

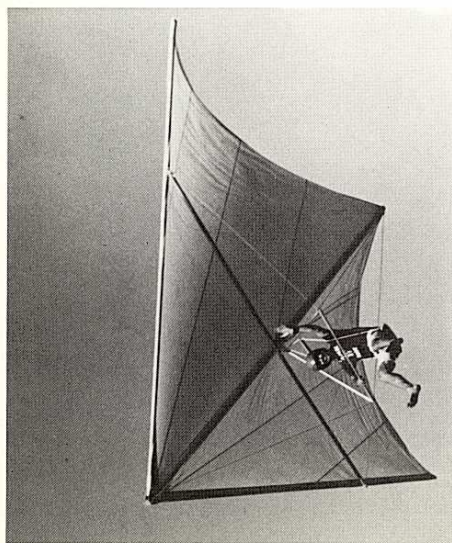
Dan Poynter

6 The American Experience

Modern hang gliding starts with Rogallo, the man whose name is almost daily on the lips of every hang glider pilot in the world. Even now, thirty years after he created the portable, folding, flexible wing that was half kite and half parachute—and was nearly used to retrieve space capsules from orbit—he remains more celebrated in the sport than any later designer, than the greatest pilots. He did not build the first hang glider, nor fly the first, but like Henry Ford, he produced the machine that lit a flame around the globe. Hang gliding now takes place in at least fifty countries, and in such as Australia, France and the United Kingdom has expanded at an astonishing speed. But the United States of America remains its home, with by far the greatest number of exponents of the sport. From here, Dan Poynter contributes this expert and detailed history of its development.

Francis Melvin Rogallo has carved a niche in the annals of hang gliding not as a pilot or builder, but because his kite has been adapted and is the most popular form of hang glider seen in the air today. Rogallo was born in 1912 in Sanger, in the middle of California, and as a child often flew kites. Recalling his youth, he said: 'When I was seven years old, an airplane flew over our town and I decided to make aeronautics my career. When I was 13, I saved enough money to buy a ride in a dilapidated Curtiss Jenny over Fresno, without first discussing the possibility with my parents. Today, I probably wouldn't fly in the same airplane if it were free.' Rogallo went on to graduate from Stanford University in 1935 with a degree in mechanical-aero engineering and worked briefly for Shell Chemical and Douglas Aircraft. Then he moved on to Hampton, Virginia, and the Langley Laboratory, later the Research Center of the National Advisory Committee for Aeronautics, where he was in charge of the Full-scale Research Division of the Low Speed Vehicle Branch. In 1939 he married Gertrude Sugden, who later shared in his work. (The patent for the Rogallo wing was taken out in the names of them both.)

The point of no return: Marvin Drewery about to step off Stony Man into the Shenandoah Valley, Virginia. This is the moment when faint hearts yearn for a nice game of chess at home, rye on the rocks, and hamburgers to follow. What a fine mess you got me into, pal!



Dan Poynter

Rogallo recalled: 'At the close of the Second World War, we thought the NACA should initiate research that would give the average citizen a better opportunity to fly by developing a more practical and less expensive airplane. The NACA decided not to undertake such a project, so Gertrude and I decided to work on it at home in our own time. One of our goals was to develop an inexpensive rugged wing that could be folded easily when the aircraft was on the ground—like a bird or bat folds his wings.'

Their experimental work resulted in the patent application in 1948 (granted in 1951) for their 'flexible kite'. The preamble to the specification on the patent reads as follows:

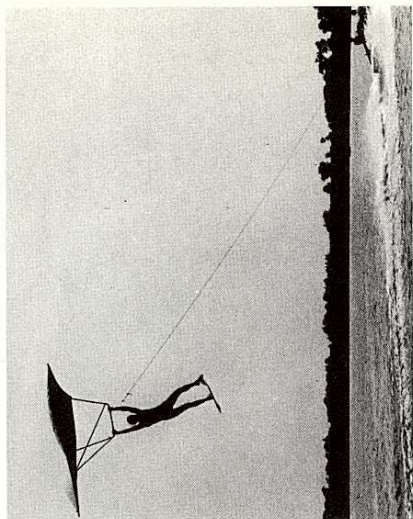
This invention relates to kites and more particularly to a kite having completely flexible surfaces.

It is an object of our invention to provide a kite of simple and economic construction and wherein the use of reinforcing members may be ordinarily eliminated.

It is another object of our invention to provide a kite which will be simple to fly and graceful in flight.

It is a further object of our invention to provide a structure for a kite having improved aerodynamic characteristics.

