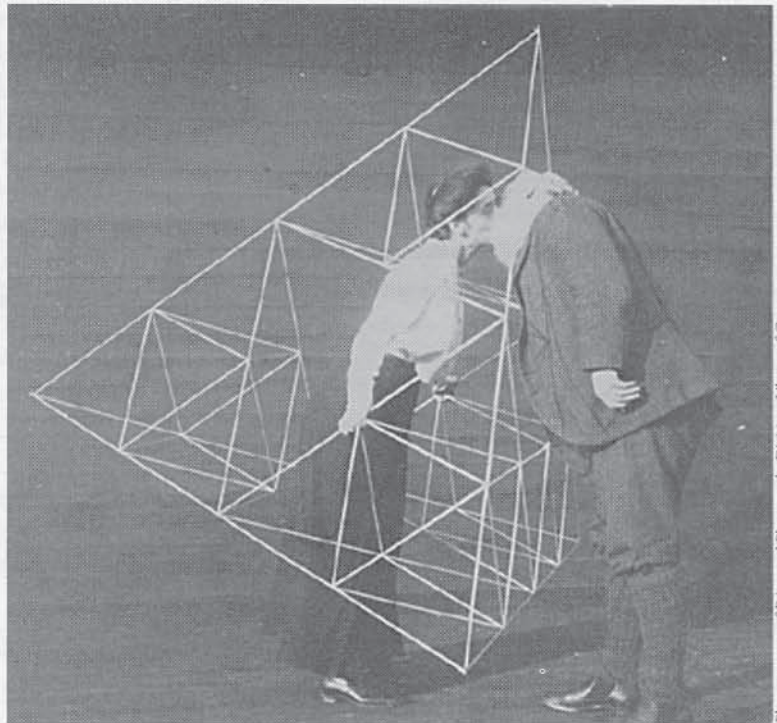


Photo courtesy of Prints and Photographs Division, Library of Congress

Mabel and Alexander Graham Bell share a kiss.

Spreading the Word on Bell's Genius

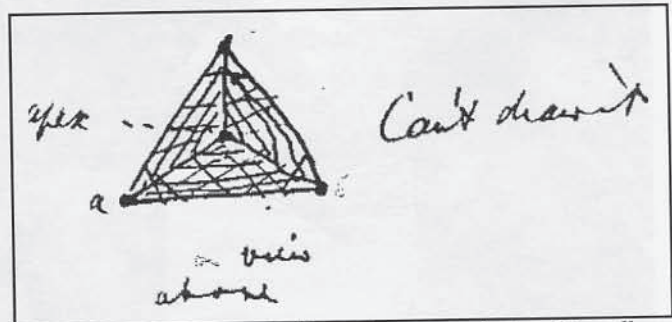
Taking advantage of the electronic communications age, the Alexander Graham Bell Institute at University College of Cape Breton, in Sydney, Nova Scotia, several years ago decided to make available on a worldwide basis the vast trove of Bell material on file at the Bell Museum in nearby Baddeck. Baddeck is where Bell had his estate and laboratories.

Ron MacNeil, an engineering instructor, received the assignment and promptly set up a project to index 20,000 of the Bell papers, using students to scan the pages and create an index to be placed on-line.

The project had three goals.

- To "mine for nuggets," in MacNeil's words. That is, were there unexploited ideas in the papers? By putting the work out globally on the world wide web, it would insure a broader vetting of Bell's genius than has been possible heretofore.
- To spread the word on Bell's own technique for generating inventions—mission-oriented research. In the Nova Scotia context, MacNeil promoted problem solving for local industries aided by UCCB personnel.
- To encourage a human response to problems, as exemplified by Bell himself. When Bell had an infant son die from a respiratory failure, his response was to invent a vacuum breathing chamber, a kind of early iron lung. When President James Garfield was shot by an assassin, Bell responded by inventing a surface device for locating the bullet, then a probe to do the same thing. Despite these successful efforts, Garfield died because the slug was too deeply imbedded in his body to be removed.

MacNeil's group, which ultimately involved some 25 people, also put more than 1,200 Bell photographs



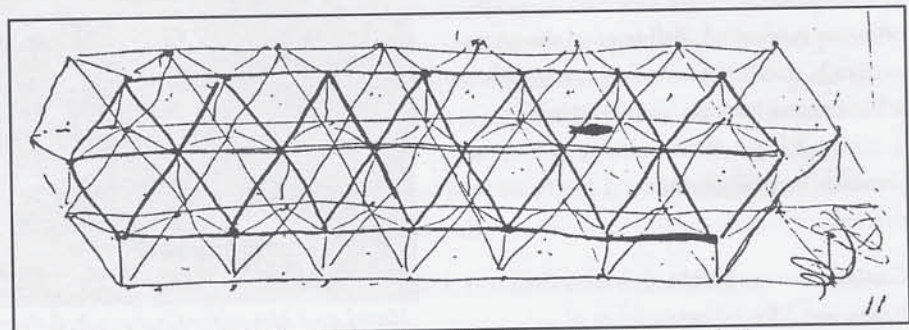
Moment of inspiration: Bell conceives a tetrahedron kite cell, and comments: "Can't draw it." August 25, 1902.

on-line, the photos to be available for viewing but not commercial purposes. Since many were made specifically for scientific purposes—a series of them in some cases showing the same object from different angles—these images constitute a valuable resource. Bell photos tend to be first-class because, among his myriad talents, the inventor was a professional photographer.

After four years of work, the institute was able to create a CD Rom with the index, available at the museum for \$40 Canadian plus postage. It also created a web site: bell.uccb.ns.ca.

The site is complemented by one at the Library of Congress in Washington, D.C., where the Bell papers are also available. The library's site can be accessed as follows: <http://memory.loc.gov/ammen/bellhtml/bellhome.html>.

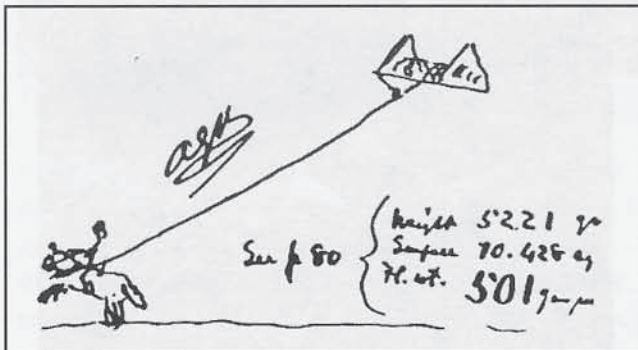
Links to other Bell material are available by accessing the above sites.



Soon he is linking the cells to make a large kite. From his "Homebooks."

"The project was incredibly fulfilling for me and for the students," says MacNeil. "We all had a sense of discovery. The material was intellectually fascinating. It broadened our view of what one person is capable of doing."

As to finding "nuggets," MacNeil says nothing came up immediately. But he imagines some genius, maybe even hundreds of years from now, picking up on a Bell insight and making an important invention from it. The problem solving aspect worked out immediately. As an example, MacNeil cites the local law firm whose computer system had so many bugs the secretaries were frightened of even attempting to send e-mail messages. A UCCB student had



Bell envisions a horse giving a kite a tow.

the whole thing straightened out in weeks. This and other local initiatives by the university also successfully addressed the linked third goal of the institute, human response to an immediate problem.

There remains a vast amount of Bell material yet to be dealt with electronically, some 40,000 pages in all. Some is typed, some is not. Included are his valuable but hard-to-decipher handwritten home and laboratory notebooks with their scientific jargon, large number of scribbled illustrations, and important marginal notes.

Eventually also, some of the valuable unpublished material by family members, associates and scholars, such as memoirs, speeches, interviews, oral histories, theses, dissertations, may be placed on-line.

MacNeil, in short, feels the world can hardly get enough of Bell. As he phrases it, "Bell's multitude of inventive ideas may well trigger wonderful inventions to come. Who knows what seeds his genius will plant in the future?" ♦

Guatemala Funeral Kites

The ritual use of kites in various cultures, particularly those of Asia, has long been known. Kite enthusiasts may have overlooked this one.

In a report (The New Yorker magazine, March 15, 1999) on the funeral of Bishop Juan Gerardi Conedera, of Guatemala, a prominent human-rights activist murdered by an unknown assailant, reporter Francisco Goldman tells how while examining the death site in the bishop's parish-house garage in Guatemala City, he was "interrupted by the arrival of a group of girls from the Sacred Family School. The students came in double file, singing hymns, first-graders first, high-schoolers in the rear.

"They carried candles and colorful homemade paper kites, which are a traditional symbol of communion with the dead in Guatemala. The kites had photographs cut out of newspapers and headlines about Bishop Gerardi and the REMHI report (a public indictment of right-wing war crimes the bishop had commissioned) glued to them, and hand-printed messages.

"The girls laid their kites down in a pile near the candles and a vase of flowers that had been placed along the garage wall, and then they went into the church to pray. It was a very moving scene."

Goldman goes on to say: "Several of the kites in the pile next to the flowers were decorated with photographs of the bishop's funeral mass. Twenty thousand spectators had watched a procession of priests and nuns follow the coffin around the plaza in front of the Metropolitan Cathedral. This is the first generation of Guatemalan children to be taught that it is possible to speak out against state murder." With, in this case, benign kites as the surprising vehicle. ♦

Building a Tetrahedral Kite

By Scott Skinner

Because the Alexander Graham Bell tetrahedral kite is completely modular, you can change the shape every time you put one together. That's what makes it such a fascinating kite.

Six years ago I talked with two Germans, Til Krapp and the late Peter Malinski, who had co-designed high-tech plastic connectors for tetras. They wouldn't sell any but they agreed to trade for them and I had to sew 100 two-foot sails to swap for enough of the connectors to make my own large tetra. By the time I finished making all those ripstop sails, I was pretty sick of the whole thing and didn't get around to making my own tetrahedral kite until last winter. The winter is really bad in Monument, Colorado, where I live, and it provides ample motivation to stay indoors and build kites.

Seeing Til Krapp fly his own tetra again last year humbled me into thinking I should finish my own, and a projected seminar on Bell at Fanø, Denmark, this year added a further incentive. Beyond that, every serious kitemaker sooner or later has to face up to the challenges posed by Bell, as he does to Cody, certainly, and to Jalbert and Rogallo. He has to see for himself exactly what their achievements were by building reproductions of their innovative kites. With the year 2000 months away, another factor in my decision to build was the increased worldwide interest in the 1900 millenium, when Bell himself was working on aeronautical projects.

Through Til and Peter, I had enough connectors to build a five-by-five-by-five unit kite, using 35 two-foot high sails; this makes a kite of more than 100 square feet, or in one configuration, one that's about 14 feet wide by 7 feet tall. Big as it is, it's a dwarf compared to the 3,400-cell kite Bell once built up in Nova Scotia when he was trying to invent a manned, powered aircraft.

I started with the color red—Bell's favorite for its beauty and visibility—then branched out to black, with shades of orange and yellow. It took me a month to sew the ripstop sails I needed. One innovative feature of the connectors is the line

of three toggles to attach the sails to. The sails, with loops sewn into each corner, had to be quite precise to avoid sag and flutter, with scalloped edges to ensure tautness. The spars are cut from aluminum arrow shafts. What with ripstop sails, aluminum spars and plastic connectors, a modern tetra is much lighter than a Bell original, which typically used silk sails, spruce wood spars and metal fittings.



Scott Skinner assembles his tetrahedral kite.

Instead of Bell's triangles, Krapp and Malinski refined and improved the design by building internal tetra frames—actually building a honeycomb-like structure based upon hexagons. This refinement omits two spars, thus saving at least 30 percent in weight and also permitting the kite to be taken down completely so it fits in a rather small bag. What I sacrificed was just a bit of structural strength, although any tetrahedral is by its nature immensely strong. Just to explain further, Bell made each of his cells with an external

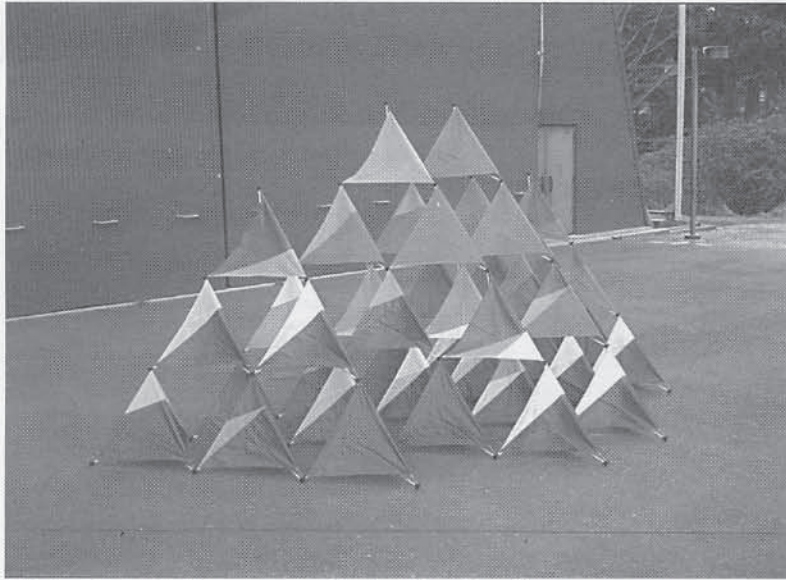


Photo: A. Fujino

The intricate, flashy tetra assembled and ready to fly.

structure—six edges, one stick along each edge. Til and Peter made an internal structure—four points of the triangular pyramid supported by four spars from an internal structural piece. This actually reduces the over-all weight by more than just the two spars per cell, since as internal spars, none of them are as long as an external edge (or spar) in the Bell original. Got all that?

Before I assembled the kite for the first time, I drew what I thought it would look like, but the two-dimensional view didn't work out when I created a three-dimensional kite and I had to make adjustments. The new shape was surprisingly—and gratifyingly—just as exciting as the one I had visualized.

The kite flew perfectly the first time. Bell did solve the stability problem, something I'm not used to. Artistically, it is lovely to see a tetra flying. As it moves in the sky, one sees the sun shining through the panels, or the complex frame may be highlighted. Viewers' perspective completely changes the nature of the kite. Esthetically and historically, I felt the kite was a personal triumph, particularly since I normally only build two-dimensional kites.

Building the tetrahedral gave me increased respect for Bell. His intellectual leap from the rectangular shape of the Hargrave box kite to a triangular shape was a stroke of genius. And then the energy and expertise he showed in developing his idea was most impressive.

The Bell kite is strong, stable, efficient and easy to fly. As a man-carrier it was completely safe, unlike many of the early gliders and airplanes. Safety was always a major concern to Bell.

What I really like about my tetrahedral is its personality. You can put it together in dozens of different ways. If you were not happy with its shape the day before, today you can assemble it differently. It's an amazing structure. ♦

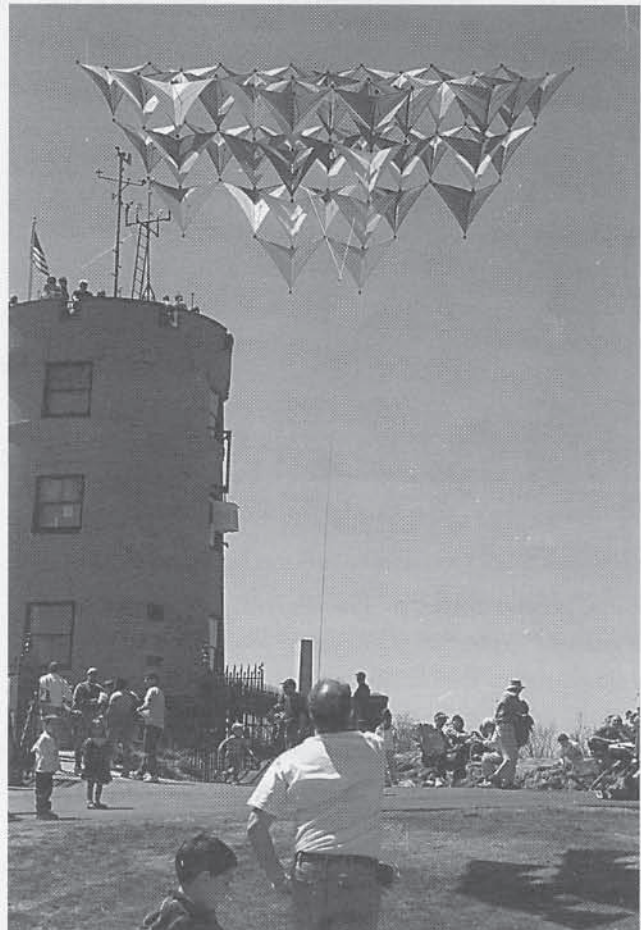


Photo: B. Rubbe

Steady as a rock in the air, before a thermal briefly intervenes. In the background is the Blue Hill Observatory near Boston.

Showing the Way to Organize Kite Festivals

By David Wagner

The inimitable Shakib Gunn is a fixture in the kite community. His famous kitefliers passports are found throughout the world, and the large festivals he organized in Singapore in the 1980s were the beginning of the international kite scene in Southeast Asia. In a series of talks with Shaikib in Singapore, where we both live, he explained his philosophy toward kites, festivals and life in general.

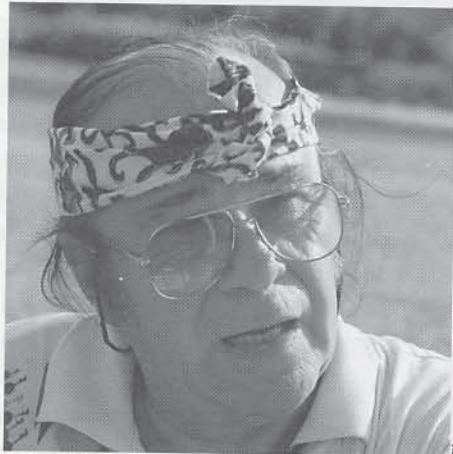
Born in Surrey, England, in 1934, Shakhib's first experience with kites was with a Gibson Girl boxkite. He learned to assemble and fly the kite in the garden by following instructions printed on the sail.

By 1953 he was living in Singapore and flying kites from a rooftop over Eu Tong Sen mansion in the middle of the city. These were kites of his own design made of bamboo and paper. At that time, everyone flew kites in the surrounding villages, or kampongs, the older men being acknowledged as the experts.

In the mid '70s, Shakib began working with much larger kites in plastic and aluminum, starting his first experiments with lifting people. Years later he was lifting children with very large parafoils.

This period also marked his first efforts in kite promotion. He arranged to produce ten thousand kites in a promotion for Edgel canned food in Australia. He got the members of a kampong building kits and soon thousands of one-meter Eddy kites with the sponsor's logo were hanging from trees and power lines throughout the eastern states of Australia. The sponsor eventually had to ask Shakib to stop his enthusiastic production.

Shakib was the first person in Southeast Asia to organize kite flying events that combined both competition and spectacle. These early international festivals in Singapore were the



The old master: Shakib Gunn.

progenitors of many other festivals in the region, including Malaysia, Indonesia and Thailand. His working with the Singapore Tourist Promotion Board, Western kitefliers and organizations, and local flying groups pioneered an approach that has since been successfully followed by a number of other groups and organizations.

This approach took some time to develop for Shakib and was an interesting allegory to his personal development as well.

In the early '80s, he was asked by the Singapore Tourist Promotion Board to represent Singapore kiteflying at the Garden Festival in Liverpool, England. Sent to a tailor to be fitted for a suit for this trip, he was told he was the last to come in. There were 16 other Singaporean performers, including lion dancers, stilt walkers and flag jumpers. He found himself driving the well-dressed group into Liverpool from London, because the driver could not be found, fending off requests to stop at Chinese restaurants.

Giving four performances a day in a stadium with little wind, Shakib quickly learned to explore other aspects of kites. On this and many subsequent trips, he began to incorporate features used by his fellow performers, including music, dance, drama and visual art. He was forming a personal view of the experience of kites that was reinforced by a trip to Bali. Shakib was one of the first Western kite observers of the impressive experience formed around kites there. He discovered the power of music, commentary and dance as an important adjunct to the spectacle and movement of kiteflying.

Later, in Thailand, he encouraged Malaysian wau fliers to dance with their kites to traditional music on a field where there was no wind. He began planning large festivals to put his ideas into the air.

During the next six years, Shakib was asked by Singapore tourism authorities to organize a series of international kite festivals in that country. This took a tremendous amount of planning and coordination with local groups. Fields had to be prepared from nothing—even grass, trees and drains had to be installed. And they had to be large enough to accommodate massive kites; the then world's largest came from Holland in 1983.

Such was local response that a sports stadium was used for design judging. This took place in a developing country with an extremely regimented society geared toward economic development. Nevertheless, the festivals were successful and well attended locally and internationally. The Singapore Tourism Board and sponsors were pleased and budgets grew each year.

Shakib developed his event coordination and commentary skills into a total approach, unique to the combination of indigenous kites and audience, and international participation. He brought computers and a new system of judging for the wau and oriental kites. His extensive knowledge of both Asian and Western kites and command of the Malay language, with an eclectic offering of music and droll humor on the sound system, made the commentating an important part of the entire presentation. Mozart interspersed with didgeridoo, Laotian court music with rock, along with inventive sound skits during low wind, put Shakib in demand with other festivals. He was soon handling the commentating, event planning and music for kite festivals throughout Southeast Asia, New Zealand and Australia.

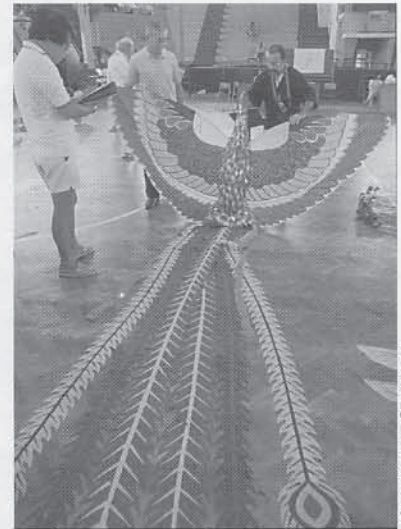
Shakib established a system of planning and judging that was key to the festival success and that he continues to pass on to other organizers in the region. Thorough post-event analysis and stored information were carefully accumulated and evaluated. He points out that the organizer clearly determines the quality of the event. He stresses that firm objectives for the festival and its sponsors must be established. Knowledgeable kite makers are better than professional speakers for commentary; the ground action is as important as that in the sky. The presentation must be multi-dimensional. And Shakib's suggestion: every kite team should include a musician.

By the 1990s Shakib had less time to put into these large events and took on more consulting work with other

festivals. In his professional work, he continues to design both corporate graphics and large kinetic sculptures for buildings. He also began to work with smaller scale events, finding he could work effectively with fewer resources. He recalls an event in Tasmania when a single white fighter kite high in the sky was flown in coordination with voice and music and captivated a crowd of thousands.

He also got tired of traveling with more than 200 pounds of kite and sound gear. He is more likely to show up at kite events with his tools for making magic, which he enjoys performing for children. Although he still does love to lift village kids in the air with his enormous parafoil, he has come to prefer the indigenous materials for his current kitemaking, including bamboo and paper. His favorite kite is still the Malaysian wau bulan. He continues to play an active role in the Singapore Kite Association, which he co-founded in 1982.

Shakib may have finally reached the opposite end of the kite event spectrum with his latest events. He has been working with the incredibly small kites made by Peter Stauffer of Australia, flown on strands of his daughter's long hair. He is working on his first "miniature kite festival," which is set



Judging a kite at the 1985 Singapore International Kite Festival.

up on a tabletop and involves considerably less management and stress than his other more spectacular productions. It is easy to transport to the most comfortable locations, and the wind is always great, because it's supplied by a fan. He and his fellow organizers can enjoy the action from the comfort of their chairs, sipping gong fu cha (Chinese tea in miniature cups) and discussing matters of pith and substance.

Shakib Gunn feels kites are a part of the pattern, the omi, the middle path, of life. When asked about his plans for the future, he summed up with a koan: "My parking coupon expires in 45 minutes." ♦

Photo courtesy of D. Wagner

Wilbur and Orville Wright Fly a Kite

The Crucial Early Experiments of 1899

By Tom D. Crouch

The names of the places where Wilbur and Orville Wright made history are familiar to people everywhere who know and cherish the story of the invention of the airplane. The brothers tested their first kite/glider at Kitty Hawk, North Carolina in 1900, then shifted their seasonal camp four miles south to the Kill Devil Hills, where they flew from 1901 to 1903. They perfected their invention at Huffman Prairie, eight miles east of Dayton, in 1904 and 1905, and opened their flying field there in 1910. Wilbur astonished the world with his first public flights from the race course at Hunaudieres, France, in the high summer of 1908, while Orville demonstrated the airplane to the Army trials at Ft. Myer, Virginia in 1908 and 1909. Wilbur taught the first three U.S. Army airmen to fly in 1909 at College Park, Maryland. And there are other familiar places, from Gardiner's Island in New York harbor, where Wilbur took off for his flight around the Statue of Liberty in 1909, to a field near Montgomery, Alabama, where Orville made the first night flights, and began to instruct the young men who would fly as members of the Wright exhibition team.

Ironically, the precise spot where Wilbur tested their first experimental aircraft is unknown to all but the most

knowledgeable students of Wright lore. Many of the circumstances surrounding that first Wright flight test remain hazy. The date of the test, even the month, is uncertain. A century after the Wright brothers began their period of active experimentation with the flights of their wing-warping kite of 1899, the time has come to clarify the record in so far as that is possible. How had it begun?



Wilbur (left) and Orville Wright at home in Dayton, Ohio. Orville's modish dress contrasts with his brother's austere suit and high button shoes.

“My brother and I became interested in the problem of flight in 1899,” Wilbur Wright explained in February 1912. When queried about the precise date when they had “conceived the invention ... [covered in their patent],” Wilbur replied that: “The general idea, which forms the basis of the patent, was conceived about the latter part of June 1899.” His brother Orville differed only slightly, noting that the moment of insight had occurred “in the early part of June 1899.” Clearly, the late spring and early summer of 1899, when the Wright brothers took their first active steps toward the invention of the airplane, was a critical moment in their story. The spark of interest had begun to smolder three years before, however, when, as Wilbur noted, “...the death

of Lilienthal ... brought the subject to our attention and led us to make some inquiry for books relating to flight.”

“But the only serious books we found were by Prof. [Etienne Jules] Marey and these related to the

Photo courtesy of National Air and Space Museum, Smithsonian Institution

mechanism of bird-flight rather than human flight. As our interest at that time was mere curiosity as to what had been done, we did not pursue the subject further when we failed to find books relating to human flight.”¹

Orville Wright recalled that there had been a great deal more to it than that. “From the date of the death of Lilienthal in 1896,” he remarked, “we were so interested [in aeronautics] that we discussed matters in this line almost daily.”²

Their interest, Orville noted, was “...again aroused [in 1899] as a result of the reading of a book on ornithology.”³ Wilbur explained that it was “...while reading a book on ornithology that we became interested in studying the appearance and habits of birds, but it soon occurred to us that the really interesting thing about birds was their power of flight.”⁴

“Our own growing belief that men might nevertheless learn to fly was based on the idea that while thousands of creatures of the most dissimilar bodily structures, such as insects, fishes, reptiles, birds and mammals, were every day flying through the air at pleasure, it was reasonable to suppose that men might also fly. Of course, there might be, and doubtless would be, many serious difficulties to be overcome, but we thought that by learning what these difficulties were and finding methods of overcoming them, the problems of human flight might be solved, and we thought that probably the cheapest and best way to take up the subject would be to acquaint ourselves with the troubles which others had met in attempting to solve the problem.”