In general we achieve the above object by constructing a kite of a substantially quadrilateral piece of fabric, paper or other light and flexible material, having bridle strings attached at various points, and a tail secured to the kite when necessary, so that the stress in the strings exerted at strategic points of the kite's surface maintains the kite in



Nobody does it this way for too long, unless he has the grip of a gorilla and plastic arm-pits. In Australia and the United States, a lot of guys with flat kites were towed on water-skis behind motor boats, giving them lift-off without the sweat of climbing a hill.

proper shape and configuration to be effectively supported even in a light breeze. Owing to the fact that our kite does not require the use of stiffening members, it is considerably lighter than other kites of the same area and hence more easily flown in a light breeze.

Though all of that relates only to a kite flown on an anchor line, the last page of the Rogallo patent application contains this interesting extract:

Further, we believe the principle described herein may be applied to man-carrying devices, such as airplanes, parachutes and gliders, and in such event stabilizing and control surfaces could be added.

Long before this, some special circumstances arose that awoke the dormant sport of hang gliding in the United States. Early in the war, in 1941, the Government banned all flying within 150 miles of the California coast. A frustrated enthusiast, Volmer Jensen, built a nice, quiet hang glider that had three axis controls and actually flew. During the next thirty-plus years he built more than a score of gliders, powered planes and amphibians. His modern hang gliders are some of the best-designed and most professionally produced.

In 1951, the then 30 year-old sport of water ski-ing was enlivened with the addition of the flat kite. In 1957, Rollie Bonneau learned of the flat kite in France and took it home to Ontario. That same year, an Australian, Doug Leishaw, introduced it to the famed water ski show park in Florida, Cypress Gardens. The kites were flat in design, similar to a toy paper kite. The flyer would hang on to the cross bar as if he were 'chinning' himself. The length of

time he remained in the air depended on just how long he had the strength to hang on. The first kites were not aerodynamically designed, so the altitude of their flight was mostly determined by how much the flyer pushed off as he skied over the water ski jump. They soon became more sophisticated and a wild Floridian named Ken Tibado directed his talents towards building and flying them, winning the first World Kite Championships at Cypress Gardens in 1957. With the addition of a swing harness, the flying became less strenuous, certain trick manoeuvres became possible, and the pendulum action of the new suspension made the system more stable.

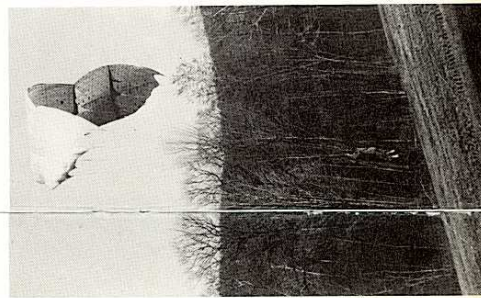
Later refinements allowed 'hands-off' flying and control of the kite's lateral movement by moving a bar. A boat-end release allowed the observer in the boat to jettison the flyer if he got into trouble; the kite would react as an air brake and settle into the water. Flat kite flying became easy and reasonably safe, and before the end of 1957, Alphonso Woodall of Cleveland was towed all the way across Lake Erie to Canada, demonstrating that kiting was not a momentary feat.

The water skiers soon adapted the flat kite to their slalom course; they would swing the bar to tilt the kite and fly around the buoys on each side of the course. Then certain gymnastic routines performed on the bar developed into another event called 'tricks' and competition began. The American Water Ski Association began sanctioning kiting tournaments.

In 1958, Sputnik was launched and the United States suddenly found itself in the space race. Interest renewed in the Rogallo kite principle; they were air dropped, towed and motorized. Millions of dollars were spent by NASA (National Aeronautics and Space Administration) and the armed services on trying to develop them into useful vehicles. A great deal of basic research and testing was done, and reams of reports were printed. NASA built and flew the Paresev test vehicle, while the US Army and Ryan Aircraft Co. developed and flight-tested a variety of towed gliders for aerial delivery of cargo and equipment. Some were so stable that no guiding was necessary from lift off to touch down. Some were released at altitude and radio-controlled to a predetermined landing point. With the simple attachment of a flexible wing, several ground vehicles, including a jeep, were towed aloft.