The first direct evidence of their serious interest in aeronautics came on May 30, 1899, when Wilbur Wright wrote what is perhaps the most famous letter ever received by the Smithsonian Institution. “I am an enthusiast,” he explained, “but not a crank in the sense that I have some pet theories as to the proper construction of a flying machine.” Noting that he was “...about to begin a systematic study of the subject in preparation for practical work to which I expect to devote what time I can spare from my regular business,” he requested “such papers as the

Smithsonian Institution has published on this subject, and if possible a list of other works in print in the English language.”⁵

Assistant Secretary of the Smithsonian Richard Rathbun replied just three days later. It was a testament both to the speed of the U.S. Postal Service in the closing years of the old century, and to the Smithsonian’s emphasis on rapid response to public inquiries, even by officials at the highest levels of the institution. Moreover, the response was full and satisfying. Rathbun provided the Wrights with free copies of four Smithsonian reprints: translated extracts from Louis Mouillard’s *Empire of the Air*; Otto Lilienthal, *The Problem of Flying and Practical Experiments in Soaring*; Samuel P. Langley, *The Story of Experiments in Mechanical Flight*; and E.C. Huffaker, *On Soaring Flight*. He also included a list of recommended publications on the subject, including S.P. Langley, *Experiments in Aerodynamics*; Octave Chanute’s *Progress in Flying Machines*, and the 1895, 1896, and 1897 issues of *The Aeronautical Annual*.

Wilbur immediately replied, thanking Rathbun for the pamphlets and enclosing a dollar for the Langley volume. An entry for the second week in June, 1899 in the ledger in which the Wrights kept a meticulous account of the receipts and expenditures of the bicycle shop includes an expenditure of \$5.50 “for books on flying.” In addition to ordering the Langley book, the brothers must have taken Rathbun’s advice and purchased the Chanute volume and the available issues of the *Aeronautical Annual*, as well.⁶

The spring of 1899 had been a busy time for the residents of No. 7 Hawthorne Street, Dayton, Ohio. The pater familias, 71-year-old Bishop Milton Wright, as usual, spent a great deal of time on the road, visiting far flung congregations, calling on relatives in Ohio and Indiana, and attending church conferences. When at home, he made periodic visits to the dentist who was fitting him with a “vulcanized” upper plate; supervised the workmen who were refurbishing the kitchen and the “east room” of the house; and handled family business, including the sale of timber on an Indiana farm.

And there was always time for his grandchildren, especially his son Lorin’s eldest boy and girl, Milton and Ivonette, who lived just around the corner on Horace Street. At young Milton’s request, he took them on walks to their

Wilbur and Orville Wright Fly a Kite

grandmother's grave in lovely Woodland Cemetery. On May 10, 1899, the three of them cheered from the upper story windows of a church office as Col. William F. "Buffalo Bill" Cody paraded his Wild West Show through the streets of Dayton. Grandfather and grandchildren alike were looking forward to fireworks on the Fourth of July.

It was a busy spring for 24-year-old Katharine Wright, as well. Katie, as her father and friends knew her, was the only college graduate in the family, Oberlin, Class of '98. Recently "elected" a teacher of English and Latin on the regular faculty of Central High School, she spent the spring and summer preparing for and enjoying her high school reunion, and entertaining visiting college friends. She and a group of friends hosted a supper for a visiting Oberlin professor on May 20. A college chum, Margaret "Mag" Goodwin, arrived for a visit after June 8. The two of them took a train for Oberlin, and their first college reunion, on June 15.

Orville would later recall that serious discussions of aeronautical issues were well under way "while Miss Goodwin ... was visiting in our home."⁷ The first step was to access the state of the aeronautical arts. "As to the state of the

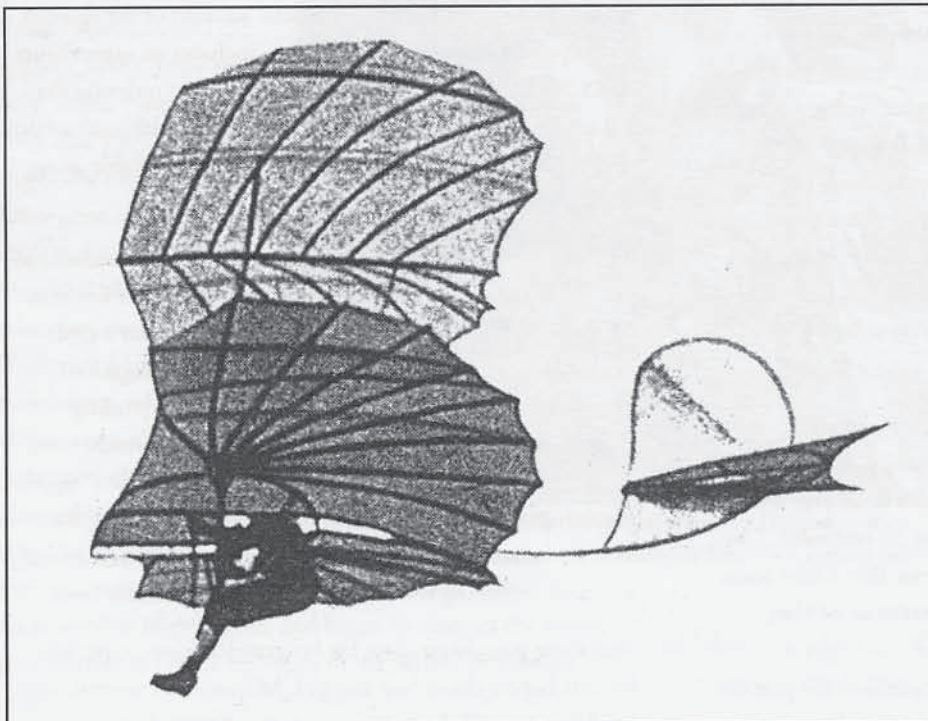
experimental knowledge at the time we began our experiments," Wilbur explained:

"...we reached the conclusion that the problem of constructing wings sufficiently strong to carry the weight of the machine itself, along with that of the motor and of the aviator and also of constructing sufficiently light motors were sufficiently worked out to present no serious difficulty; but that the problem of equilibrium had been the real stumbling block in all serious attempts to solve the problem of human flight, and that this problem of equilibrium in reality constituted the problem of flight itself."⁸

From the outset, as Wilbur explained, "we were actively studying the means of controlling aerial apparatus in the air..."⁹ They immediately recognized that the real problem related to control in the roll axis needed to raise or lower either wingtip at will to maintain balance in the air. "[We] ...conceived the idea of adjusting right and left wings to respective difference angles of incidence," Wilbur explained, "for the purpose of controlling lateral balance."¹⁰

How was that to be achieved? Orville suggested "...mounting the wings ... upon axes extending laterally from the center of the machine with gears attached to the two wings meshing so that when the lever attached to either wing was pushed forward or backward the wings would face forward at different angles to each other."¹¹ Wilbur, however, argued that the scheme was impractical because of the weight of such a mechanism and the difficulty of incorporating it into an adequate structure.

Harriet Silliman, another one of Katharine's college friends, arrived for a visit on Thursday,



Otto Lilienthal gliding. His death in 1896 got the Wrights interested in aeronautics.

July 20. ¹² Wilbur was working late in the bicycle shop a day or so later, while Orville and Katie were off somewhere entertaining Miss Silliman.

“One evening while studying the movements of a little square paper tube which I was using for the purpose of noting the movements of one side which I conceived to represent the upper plane of a double deck structure and the opposite side which I conceived to represent the lower plane, I noticed that the upper plane could be moved bodily forward or backward with reference to the lower plane which would be useful in controlling the fore and aft equilibrium of the apparatus, or if the top plane were moved forward at one end and backward at the other the whole structure would be twisted so that the right ends of the plane would be pulled down at the rear while the left ends would be elevated. Thus each plane would assume a screw form or helicoid and the right wing would have a greater angle than the left wing.” ¹³

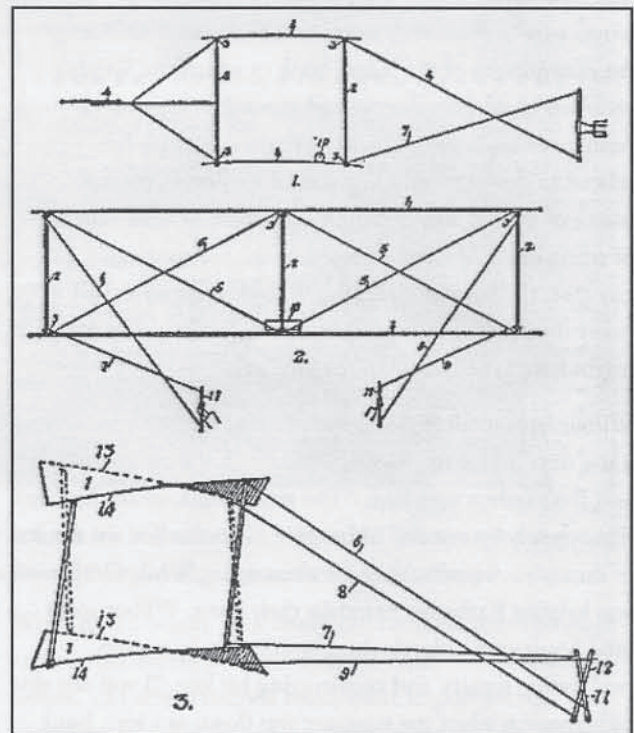
When Orville returned home with the ladies later that evening, Wilbur was waiting with the box. “By marking vertical and diagonal lines on the ...two vertical walls...[Wilbur] represented the upright posts and the diagonal truss wires of a superposed aeroplane.” ¹⁴ Wilbur carefully positioned his index fingers and thumbs on either end of the box and twisted. Orville recalled that they became “... very enthusiastic....” ¹⁵

Wilbur then proceeded to build “...a little model made out of bamboo having lateral spars and upright standards connecting them, the whole being braced by truss threads.” ¹⁶ It was an even clearer demonstration of the warping principle, and indicated a means of incorporating the technique into an actual structure.

His next step was to design, build and test their first real aircraft, a kite that would enable them to test their control system in the air. “The kite had two slightly curved planes,” Wilbur explained, “about thirteen inches from front to rear, and about five feet from tip to tip, one being placed above the other and connected to it by two rows of upright standards, one near the front edge and the other row near the back edge.” Wilbur attached the upright struts to the

wings with flexible connections, “...so that the top plane could be thrown forward or backward with reference to the lower plane.” ¹⁷

A single rod attached to the mid-point of the middle rear strut supported a rectangular, horizontal elevator. When the top surface of the kite moved forward or backward, the trailing edge of the elevator rose or fell to assist the kite in climbing or diving.



The Wright warping kite of 1899. Their airplane design breakthrough came when they consciously chose unstable supporting surfaces which had to be controlled by the aviator to keep the plane in the air. Drawings by Orville Wright.

Orville remembered that the kite surfaces were braced across the front and back with light wires forming a Pratt Truss, a classic American bridge truss. This would allow the top surface to move to the front or rear of the lower wing, causing the kite to climb or dive. The wings could also be twisted, like the box and the bamboo model, for lateral control, but they would not be free to move to the right or left in parallel with one another. Lines connected to the top and bottom of the outside front struts on both the right and left sides led to wooden sticks held by the operator.

Wilbur and Orville Wright Fly a Kite

The lines on the right and left were crossed, so that the operator could tip the top of the two sticks in his hand forward to allow the top wing to move back, causing the kite to climb. Pointing the top of both sticks to the rear would cause a dive, and pointing the top of one stick forward and the other to the rear would cause the kite to bank in one direction or the other. It would be the first flying machine of any kind capable of maneuvering completely under the control of the pilot.

The structure of the kite was built entirely of pine. The wings were covered with fabric and sealed with shellac.¹⁸ An examination of the ledger book in which the Wrights recorded all of their income and expenditures reveals a number of interesting purchases that might have been related to the kite, including several entries for ten cents worth of muslin, and a Wilbur's purchase of a ten cent ball of string in the last week in July, or the first in August. In any case, the book records that Wilbur reported a great many unspecified expenditures during late July, any of which might have been related to the kite.¹⁹

Wilbur later recalled that he was at work on the kite "within a few days" of having experimented with the cardboard box and the bamboo structure. "The actual work on the kite was done mostly by myself," although "...it embodied the results of numerous conversations between us."²⁰ While Orville was helping Katharine entertain their guest, Wilbur spent long hours at the bicycle shop, waiting on customers, performing repairs, and constructing his kite. "I was not able to be present when the structure was flown as a kite, but I operated the machine in ... our store before it was taken out to be flown," Orville recalled. "My brother held the kite in his hands while I warped the wings by means of the four cords."

Katharine, Harriet, Orville and a group of other friends left for a camping trip at a spot near Dayton's Fairview Park during the first week in August, 1899. The party returned home on 7 August, the first Monday of the month.²¹ The tests of the kite, Wilbur recalled, were made before the trip. Orville agreed with his brother, recalling that he had returned from the camping trip on Tuesday August 8, and that Wilbur had visited him in camp on Sunday, August 6, at which point they discussed the kite tests that had been conducted prior to his departure. In the late summer of

1899 the Wrights did not have an assistant who could man the bicycle shop in their absence. Presumably, Orville did not witness the kite tests because he had to mind the store.²²

Wilbur reported that he flew the kite "a number of times about the end of July."²³ He had given the question of where to fly it considerable thought, and selected an open area on the grounds of the Union Theological Seminary, at the corner of West First Street and Euclid Avenue. "This field is now part of the city," Wilbur explained in a deposition offered just a month before his death. "But at that time [it was] a retired place where I thought no one would intrude."²⁴

Officials of the Church of the United Brethren in Christ opened the doors of the impressive three-story structure in 1878. Since that time, it had become a landmark on the western edge of Dayton. Eight years before, Katharine, then a high school student, had described the place in an essay describing the sites encountered by passengers on a horse car traveling east along West Third Street. Having begun the journey at the Third Street car barns, and passed the already historic Miami City school, the tour guide directed the attention of her readers to the next noteworthy site along the route.

"To the left, about two squares distant, is another school, sometimes irreverently called "the preacher factory." Its official name is Union Biblical Seminary. It stands in the center of a beautiful campus on high ground overlooking the valley of Wolf Creek, and is the first building to attract the eye of travelers entering the city by railroad from the west."²⁵

Wilbur remarked that he had flown the kite more than once. The fact that the drawings of the kite which he prepared for use during a deposition on the morning of March 30, 1912, show a short section of pipe tied to the center forward strut certainly indicates that he had flown it enough to realize that it was tail heavy.

In spite of Wilbur's desire for privacy, there were witnesses to the tests. Fred Fansher recalled that he had been flying kites with ten or twelve other boys in an empty lot adjacent to the seminary at the corner of Summit and West First, when Wilbur Wright walked by carrying "...what looked to us like a peculiar sort of box kite." Curious, the boys pulled their

own kites down and followed Wilbur onto the seminary grounds.²⁶

John Myers remembered that Wilbur had asked him to hold the kite as far above his head as he could and to let it go when instructed. "There was quite a big wind that day," he noted. "I recall that when he tilted the planes the kite came down very rapidly, darted in other words.... He made several attempts and then boxed it up and put it away."²⁷

John Reiniger had been there, as well. "At times it would have a tendency to come down." He recalled, "which would be overcome by the manipulation of the sticks in Mr. Wright's hands." Once, he remembered, the kite had gotten completely out of control and swooped down to the ground.²⁸

Of course, Wilbur gave Orville a detailed account of the tests. Several days later, John Reiniger and his brother Walter stopped by the bike shop and provided what we can safely assume to have been a less measured description of the proceedings. "According to Wilbur's account of the tests," Orville remarked, "the model worked very successfully."

"It responded promptly to the warping of the surfaces, always lifting the wing that had the larger angle [of incidence]. Several times, according to Wilbur's account to me, when he shifted the upper surface backward by the manipulation of the sticks attached to flying cords, the nose of the machine turned downward as was intended; but in diving downward it created a slack in the flying cords, so that he was not able to control it further. The model made such a rapid dive to the ground that the small boys present fell on their faces to avoid being hit, not having time to run."²⁹

During the course of a series of patent suits that began in 1909 and ran for over two decades, the origins and operation of the 1899 kite would repeatedly become a matter of some legal importance. It was, after all, how the



Postage stamps from Africa pay homage to the Wrights' triumph.

Wright had begun. As a result, the brothers were forced to reconstruct events that had occurred more than a decade before, and which seemed much more important in hindsight that they had at the time. In general, the method of dating the small steps leading to the kite tests by remembering the comings and goings of guests, camping trips and other household events, seems to have been quite successful.

There is one puzzling anomaly, however. The brothers relied on their father's meticulous diary to establish a basic timeline of events in the Wright household during the spring and summer of 1899. In his entry for July 7, Bishop Wright reports that his grandson Milton visited that evening, "to see the flying machine."³⁰ According to the chronology reconstructed by the brothers, however, there was no "flying machine" in early July. The incident with the paper box, which set everything in motion, did not occur until on or

Photo: S. Skinner

about July 20. Perhaps young Milton came to look at pictures of flying machines in the books and pamphlets that his uncles had recently acquired.

In addition to reconstructing the weeks when they had taken their first steps toward the invention of the airplane, the Wrights had to locate witnesses who could testify to having seen the kite maneuvering in the air. Some of the boys were easy enough to find. John Reiniger was still living in Dayton, as were Fred Fansher, who was serving as secretary of the Chamber of Commerce in 1912, and John Myers, who had become an electrician. The Wrights wrote letters to other men, now living as close as Cincinnati and as far away as Georgetown, Texas, whom they thought might have been among the ten or a dozen youngsters who had seen the kite fly thirteen years before.³¹ Apparently, there were no responses.

Opposing counsel in the various patent suits would also express curiosity with regard to the ultimate fate of the objects that had played such an important role in the initial involvement of the Wright brothers in aviation. "I do not think that we have parts of any of our kites or gliders before the motor aeroplanes [sic] of 1903," Wilbur explained.³² While he did not actually remember, he presumed that the little bamboo model had been "thrown in the waste basket or wood box."³³

"The kite remained about the store for three or four years," Wilbur recalled, "and was used at various times in making experiments with an automatic stabilizer." During one of those tests, probably in 1905, "...it was so badly broken that no attempt was made to rebuild it."³⁴ The 1899 kite had outlived its historic progeny, the 1900, 1901 and 1902 Wright gliders. Like them, however, it ultimately found its way into "the waste basket or wood box."

"Following these flights [of the 1899 kite]," Wilbur recalled, "we decided to build a much larger kite sufficient to support a man, and we made a search for grounds in the vicinity of Dayton but found nothing that suited us."³⁵ This time they would have to look a bit farther afield than the Union Theological Seminary. Just a year later, on Thursday, September 6, 1900, Wilbur Wright boarded a Big Four train at Dayton's Union Station. He was bound for Elizabeth City, North Carolina, where he would hire a boat to carry

him across Albermarle Sound to the little village of Kitty Hawk, on the Outer Banks of North Carolina. Safely packed away in the baggage car were the prefabricated makings of the 1900 kite/glider, the first full-scale Wright airplane. The freight charge was \$2.53, several times the cost of the small kite that had started it all.³⁶ ♦

Bibliography

- 1 Wilbur Wright testimony, U.S. District Court, Western Division of New York. *The Wright Company vs. Herring-Curtiss Co. and Glenn H. Curtiss*. In Equity No. 400. Complainant's Record. Vol. 1, pg. 474.
- 2 Orville Wright deposition, The United States District Court, Southern District of Ohio, Western Division, Charles H. Lamson vs. The Wright Company, In Equity No. 6,611, pg. 78, Defendant's Copy, The Papers of Wilbur and Orville Wright, Manuscript Division, Library of Congress, box 63.
- 3 Orville Wright deposition, January 13, 1920, Regina C. Montgomery et al vs. the United States, in Marvin W. McFarland, *The Papers of Wilbur and Orville Wright* (New York: McGraw-Hill and Company, 1953), vol. 1, pg. 3. Hereafter PWOW.
- 4 Wilbur Wright testimony, *Wright Company vs. Herring-Curtiss Co. and Glenn H. Curtiss*, Vol. 1, pg. 474.
- 5 W. Wright to the Smithsonian Institution, May 30, 1899, in McFarland, PWOW., vol. 1, pg. 4-5.
- 6 Entry for June 15 (?), 1899, 1899 ledger book, Box 77, pg. 13, Papers of Wilbur and Orville Wright, Manuscript Division, Library of Congress.
- 7 Lamson vs. the Wright Company, pg. 78.
- 8 Wilbur Wright testimony, *Wright Company vs. Herring-Curtiss Co. and Glenn H. Curtiss*, Vol. 1, pg. 478.
- 9 Lamson vs. the Wright Company, pg. 14.
- 10 Lamson vs. the Wright Company, pg. 14.
- 11 *Ibid.*, 78.

- 12 Bishop Milton Wright, Diary, Paul Lawrence Dunbar Library, Wright State University.
- 13 Wilbur Wright, Lamson vs. Wright, pgs. 14-15.
- 14 Orville Wright, Lamson vs. Wright, pg. 79.
- 15 Ibid.
- 16 Wilbur Wright, Lamson vs. Wright, pg. 15
- 17 Wilbur Wright, Lamson vs. Wright, pg. 16.
- 18 Wilbur Wright to Octave Chanute, August 10, 1900, in McFarland, Papers, vol. 1, pg. 22.
- 19 For the string see: 1899 ledger book , pg. 59, Wright Papers, Box 77.
- 20 Wilbur Wright, Lamson vs. Wright, pg. 17.
- 21 Orville Wright, testimony, U.S. District Court, Western Division of New York. The Wright Company vs. Herring-Curtiss Co. and Glenn H. Curtiss. In Equity No. 400. Complainant's Record. Vol. 1, pg. 807. "While Miss S. was visiting us we spent a few days camping north of the city, that is, my sister, Miss S. and I camped with some friends...We were camping about one week and we returned to Dayton, as I remember it, the first Monday of August 1899."
- 22 For Orville's recollections see, "Orville Wright on the Wright experiments of 1899," in Marvin W. McFarland, ed., The Papers of Wilbur and Orville Wright (New York: McGraw-Hill and Company, 1953), vol. 1, pg. 11.
- 23 Wilbur Wright, Lamson vs. Wright, pg. 16.
- 24 Wilbur Wright, Lamson vs. Wright, pg. 17.
- 25 Katharine Wright, "Rambles in Miami City," [Central] High School Times, December 1891, pg. 7.
- 26 Deposition of Frederick W. Fansher, Dayton, Ohio, February 2, 1921, Regina Cleary Montgomery et al. vs. the United States, Court of Claims of the United States, No. 33852. Typed copy of the deposition in the John J. Montgomery biographical file, National Air and Space Museum. See also Fansher's earlier deposition, in Lamson vs. Wright, pg. 90.
- 27 Deposition of John K. Myers, Dayton, Ohio, February 2, 1921, Regina Cleary Montgomery et al. vs. the United States, Court of Claims of the United States, No. 33852. Typed copy of the deposition in the John J. Montgomery biographical file, National Air and Space Museum.
- 28 Deposition of John D. Reiniger, Lamson vs. Wright, pg. 95.
- 29 "Orville Wright on the Wright experiments of 1899," in McFarland, ed., Papers, vol. 1, pg. 11.
- 30 Bishop Milton Wright, Diary, July 7, 1899, Paul Lawrence Dunbar Library, Wright State University.
- 31 Wright brothers to Horace Hiscy, April 13, 1912; Wright brothers to Joseph Scholl, April 13, 1912; Wright brothers to Horace Drury, April 13, 1912, all in The Papers of Wilbur and Orville Wright, Manuscript Division, Library of Congress, box 63, materials relating to Lamson vs. Wright.
- 32 Wilbur Wright, Lamson vs. Wright, pg. 49.
- 33 Ibid.
- 34 Ibid., pg. 17.
- 35 Ibid.
- 36 For freight charge see: 1900 ledger book, pg. 153, Wright Papers, Box 77.

An Important New Resource for Collectors

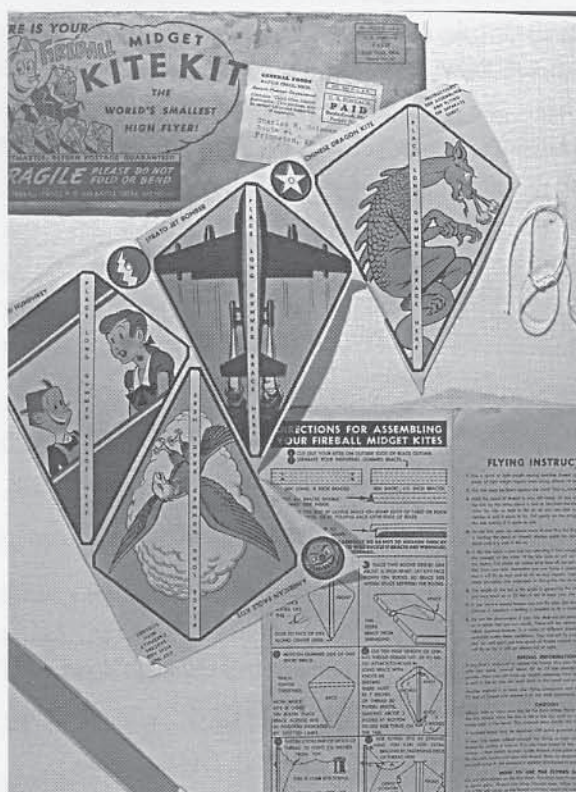
By Scott Skinner

There's so much to say about eBay, the online auction site, that I have to sit and think about where to start. If you follow the financial news about internet stocks, there is little doubt that you have heard of eBay. It has shown huge stock price gains, followed by pretty wild fluctuations, and it has done it all with few traditional measures of value. (A view of its financial history just in 1999 shows an increase from just under \$100 a share on Jan. 1, to more than \$200 a share in May, to around \$90 in August.)

People are optimistic about its potential and a look at eBay's home page shows you why; 2.4 million items for sale in 1,627 categories. Over 1.5 billion page views per month in August. eBay describes itself as "the world's first, biggest, and best person-to-person online trading community. eBay is your place to find the stuff you want, to sell the stuff you have, and to make a few friends while you're at it! Whatever you need, odds are you'll find it at eBay: there are more than 1,000 categories and more than a million auctions a day."

If you've never used eBay, finding it on the web is easy; a search on eBay or eBay.com will get you to the home page. There you will find a listing of many of the major auction categories that might be of interest; antiques, dolls, sports memorabilia, and so forth. But for the kite collector, none of those categories is specific enough to be much help—you'd be searching thousands of items just to find one kite-related one. Herein lies the beauty of eBay: you can use keyword searches to search through all of the hundreds of auctions to find just those items of interest to you. In our case, using the word "kite" produces a listing of around 200 items that are either kites, pictures of kites, articles about kites or other surprising things somehow related to kites. (By the way, I was online for two weeks using "kites" as my search word and it normally finds only about 50 items. My advice is to search using both words.) On the eBay home page, right beside the "search" window, you can even click on "tips" and find out ways to refine your searches. (Yes, I should have read that on the first day.)

Now, in order to use eBay, you must become a registered user—again, a very easy hurdle to jump—just find the "register, it's free and fun" block, click, and follow the directions through the process. You must be 18 years of age to become a registered user, and you have to provide some personal information, but since your transactions will be directly with the sellers of goods, you don't have to provide credit card information or financial data to eBay. Once registered, you will use your eBay email name and password whenever you participate in an auction.



An eBay purchase; The "Fireball Twig" midget kite kit.

eBay is a wonderful tool for those of us who are always on the lookout for interesting kite paraphernalia because, let's face it, we are a very small community. eBay allows us to tap in to much larger and more organized groups of collectors: for example, a Steiff dealer in Germany might have an old Roloplan kite. In the very large pool of Steiff collectors this

would be of interest to a few of them, but it is greatly interesting to us kite collectors. Auction pricing may put the item out of reach, but at least we have the chance to bid on an item that we wouldn't have even been exposed to, otherwise. By the same token, items come up for bid from the worlds of ceramics, prints, cards, and even furniture. These would be impossible to find anywhere else but in the centralized world of cyberspace. As an aside, I have been struck by the variety of locations where these items come from. Of the dozen or so things I've bought, they have come from Germany, Japan, America's West and East Coasts, and in between, and most come from small dealers or individuals—impossible to search out by foot, car, or plane.

Another important tip is the old warning, "buyer beware." Remember that many of the sellers of eBay items are individuals—they may honestly believe that they have a true antique and describe it as such. It may or may not be true. A classic example is the "HiFlier" paper kite that does, indeed have a copyright date printed on the sail. The date of copyright and the date of manufacture are not the same. I tend to believe the best about people and think that mistakes are made because of what others tell them or their inadequate research. I don't believe there are a great number of unscrupulous sellers, but certainly some item descriptions are simply not accurate. eBay does have some "insurance" built into the system with "feedback", with which you can talk about deals and dealers that you feel are not honest or fair. The best thing any buyer can do is to watch the auction items over the period of several months. This will, at least, give you an idea of an item's rarity, you can then make a decision as to value.

Finally, as a collector of kites and kite paraphernalia, I note that eBay is a great way to get in touch with other serious collectors. In many ways it ensures that these items are not lost to the kite community forever by going to collectors and collections with other focuses. One eBay devotee makes it a point to forward duplicates to the World Kite Museum, and certainly, I have done the same for The Drachen Foundation. It's interesting to note items that come up for auction repeatedly; trade cards, stereoviews, and some books, but you always gamble that the one you let go is the only one. I'm very optimistic that as eBay grows, even rarer items will find their way into the collections of kite fans. ♦

Kites on the Internet

Collectors of arcana, like kites and kite accessories, are reveling in a new source of material—the world wide web. Auction sites like eBay, Amazon, Sotheby's, Christie's have made visible, and available for purchase, often at inexpensive prices, not only major kites but also the wonderful flotsam of the sport, notes collector Scott Skinner of Monument, Colorado. Skinner is president of the Drachen Foundation.

"Books come up almost daily," he notes. "Drachen obtained an unusual volume on kites put out by the Chicago Park Commission. Who knew such a thing even existed? Drachen also obtained a great old stereo card showing Japanese children flying Korean kites. Anything to do with kites is likely to show up sooner or later. This material formerly would have been invisible. Now it's showing up for kite collectors, of whom there are not that many, in fact.

"Some of this material is second, third, fourth generation stuff—items handed down in a family.

"A lot of the things being sold are common—kite pins, stamps from around the world showing kites, commercial kites—but there have been some gems too, a commercial Silas Conyne cloth kite, a beautiful Steiff eagle kite made by the teddybear people, pre-World War II things.

"What I particularly like is that this material is now going to the kite community and being saved, instead of being lost. There's power in numbers. Almost without trying, a seller can get to tens of thousands of potential customers. The whole internet auction concept is in its infancy, but it's exciting, it gives me a lot of optimism." ♦

Fanø 1999 Alexander Graham Bell Symposium

Fanø 1999 had the best weather in the 15 year history of the kitefliers' meeting. Only one day was washed out by the showers, so typical on this small Danish island, and what a pleasant coincidence that it was the same afternoon that the scheduled Alexander Graham Bell Symposium was to be held. Over 65 enthusiasts sought shelter and information in Fanø's elementary school, and, as showers pelted the island, were treated to lectures by Ralf Schroder and Achim Kinter. (For a sample of Ralf Schroder's design work, see "Drachen Sport und Design" May 1999.)

Ralf Schroder fell in love with the tetrahedral form. He was so taken with the design ideas of Bell's creation that he fabricated his own plastic connectors to build his early kites. Fashioned by bending and melting plastic tubing, the connectors featured tie-ons to support an external sail—thus allowing each cell to use only four spars instead of Bell's six. These early connectors proved too brittle and Ralf sought to develop a universal tetra connector that would be inexpensive, accessible, and easily fabricated.

Ralf found the building block he was looking for in a building supply store. Spherical wooden cabinet knobs were large enough to be drilled for spars, small enough to be light and strong, and sold for only pennies apiece. With help from a machinist friend, Ralf designed an elegant steel tool in which his tetra connector could be fabricated. The knobs, manufactured with one flat side, are locked inside Ralf's tool, drilled by lathe or drill press, and transformed into connectors. Ralf showed pictures of his kites—made to almost any size and any configuration due to the utility of his connectors.



Kitefliers on the beach at Fanø Island, Denmark.

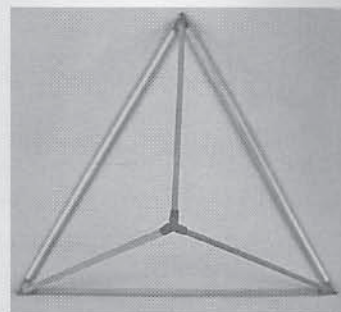
Photo: S. Skinner

Following the discussion of hands-on tetra building, Achim Kinter showed over 100 slides covering the life of Alexander Graham Bell as well as his extensive work with kites, boats, and airplanes. Many of the slides presented were from the Bell Museum in Nova Scotia—lent by The Drachen Foundation for the event. Though the slides featured many of the familiar kite images we've come to expect, Achim enjoyed telling many of the "little-known-but-interesting-facts" of Bell's experiments. (His favorite concerned the lover-of-life Bell, casually drowning sheep in order to further his own understanding of drowning.)

Finally, The Drachen Foundation also presented photographic copies of original Bell lab notebooks, graciously shared by Margo and Bevan Brown. Interesting photos of the Bell man-lifter (with cells uncovered and covered), the Bridge Kite and its variations, and a game of "toss and catch" with a kite, are included in this collection. Photos of

the Oionus Kite, named for the Greek bird of omen, include a rare shot while tethered for a test flight. The unusually configured Victor kite was another surprise.

A surprise for the meeting participants was the five original Bell tetra cells, hand-carried to the event by Drachen Foundation Board President Scott Skinner. Recently acquired from the Bell Museum, the



An original Bell tetrahedral cell.

Photo: W. Wright

cells give a clue to the monumental work done by Bell; could anyone present imagine the kite with over 3,400 of these cells! ♦

The Discovery of the Holy Grail

(And How It Can Help The Drachen Foundation)

By Scott Skinner

Like it or not, the collector is just below the surface in everything I do. When making kites, I'm influenced by historical examples from East and West; when watching kites, I'm drawn to those I'd like to own; and when reading about kites I'm struck by images and articles that I'd love to have original copies of. Having a day to myself in Salt Lake City, recently, I was hoping to make a trek down to Provo to an Oriental antiques store that I had heard good things about. In calling for directions, however, I found that their number had been disconnected—not a good sign. As an alternate strategy, I decided to check out the local antique scene in Salt Lake City and, to my delight found a listing for an antique toy specialist (I didn't want to celebrate prematurely, but thought that this could be "happy hunting.").

As I started along the prime street, I noted that six or seven stores would keep me busy for the better part of the day. Of course, the "toy guy" was my first stop—I wanted to be fresh for this part of the hunt—but, damn, he was closed! What's more, he was closed and had a nice smiley face Hi Flier in the window! I held out some hope that he might open a little later, so started through the other stores. After two or three stores that were just not the type of places to hit pay dirt, I turned up the street to what looked like a small second-hand bookstore, at this point thinking that the day was going to be a waste.

What I found at Ken Sanders Rare Books took my breath away! First was the fact that the store façade camouflaged the size of the interior: it was huge. Second, the eclectic display of rock and roll posters, Utah memorabilia, and cartoon art were not necessarily a great place to look for kite stuff, but very interesting anyway. Finally, after asking about aeronautical books and being told that "we really only have a few of those," I found what really took my breath away. Tucked in among a nice selection of aviation histories was a book that, to me, was solid gold. It was the 1910 Smithsonian bibliography of aeronautical books and articles, *The Smithsonian Miscellaneous Collections, Vol. 55—Bibliography of Aeronautics*. What could be more valuable to people studying those seminal years just before and just after the Wright Brothers' history-making flight? Here was an organized listing of books and articles from all over the world that recorded man's complete knowledge of flight. I was further convinced of the bibliography's value when I paged to the "Kites" heading and found almost a full page of references included in the bibliography. Understand, these weren't the references, themselves, instead they were just the reference numbers of all those listings; almost 500 in all!

I took the time to visit a downtown microbrewery to spend some time with the book. Thinking of many of kiting's who's who, I looked for references by Rotch, Bell, Cody, Sacorney, Lecornu, and others. In every case there were articles or books listed. In most cases, far more references were listed than I had ever been aware of. ♦

Creations of whimsy, imagination and hope, kites have long fascinated us earthbound humans. They allow us, their fliers, to vicariously escape the burdens of gravity—even life—as they soar through the heavens. —Warren Judd

About Drachen's New Thai Collection

By Scott Skinner

The collection of Thai royal kites Ron Spaulding of Bangkok put together for The Drachen Foundation is notable because it is the first time the Foundation has gone out and actively sought to obtain a comprehensive collection of kites from a given tradition, complete with all the accessories used to fly them, the tools to craft them, as well as samples of native materials used in their manufacture.

In addition to obtaining this extensive holding, perfect for a small-scale exhibition, we made it a point to sit Spaulding down and have him give us non-kiteflier, that is to say not overly technical, information on every item he hand-delivered to the Seattle headquarters of the Foundation. In many cases, it was very detailed information because Spaulding is clearly the English-language expert on the Thai royal kite tradition and the perfect person to get this vital historical information down on paper for this and future generations.

Ron, an advertising executive by profession, added his own charming note to the documentary process by making lovely drawings to illustrate points he wanted made.

The Thai royal kites are of particular interest in the ancient,



Ron Spaulding with pakpao kites.

varied kite-fighting annals of Asia because instead of the normal single type of kite, used in India and elsewhere, there are two Thai royal kites, the chula and pakpao. They are very different; one is large, a bit ponderous, and definitely male; the other small, flighty, abundantly female.

The two kites use completely different methods of trapping each another—the chula has barbs on its line, the pakpao wraps its tail around its adversary to wrestle it to earth. Each type of kite has its own strengths and weaknesses.

Chula and pakpao aerial jousts are truly a battle of the sexes, and that gets people's attention in a big way.

The success of the Thai project, conceived by roving Drachen correspondent Ben Ruhe, has convinced the Drachen Foundation to duplicate it in other countries, particularly where centuries old kite-making traditions may be imperiled. Similar projects are now under way in Cambodia and in Bali in Indonesia. Drachen is investigating the kite situation in Vietnam, Laos, Nepal, Tibet and elsewhere in Asia. It already has very considerable holdings of Malaysian, Indian and Chinese kites and kite materials.

These kites are so inexpensive, relative to their value to the kite community, that the Foundation feels a duty to ferret them out at this point in time, while they are still readily available.

My own collection of Japanese material, on loan to the Foundation and put together over the last dozen years with advice from such experts as Masaaki Modegi of Tokyo, is very large and of absolutely first quality. Included are many beautiful and ingenious accessories and tools.

Also, investigation of the kite-fishing tradition in Oceania, where the kite may well have been invented many centuries ago, rather than in China where it has long been thought to have originated, is now actively being conducted on behalf of the Foundation by several researchers, including author, artist, kiteflier Tal Streeter.

What with all this Asian material, a smattering of kites from many countries around the world, plus its large holding of high quality American and European kites, with accompanying extensive documentation, The Drachen Foundation is making every effort to carry out its mandate: the increase and diffusion of knowledge worldwide about kites. ♦

The Royal Kites of Thailand

Battle of the Sexes Staged in Bangkok Skies

By Ron Spaulding

Editor's note: Earlier this year expatriate American Ron Spaulding, now living in Bangkok, delivered a complete set of Thai royal kites to The Drachen Foundation, including all their appurtenances—flight accessories, crafting tools and the native materials used to make them. He made these notes on the collection he had commissioned from master builders in Thailand.

The Competition

The Chulas and Pakpaos engage in an annual battle of the sexes at Sanam Luang, the Royal Parade Grounds next to and directly north of the Grand Palace in Bangkok.

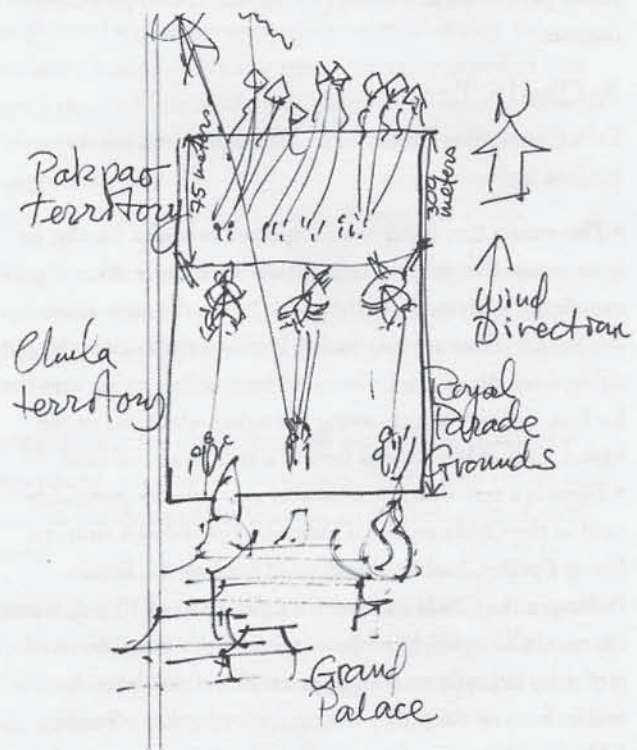
Kiteflying from March 15 to April 15 is the time when winds—"kite winds"—blow from the south. The due north orientation of the venue and the way the winds blow over the palace provide excellent flying conditions.

The grounds are approximately 300 meters in length. The northern 75 meters of the field is Pakpao territory; 225 meters are designated Chula territory. A rope line several feet in the air separates the two territories.

The object of the competition is to acquire points through capture. The competition consists of a series of matches that are launched in quick succession, each lasting no more than five minutes. In the quest for high scores, teams try to maximize the number of matches played. A team's points are accrued by the number of matches it has won.

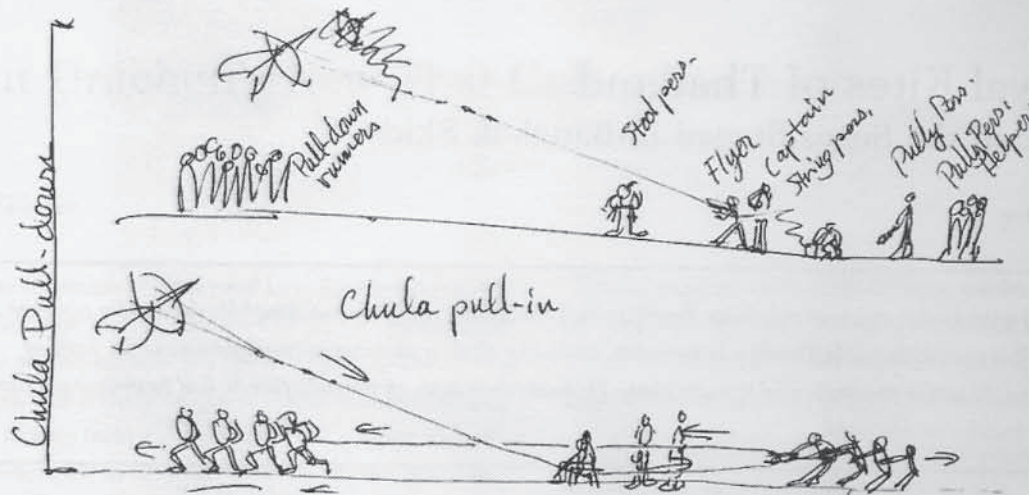
The Chulas are the grand male kites, the Pakpaos the teasing, flirtatious female kites. Although three Chula teams are stationed at the southern end of the field, only one Chula is flown into Pakpao territory at a time, where several female kites are stationed and fluttering.

Each match is fast, fierce and playful. The Chula chooses a Pakpao and that choice is final for the match. Both the Pakpao and Chula dance around each other, vying for the



advantage of height. The male-female interplay is dynamic. The Chula tries to ensnare the Pakpao using his barbs and the Pakpao tries to entangle the Chula using her lasso or tail.

Whichever kite brings the other down to the ground wins the points for the match. Kites are returned to respective teams while a new match is already under way.



A Pakpao Team

Two to five people make up a Pakpao team: master flier, pulley person, basket-string person, one or two pull-down runners.

A Chula Team

Each Chula team has between 20 and 30 members, as follows:

- The master flier is the most respected member. Ideally, he is an expert flier of great strength with decades of experience in flying.
- The captain directs the team action on the field.
- There are two “string boys”—members who let out string from the rattan baskets and later collect string into the baskets. Quickly maneuvering the string which sits in the basket kind of like a water hose is a skill in and of itself.
- There is a pull-down person who uses a pulley to quickly haul in the Chula and he is assisted by pull-down runners. Using a pulley doubles the speed of hauling the kite in. Pulling in the Chula requires strength.
- Up to 10 pull-down runners.
- The pull-in of the Chula is assisted by “the stool guy” who sits on a stool equipped with rollers above the line and in front of the pulley, acting somewhat like a breaker.
- The kite doctor is often a really old guy who knows a lot but can’t run around anymore and is on-site for the many post-combat repairs. His kit for field repairs during the competition contains paper, scissors, bamboo pieces, string, tin, glue, wax and strips of tin sheeting, which are rolled and act as a brace for broken spars.
- An important member of the team is the flier who chooses a kite from the stable, based on the flying conditions.

The Teams in General

Members are generally part of a long family tradition. Even with the family, a son may or may not want to participate in the sport and if he does participate it is only after years of experience that he attains expertise. After a flier chooses to fly either the Chula or Pakpao, he sticks with that type of kite. There is no crossover. Both require skill and experience and a high degree of specialization.

Origin of the Chula Kite

A legend is told of an Ayutthaya king who forbade kite flying over the roof of the royal palace. Swarms of kites disrespectfully flew over the roof and often became entangled. The king decreed offenders would lose a hand, but to no avail. Determined, the king then invited the finest kitemaker in the land, Chula, to court. Little is known of Chula; however, the master kitemaker proved highly skillful and his namesake creation was successful in capturing the offending kites.

Origin of the Pakpao Kite

A concubine living in the royal palace named Lady Pao, or Pakpao, flew a kite with heavy sticks and a very long tail which impressed the king so much he named it for her. Although designed for speed, agility and precision, the Pakpao flutters—a teasing, feminine pattern of flight.

Customs and Beliefs

Chula and Pakpao kites are spoken of as “body parts” in Thai. The Chula kite has a head, wing, waist, legs; the Pakpao has a head, wing and tail. The head of the Chula, “descended” from royalty, is never to be stepped over, particularly by a woman. It is understood that crossing over

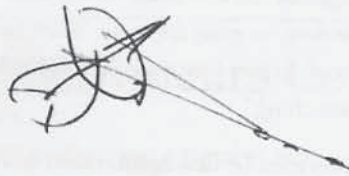
a Chula's head can irrevocably hex its flying powers, in accordance with Buddhist custom and belief. In Thai culture, the head is revered and the feet reviled.

Chulas and Pakpaos have life and individuality, heart and soul. If a kite is inexplicably performing poorly, it may be said, "That kite doesn't have heart."

Specifications of the Chula Kite

The Chula is a pentagonal kite equipped to catch other kites by means of three to five barbs attached to the flying string. It is a large kite, currently 193 cm wide by 254 cm long, made of paper, bamboo and string. The head of the Chula is bowed in a dihedral to afford "give" should it fall on its nose. The kite is less lucky should it fall on a wing.

Historically, the Chula has had three different styles: the original Hanuman or Giant, referring to giant mythical monkeys and flown up until the 1930s, the Ling or Monkey, more streamlined than the Giant with smaller legs and more pointed wings, and the Manut or Human Shape, flown since 1960 and falling between the Giant and Monkey variations.



A competition Chula generally has a three-season competitive life. A new Chula's bamboo has a lot of flex and thus might be favored for use in lighter wind. An older Chula, sturdier and with less flex, might be chosen to fly in stronger winds. A team may have a stable of 10 Chulas. A kite is chosen for a match based upon its unique characteristics and the flying conditions.

Specifications of the Pakpao Kite

The Pakpao is much smaller than the Chula; current dimensions are 75 cm by 88 cm and like the Chula is constructed of bamboo, paper and string. Historically, there have been two types of Pakpaos, the Olive, made and flown until 1960 with wings tucked to create an olive-shaped curve, and the Square, the present day variation, with squarer wings better adapted to catch the air.



Construction and Materials

Great care is taken in the preparation of the bamboo, since this element is critical to its success in competitive flying. On a Chula, the top and bottom spars of the wings and left and right spars of the legs must be "brother-sister" pieces of bamboo, viz. pieces of bamboo that share a cut edge. The reason for this is that these pieces will have corresponding knots and imperfections in parallel on the kite, critical for balance and flying precision. The crafting of the spars must be mirrored exactly, otherwise both are useless. This takes skill. The saying goes, "If you're mad at your wife, don't touch the bamboo."

Preparation of the bamboo takes great care, experience, concentration and time. The bamboo is first split with a specially designed splitting knife, then it is gradually straightened section by section. To accomplish this, the bamboo is coated with palm tree sugar and exposed to heat from a charcoal-heated clay pot filled with steaming water. It is then pressed between the flat wooden edges of a wooden straightening tool. The bamboo is rounded, smoothed and tapered with shaping and finishing knives and a rasp.

String is made from plant fibers. There are line strings, binding strings and sewing strings. To prevent tangling, the string is run through a ball of wax to give it a strengthening coating.

String is anchored on the bamboo spars of the kites and is then strung in a grid-like formation. Small paper circles are glued to the sheets of paper at the grid intersection of each string.

Since they are considered to be flying machines rather than decorative objects, the kites are unadorned. Glue, made up of rice flour and water, is used to attach the small paper stickers that adhere the paper to the kite. For champion or exhibition kites, gold paper may be used for the stickers.

Inventory

The collection delivered to Drachen Foundation included 6 Chula and 18 Pakpao kites, pulleys, pull-in stool, string ball, rattan baskets, line spurs, "doctor kit," tails, lassoes, knives, rasps, shaping tool, pre-cut and shaped bamboo, clay bowls with palm sugar included, clay pot with inner rack and charcoal, plant fibers and miscellany including a video on the subject. ♦

Famed Blue Hill Observatory Reopens to Public

In continuous operation since 1885, the Blue Hill Observatory near Boston had a rebirth this spring as a weather museum and science center. After a \$1.3 million renovation, it reopened to the public with private educational foundation status. Blue Hill almost from its inception had been associated with Harvard University but that connection was severed some years ago in a cost-cutting move by the university.

The oldest continuously operating weather observatory in the U.S. and a National Historic Landmark since 1989, Blue Hill willed itself a perfect day for its celebration. There was literally not a cloud in the sky. There was a panoramic view of the whole of central Massachusetts. Absolutely perfect weather.

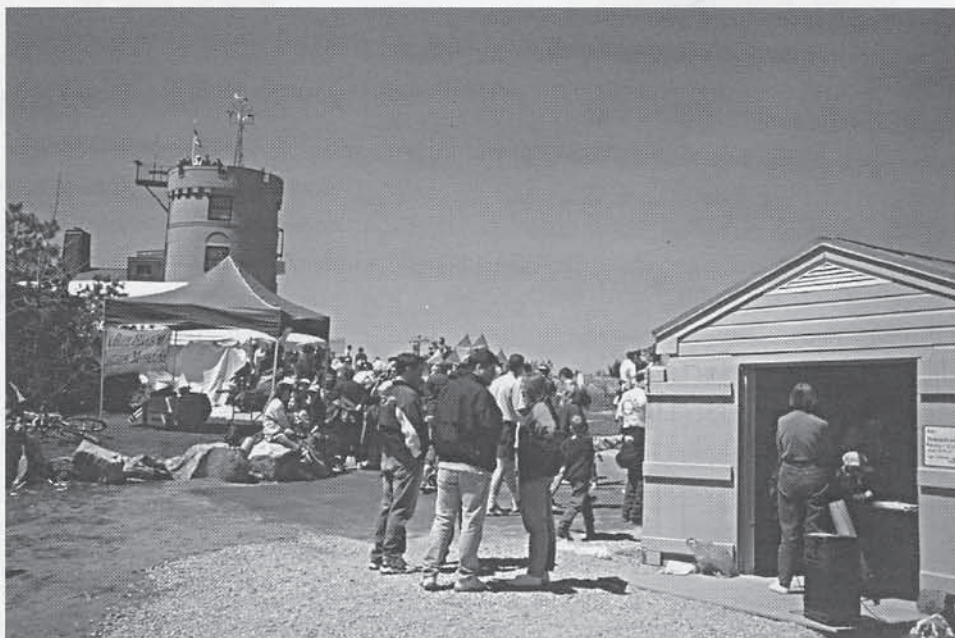
Among the many thousands attending the day-long event—invitees, hikers, mountain bikers, bird watchers, throngs drawn by live television coverage of the doings—was Scott Skinner, president of the Drachen Foundation and new member of the Blue Hill Board of Directors. Drachen is contributing to the refurbishment of the observatory's kite shed, a reconstruction of the historic building from which early weather instruments were flown by large Eddy and Hargrave-style kites to heights of over 12,000 feet.

Although the Metropolitan District Commission, landlord of the mountain and contributor of the rehabilitation funds, made its presence felt in every direction with an opening ceremony, ribbon-cutting,

tents with giveaway literature and kites, and park rangers by the dozens directing proceedings, Skinner in the opinion of many stole the outdoor show all by himself. Taking an hour and a half to assemble a tetrahedral kite he had built modeled after an Alexander Graham Bell original from the turn of last century, Skinner put the 7-by-14-foot beauty up in the air between a 170-foot WGBH-TV tower on one side and the Blue Hill Observatory tower with its dozen whirling, delicate weather instruments on the other.

His flying room was extremely limited and was additionally complicated by a close-in crowd. When a strong thermal took the giant kite directly overhead, Skinner lost some control of it. Observers worried a little. Eventually he regained full command of the tetra and managed a safe, soft landing, to great applause. Then he wiped the sweat off his brow. Expert flier though he is, he later said it had been a near thing.

Afterward he flew again, under less challenging conditions, and again was a great hit with the crowd.



The new kite shed (right) at Blue Hill.

Photo: B. Rulhe

Music in the Indonesian Sky

Report on a Kite Festival in Beautiful Bali

By John Stevenson

Because of Indonesia's current problems, the decision to hold the festival in the beautiful town of Sanur, Bali, could not be made until two weeks before the starting date. At such short notice, less than a dozen international participants were able to join in the mid-year event. Guests came from Brunei, Singapore, Japan, France, Austria, Holland, and the U.S. Bali itself was more than well represented. One hundred and sixty *banjars*, or districts each provided a traditional Indonesian kite, some as wide as twenty feet and requiring as many as twenty people to fly, plus a supporting *gamelan* orchestra. It took three days to fly them all on the large festival field, close to the sea to catch the best winds.

The festival was organized around the three most popular traditional shapes of kite (or *layang*) in Bali: The *bebean*, a huge fish-shaped kite; the *pecukan*, a graceful bowed shape with two prominent hummers; and the *janggan*, a kite with a head in the form of a *naga*, or snake, and a 100-meter-long tail.

The huge *bebeans* are basically festival kites and for this festival had to be a minimum of five and a maximum of six meters across. The *pecukan* (pronounced PEchukan) is the everyday individual Balinese kite-shape, but some of the *pecukans* at this festival were also up to six meters across.

Each participating *banjar* constructed a kite for this biennial festival, a big commitment of resources. To the cost of the huge kite itself would be added the cost of maintaining an orchestra to encourage the kite, matching tee-shirts for the handlers, transport by truck of the kite to the festival site, etc. The *banjar* is a basic feature of Balinese society, a kind of men's club with 250 to 300 members, that keeps alive local ceremonies and other traditional activities, including kite-



A village team heads for the festival with its giant kite.

Photo: J. Stevenson

flying. The ancient traditions are maintained not only in towns and villages throughout the island but even in urban settings such as Denpasar and Kuta.

At the festival, the judges used five criteria to assess the kites: shape, color, sound (from hummers attached to the kites), flight performance and the performance of the kite's supporting orchestra. The music could be very exciting. If the wind dropped and the kite dipped, the tempo of the music rose as the musicians encouraged it to fly higher. The deep slow regular beat of the large gongs as each kite prepared for takeoff and was launched plus crescendoes from the small brass drums were an omnipresent feature of the festival.

To these sounds were added the cheers of the crowds, who enthusiastically followed the progress of every entry. People would also sing for a wind. Sometimes one of the judges would break into song over the loudspeakers to pray for a wind.



Photo: J. Stevenson

Carrying a graceful, bowed pecukan kite on to the flying field.

The wind being lighter than usual for this festival, held last year, many of the larger kites, which are extremely heavy, did not get into the air for more than a minute or two. Taken to the site by truck, the kites are hand-carried by up to twenty men onto the field. The *bebeans* are launched by up to ten men, with another ten or more hauling on the ropes.

It rained a little on the first day—the cotton fabric absorbed the moisture, further increasing the weight of the kites.

A team would run to catch their huge and heavy kite, maybe twenty feet across, if it looked as if it was about to crash; amazingly, they would usually succeed and hold it upright without it touching the ground.

Each of the large *pecukans* had two hummers, called *guwangan*. Although not aerodynamically needed for the kite to fly, they are an integral part of the Balinese kite. They make a melodious hum as the wind passes over them. They are bow-shaped, and made of rattan or

bamboo. The upper *guwangan* is called the man, the lower the woman. When a kite flies out of sight, either in clouds or after dark, its sound will still be audible. Sometimes if a kite has flown for many hours and night falls, rather than pull it in, the fliers will simply tether it and let it fly through the night. Its sound will be the first thing the fliers hear in the morning.

While foreign kites were not included in the official festival program, they were flown intermittently by visitors at the side of the field. “International festival” was therefore something of a misnomer. However, all the foreign guests had a wonderful time at the event, organized by the very hospitable Nyoman Adnyana of Denpasar and his group, and learned a great deal about the very different traditions of kite-making and kite-flying in Bali. The Balinese way of doing things communally was a major impression of the visit. Balinese kiteflying, which in the West is an individual experience, is a fine example of the communality. ♦

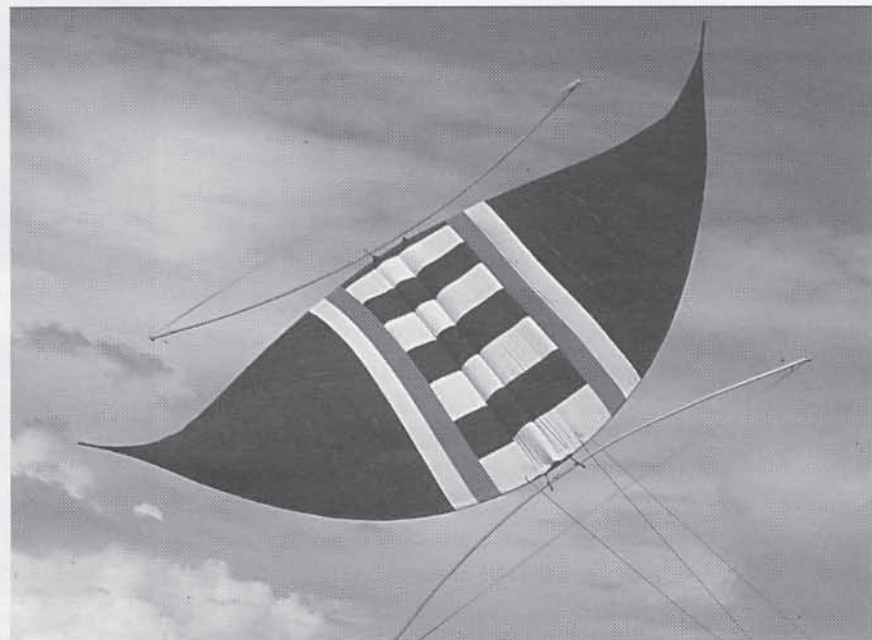


Photo: J. Stevenson

The pecukan in flight. Notice the two large humming devices.

As one of the exhibits, the park service showed birds from its nearby nature center. Only an owl and a raven were displayed. Rangers felt the large number of children flying their giveaway kites would have terrified larger, more nervous raptors such as hawks and turkey vultures. Our drive down the mountain later that evening showed the natural presence of the raptors. A red-tailed hawk, within feet of the road, helped itself to an unfortunate mouse.

After a meeting participated in by Skinner during which the Blue Hill Board of Directors sketched an ambitious education program, including daily school tours of its charming small museum and scientific facilities and use of its computer room for weather observation work by students and teachers, a large reception drew more than a hundred corporate sponsors, weather forecasters from television and radio, U.S. Weather Bureau officials, current and former Blue Hill employees, and professionals from many associated fields.

In his capacity as president of the board and chief mastermind of the rebirth of Blue Hill begun as far back as 1981, Dr. Bill Minsinger, a surgeon and Dartmouth instructor, served as master of ceremonies. Retired school principal Charles Orloff, the enthusiastic new director, made knowledgeable comments. Both have been meteorology buffs since childhood. With such leadership, it is clear the world-famous Blue Hill Observatory now has a vital new lease on life as it continues its 114th year of uninterrupted and vital weather studies. ♦

-Ben Ruhe

The All-Too-Convincing Condor

Some years ago, Scott Skinner was a member of a local kite club invited to fly at a nonprofit raptor center near Denver. Skinner, from Monument, Colorado, is president of the Drachen Foundation. The idea was to generate a little publicity for the center to help it with publicity and fund-raising.

"The center was a place where injured birds, from prairie falcons to owls to golden eagles, were rehabilitated after injuries such as broken wings, then released back into the wild," says Skinner. "They were mostly birds hit by cars, or ones that had lost their feathers, or had eyes missing, whatever.

"We kitefliers were positioned away from the cages where the birds were and some 50 people came to watch us fly. The birds themselves were in pens with views blocked to the sides, so they couldn't see each other and become nervous. But the cages were open to the skies.

"For myself, I chose a 10-foot Stan Swanson condor kite as the most appropriate thing to fly and put it up in the air only a couple of hundred feet.

"Within minutes, the raptor center people hurtled over and asked me urgently to take down my kite. It was terrifying the wild birds because of its convincing flight and enormous size. Some of the raptors had become so agitated the center personnel felt they risked injuring themselves in new ways. That wasn't the point of the kite fly at all obviously. I was of course happy to comply immediately by bringing down my kite.

"That's sort of the end of the story, except for me to pay a small tribute to Stan Swanson, who was able to create such a marvelously life-like tethered bird. He hit the nail on the head with that kite." ♦



Swanson's condor in flight.

Photo: S. Skinner

Tails, Tilt and Bridles: 3 Research Papers

By Ed Grauel

At age 93, the remarkable Ed Grauel of Rochester, N.Y., continues to research, design, build, fly, collect, exhibit, write and lecture on his long-time passion—kites. The Drachen Foundation Journal is pleased to present herewith another sampling of the unique research he has completed over the past decades.

Tails: Fat or Skinny?

Should a tail be long and narrow, or short and fat? Should it be attached directly to the kite itself, or at some distance away from the kite? Does it make any difference anyhow?

To get some answers, I made up four conventional 36-inch diamond-shaped flat kites exactly alike and in the same ripstop material. Then I made four tails 4 inches by 15 feet long, also of ripstop. The surface area of the tail was determined by trial and error to allow the kites to stay in the air in at least a 15 mile an hour wind.

One tail was attached directly to one of the kites, another an inch away, a third six inches away and the last six feet. Aided by assistants, the four kites were put into the air simultaneously and flown on the same weight of line, side by side. All observers agreed they could detect no significant differences either in the angles of elevation or in any other flying characteristics of the four. Conclusion: The distance from the kite a tail is attached makes no apparent difference. Nothing very startling here.

Next, three more tails were made in the same material. They measured 1 inch by 60 feet, 2 inches by 30 feet, and 8 inches by 10 feet. A fourth tail, previously used, measured 4 inches by 15 feet. Each was 720 square inches in size. One tail of each size was attached to each of the four kites on a two-inch lead.

The kites were again put into the air and minimum and maximum wind speeds plus normal angle of elevation measurements were taken for each kite. Not unexpectedly, since each kite carried the same 720-square-inch tail, the minimum wind movement required to lift the kites (five

miles an hour) and the normal angle of elevation achieved by each kite (57 degrees) was substantially the same for all four kites.

The maximum wind tolerance each kite would take before looping, diving or otherwise become erratic increased somewhat as the tails lengthened (from 20 miles an hour for the shortest to 25 miles an hour for the longest). But the principal results of the tests came from simultaneously observing the kites in flight. As it turned out, the primary difference was the way each kite would wander across the sky horizontally, through an arc up to 45 degrees.



Ed Grauel's "kitemobile"—a gas-guzzling 1966 Impala.

Photo: S. Skinner

The kite with the extra wide, shortest tail (6 inches by 10 feet) wandered widely in winds of 10 to 12 miles an hour; the wide, short tail (4 inches by 15 feet) started its wandering in the 14 to 16 mile an hour range; the medium width and length tail (2 inches by 20 feet) wandered at about 18 to 20 miles an hour; and the narrow, long tail (1 inch by 60 feet) flew steadily with very little wander up to its maximum wind tolerance of 25 miles an hour.

From this data it might be expected, all other things being equal, that a kite will take a higher maximum wind and fly more steadily in its orbit with a longer, narrower tail, than if it carried a tail which was shorter and wider. But for practical purposes, the ratio between the length and width of tails doesn't appear to make a whole lot of difference to most kitefliers—except perhaps the theoreticians and purists.

Causes of One-Side Tilt

Over a period of several years I managed to collect about 20 kites of various types which had one thing in common: even though each kite was supposedly symmetrical, each one tilted consistently to one side when flying in the air. When I couldn't readily detect the cause of the difficulty, I set the kite aside for later, and perhaps more mature, consideration.

I eventually completed a study of these kites and managed to isolate the cause or causes of tilt in each of the kites—except for one of them. This one, a keel-less delta with a flap or fold along the trailing edge, still completely baffles me. Perhaps the fold is flapping unevenly in the wind, but I haven't been able to observe such action.

Although each kite was symmetrical in surface area, spreader location, weight and length of wing spars, non-symmetry in any of those details would obviously have to be the number one cause of one-side tilt.

The second cause, as became clear from my testing, turned out to be uneven bending of the spreaders, usually as a result of uneven weight distribution in the material used for the spreader. Even though the spreaders appeared to the eye to be even and straight, by reversing them on the kite, the tilt moved to the other side of the kite, proving they were

The question sometimes comes up whether a tail with weights to create an additional gravity pull would work as well, or better, than a conventional tail, which depends upon the amount of wind resistance created. As a test of this, I made up a tail consisting of 75 feet of 20-pound braided nylon cord, eight quarter-ounce weights, and eight small streamers totaling 96 square inches of surface area.

In winds up to 12 miles an hour, a kite with the weighted tail flew as well as one with a conventional one, except at a higher angle of elevation. At 12 miles per hour, however, the kite became erratic and above that went into uncontrollable power loops and dives.

So, as a general rule, to stabilize an unruly kite, add surface area with the least possible weight.

bending unevenly in the air under wind pressure. Solution: a new spreader, preferably in a heavier weight.

Interestingly enough, the third most important cause was the spreader being too heavy or too light in weight. In these cases, it can be assumed the weight of the spreader moves the center of gravity of the kite either too far forward or rearward, and prevents level flying. Normally the center of gravity should be within 40 to 60 percent of the distance down the center mast.

Uneven pocketing, the leading edge folding in unevenly, the cover not taut enough along the center mast—these also proved important causes of some one-side tilting. To detect these problems required use of binoculars and long periods of watching the kites in the air under various wind conditions.

Other less frequent causes turned out to be the location of the towing point being too high or too low, center mast too heavy, or a too high aspect ratio (the kite being too wide for its depth), all of which might accentuate other asymmetries.

There were then, as I discovered, at least nine causes of one-side tilt, determined by my study of the 20 problem kites.

However, every kite, whether a problem or not, eventually develops a one-side tilt when it passes its maximum wind tolerance. At this point a kite will go into a power loop or power dive and invariably it will go in the direction caused by one or more of the difficulties cited above—or perhaps others which failed to show up in this study.

Best Bridle Location for Sled Kites

Over several years I managed to accumulate almost 20 sled kites of various sizes and features, made by different designers. As measured by minimum-maximum wind range and lift-drag ratio, the three best kites had bridle locations down 31, 30, and 27 percent from the leading edges. On this basis, I came to a tentative conclusion that approximately 30 percent from the top was the best location for most sled bridles.

To determine the validity of this observation, I made four sled kites 30 by 40 inches, all exactly alike except that bridle points were placed at 20, 25, 30 and 35 percent down from the leading edge. In addition, I made similar sets of sleds in half, quarter and eighth sizes a total of 16 kites for testing purposes.

Measurements of minimum and maximum wind tolerance and of the normal angle of elevation were taken for each kite, plus a subjective evaluation made of the flying characteristics of each kite.

For the full, half, and eighth-size kites, the 30 percent bridle locations proved best, but in the quarter size the 35 percent position was somewhat better than at 30 percent. While the measured differences between the 30 and 35 percent positions were small, there were observable differences in the flying characteristics. At the 35 percent position, the kites pulled harder, flew at a lower angle, were more sluggish on takeoff, and had more wobble in the air than at the 30 percent position. And this was also true for the small quarter-size kites.

Until and unless further data becomes available on this subject, my opinion is that a 30 percent position down from the leading edge is the best location for sled kites of various sizes, rather than the usual 33 1/3 percent position. ♦

Dangerous Big Kite Flying

By Peter Lynn

Here's an eyewitness report of the most irresponsible bit of gratuitously dangerous big kite flying I've ever seen.

At Sardinia last July while launching the Mega Ray, I allowed the tail to drop on and then relaunch from a beach restaurant.

As a throwaway comment during the prelaunch safety briefing, I had mentioned this as a

possibility, though until I unthinkingly altered the length of the side line lengths it was not in line. The "No Limits" team from Cuxhaven rather thought that trashing restaurants was in their job description and took on "tail patrol." Diverse objects like lights and antennae were ripped off the roof, a rubbish tin was elevated and its contents distributed over patrons seated outside and the concrete base from a beach umbrella was suspended like a sword of Damocles until it dropped back on the just new roof, cracking one of the main beams. Not the worst incident was pulling a parking sign out of its foundation and tipping it over.

Worst because Volker of the team was up it at the time, unhooking the snagged tail, and fell against a curb, cutting his lip.

I have always said of accidents in the past that they can be looked at two ways: either as lucky they weren't worse or as unlucky to have happened at all. This one was definitely one hundred per cent lucky not to have been worse. ♦

(Editor's note: Lynn is a Drachen Advisory Board member from Ashburton, New Zealand. He notes that he wrote this account while occupying seat 36A on United flight 842, but fails to reveal his destination.)



Photo: S. Skinner

Lynn deep in thought.

Letters to the Editor

Thanks From the Smithsonian

Dear Ali Fujino,

I can't thank you and your colleagues at the Drachen Foundation enough for your generosity in donating an original 1903 Samuel Franklin Cody poster to the collection of the National Air and Space Museum. When my nine-year term as chairman of the Aeronautics Department was coming to an end last year, I offered to take charge of the NASM kite collection, among other duties. As I'm sure you are aware, kites were the earliest flight-related objects in the Smithsonian collections. In spite of that fact, our museum has paid far too little attention to our holdings in this area over the past two decades. I intend to change that, improving the care given to the kites now on hand, as well as expanding and improving our collections. The Cody poster certainly represents an important step in that direction.

I have followed the work of the Drachen Foundation with interest for several years. As an historian of flight, I share the interests of your organization and applaud your goals.

*Sincerely,
Tom Crouch
Senior curator
National Air and Space Museum
Smithsonian Institution
Washington, D.C.*

Fan Letter From The Netherlands

Dear friends,

Finally was able to open e-mail file on Drachen's Samuel Cody symposium at Dieppe last year. My compliments. Symposia should be continued!

*Frits Sauve
The Netherlands*

Kids Having Fun With Kites

Dear Drachen folks,

We had a great time making kites and tried them out on the playground when we got back to school. Forty-five kids running with their kites! It was great. Some even flew high. So thanks.

*Loren Smith
Bryant Elementary School
Seattle, Washington*

'A Terrific Mix'

Dear Drachen,

The second issue of the journal had a terrific mix of pieces, and well done pieces. I especially liked the Wright Experience coverage, with a separate box for the two men's long quotes—an inspired idea. And *Stooping to Conquer* was fascinating. The journal really looks professional—the Pictures in the Sky and both the falcon pictures were superb.

*Ellen B. Phillips
Washington, D.C.*



Photo courtesy of Azteca Restaurants

"Jaime and Pepe testing out their homemade corn (as in tortilla chips) kites."—An advertisement by a Seattle-based Mexican restaurant chain in Seattle.

The Wright Patents

Dear Drachen,

In many of the books and articles I have seen about the Wright brothers, mention is made of their patents, but the number was never stated—could it be dozens or hundreds?

To find out, I took time to check the books listing patents issued for each year they were active—a two- or three-hour stint at the Erie County Library in Buffalo. I found only six patents issued in their names. The patents covered primarily controls for aircraft, rather than power source.

Here's a listing of the patents:

1. Number 821,393, applied for 5-28-03, issued 5-22-06, a biplane glider with controllable flaps to be operated by four lines;
2. No. 908,929, 7-15-08, 1-5-09, mechanism for flexing rudder on a flying machine;
3. No. 987,662, 2-17-08, 3-21-11, flying machine;
4. No. 1,075,533, 2-10-08, 10-14-13, flying machine with vane activated by air pressure;
5. No 1,122,348, 2-17-18, 12-29-14, flying machine with adjustable surface.
6. No. 1,504,663, 5-31-23, 8-12-24, method of changing cambers of upper and lower wing surfaces. The last patent was issued jointly to Orville Wright and a James M. Jacobs.

Note that the very first and critically important patent issued to the Wrights was for their glider of 1902, and not the famous Wright Flyer of 1903. The point is, the glider had all the elements, except power, necessary to permit the Flyer which followed to become the world's first manned, powered airplane.

Orville Wright was once asked if the biggest kick he got was when the Wright Flyer took off in flight. "No," he said, "I got



Greetings from Outer Mongolia,

Thank you for your #2 Spring 1999 issue of Kite Journal. You've profiled some really interesting folks and subjects.

*Sincerely,
June Carmichal
U.S. Embassy, Ulaanbaatar*

more thrill out of flying before I had ever been in the air—while lying in bed thinking how exciting it would be to fly.”

*Kites string along,
Ed Grauel
Rochester, New York*

Keep Your String Unknotted

Dear Drachen,

Exciting and informative content in the Spring '99 issue of the journal. I hope you are organizing a suitable celebration for the Wright centennial in 2003. It will have an audience from all generations. This anniversary is, in my view, of a greater magnitude than the millenium climax parties planned for the end of this year. Compliments and thanks, and don't get knots in your string.

*Richard Van Den Berg
Fountain Hills, AZ*

*Letters to the editor compiled by
Elizabeth Snodgrass*

On the Copycat Issue

(Editor's note: One of the most innovative kitemakers in the world, Peter Lynn of Ashburton, New Zealand, wrote the following essay on the theft of ideas in his June 1999 newsletter.)

Somebody who signs himself M.... has published a piece on the rec.kites internet site claiming that my acknowledgement of Paul Garber's target kite development in 1940 as being the foundation for my firm's new winch and brake bar for kitesurfing somehow therefore sanctifies those who want to copy some of our designs now. M..., this is drawing a very long bow, one that is bent, has a frayed string and lacks an arrow, to carry the analogy to the limit.

Innovations can be protected by copyright and patent; if this was not so then there would be little incentive for innovators to expend the huge efforts that are required to come up with truly new things. But, this protection is for a maximum of 16 years approximately (depending on the jurisdiction) and this too is necessary to maximize the long term social benefits of invention.

From 2049 you have my full permission to copy any of my 1999 designs, in fact, you only have to wait until 2015 and then you don't even need my permission to copy, and you will honor me by so doing, as we honor Paul Garber and the many contributions he made to the world of kiteflying.

Kite Song

*First you run with it riding behind you on a short string
feeling the shape of it tugging in tight light gasps
already moving towards freedom
Then you feel the wind take it
and you turn quickly, running backwards,
paying out the string fast as the wind demands
It shivers once or twice with a tissue thin buzz
and then mounts rapidly,
taking the string like blood
from the pumping heart of your hands*

—John Ratti,
"Samson's Riddle,"
New York 1985

Hay on Wye is a small Welsh village renowned as the home of more than two dozen used bookstores. Amid such literacy, is it a surprise that the area's lone kite store named itself "Way on High?" (Not to be outdone in wit, patrons suggested "High on Wye," and "Wye Kites Fly.")

High-Flying Weather Forecasts

Going kiteflying? If so, and if the weather looks dicey, you might log in on the new web site www.kitecast.com which gives all kinds of detailed information on prospective flying conditions in 36 U.S. cities and their regions. Because it is advertiser-supported, the site is free. It is provided by Weather Services International, a Litton Industries company.

In addition to the weather outlook, the site provides information on kites, such as flying tips, principles of flight, the effects of wind and so on. There is a photographic gallery and even an essay on indoor flying, the very point of which is to avoid weather problems entirely. Information in general is quite sound because the site is advised by both the American Kitefliers Association and American Kite Trade Association.

ABOUT THE NEW AUTHORS

TOM CROUCH

Senior curator of aeronautics at the Smithsonian's National Air and Space Museum in Washington, D.C., Tom Crouch went back to original sources and wrote an essay to mark the centennial of the Wright brothers kite of 1899. In his words, "it is the most detailed account of this aspect of the Wright story prepared to date." He delivered it at a gathering at the Aviation Heritage Park in Dayton, Ohio. Crouch is the author of many books, including "The Bishop's Boys," one of the finest accounts of the Wrights and their epic invention, the airplane.



JOHN STEVENSON

After taking a degree in modern history at Oxford, John Stevenson lived and worked in East and Southeast Asia for 20 years. Here he became familiar with some of Asia's vibrant kiteflying traditions. Now based in Seattle, he has been acting curator of Chinese art at the Seattle Art Museum and is currently involved in book production at the University of Washington press.



RON SPAULDING

Ron Spaulding is an expatriate American who has lived in Bangkok for many years, speaks the language fluently and has a Thai wife. An advertising executive, he early on became interested in Thai kites and has devoted himself to keeping the tradition of their making and

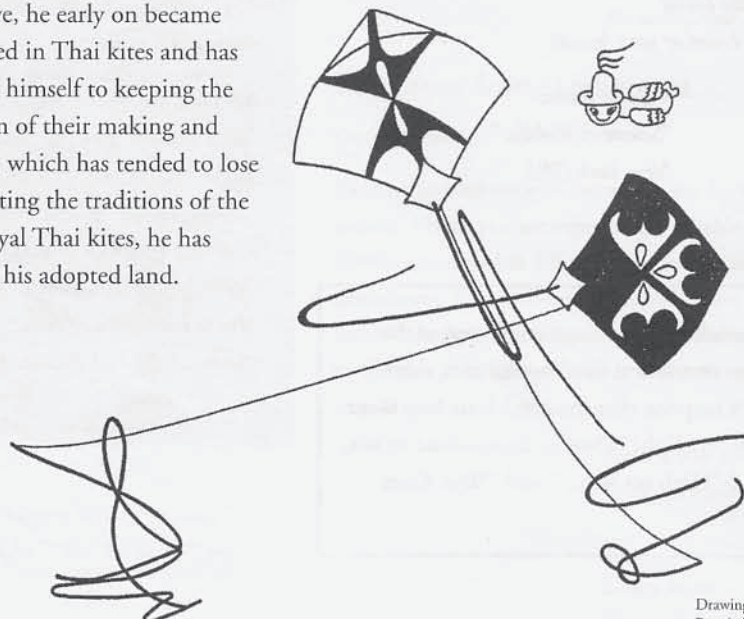


Photo: A. Fujino

flying alive, in an evolving culture, which has tended to lose interest in the old ways. By promoting the traditions of the famous and completely unique royal Thai kites, he has made a significant contribution to his adopted land.

DAVID WAGNER

An expatriate American living in Singapore, David Wagner creates large stained glass installations for a living and makes, flies and writes about kites as a hobby. He specializes in Malaysian kites in particular and Southeast Asian kites in general.



Drawing by Mary Jo McKinnon
Permission to use given by Joe Vaughn

THE DRACHEN JOURNAL

This journal is produced by The Drachen Foundation and is issued twice a year.

Single copies and subscriptions (including back issues) are free to anyone interested. Contact the Foundation administrative office with your mailing address.

If you have questions or comments about the Kite Journal or kites in general, please submit them to:

The Drachen Foundation
1905 Queen Anne Avenue North
Seattle, Washington 98109-2549
telephone: (206) 282-4349
fax: (206) 284-5471
email: info@drachen.org

ABOUT THE EDITORS

Ali Fujino has been a museum specialist since age 19 and early on became fascinated with anything that can become airborne.

Ben Ruhe is a writer who regularly contributes articles to special interest publications on topics as diverse as boomerangs, flint-knapping, and tribal art.

Scott Skinner, a former pilot instructor at the U.S. Air Force Academy, has been a kite enthusiast for two decades. He is dedicated to promoting interest in kites and kitemaking worldwide.

Elizabeth Snodgrass, an amateur anthropologist, is a Drachen Foundation aide and compiles this publication.



Fanciful drawing by Harm van Veen of Gravenhage, The Netherlands. From the Scott Skinner collection.