All this activity and the resulting publicity stimulated the thought of people all over the world. One was Barry Hill Palmer, who writes of his work in 1961: 'I had been working on man-powered aircraft and other aero absurdities when two people where I worked at Aerojet General, in Nimbus, California, came to see me independently and showed me a magazine photograph of Ryan's first powered flex wing. I don't know whose light went on or whose buzzer went off, but the conclusion was that a hang glider could be built. I sized up the wing and studied its performance, using a digital computer, in late 1961. But as you know, ideas are cheap and it's the doing

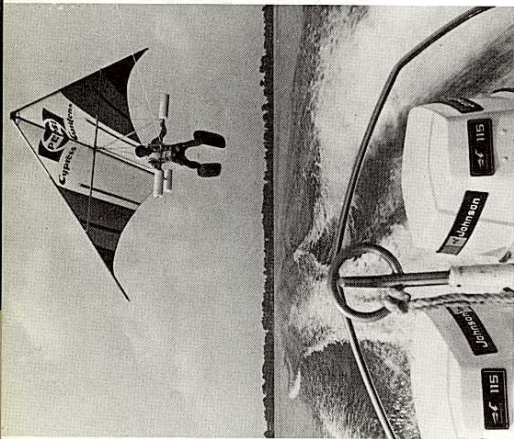
There were many attempts to make more practical use of flexible delta wing principles. Below: a Rogallo-type parachute and, right, the intriguing powered Ryan Flex Wing: 'the craziest kite in the sky', 1962.



that counts. The first wing I built was a 22 footer. Analytical studies indicated that the 80 degree apex angle then used on Rogallo wings was too narrow, so it was opened up to a conservative 90 degrees. I was concerned about the very problems in pitch that are now doing-in some of the fliers. My first wing, in its final development, was the wing that re-started hang gliding. It performed quite well, after a learning period required to fly an aircraft that was not guaranteed to fly. By 1962, three of us, John Sealman, Kenneth Clarke and myself were flying the wing and then John went on to build the black wing using first class construction and a \$130 cost to match. Mine cost little over \$10.

Typical flights were started with sort of a hop, landing, a skip and the flight. Why I would make the preliminary jump, I don't know, but everyone else did the identical thing. The flight would usually run some 120 yards.

The American Experience



Today, this sort of operation is reckoned as part of water-skiing and not of hang gliding.

The longest, which resulted in some very sore and tired underarms, was over 200 yards. The aircraft flew at around 10 to 15 feet altitude but gusts would lift it much higher, to a maximum of 80 feet. Later on I developed a fully-flared landing into the wind with essentially zero forward speed. Things became more interesting when we discovered that we could land the wing at zero forward speed in zero headwind, quite a feat for a fixed wing aircraft. So Barry Palmer was the first to foot-launch a Rogallo wing, an historic moment in the development of hang gliding.

The first swing seat came around 1963. Rather than borrow the swing that the water skiers were using with their kites, Palmer fashioned a ski-lift type of seat and mounted it to the wing with a home-made universal joint. A single stick projected down from the wing and carried the wing structural support. He later went on to build and fly some very successful powered versions.

In North Carolina in 1961 Tom Purcell, Jr, towed aloft a Rogallo wing, to which he added floats and flew behind a boat. In 1963, John Dickenson, an Australian engineer known as the 'Father of Kiting', was the first water skier to put down his flat kite and try a Rogallo. He found that the delta-shaped kite's altitude could be varied by changing the angle at which it flew. It was Dickenson who introduced the Rogallo to fellow-Australian water-ski kitemen Bill Bennett and Bill Moyes, who continued to fly the product he designed and built. At first the flat-kite advocates ostracized the delta, and then tried to force it into the mould of the flat kite competition. But soon the Rogallo was found to be more versatile; it could be released at altitude to glide back down to a landing. It was a whole new concept. The new Rogallo flyers preferred free flight to the captive tow line and many lost interest in competing with flat kites.

One of the most famous creations in the history of the sport: Richard Miller's original Bamboo Butterfly, right; and a later model, below.



Richard Miller

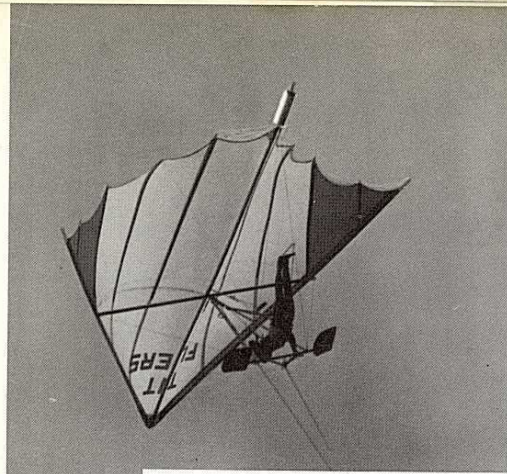
At about this time, another of the memorable names of hang gliding emerged: Richard Miller, who was to build and fly the 'Bamboo Butterfly'. In an early edition of the American magazine *Low, Slow and Out of Control* he wrote: 'It was during an idyllic six weeks on Cape Cod in the autumn of 1962, much of it spent climbing on the great dunes that face the Atlantic, that the urge to build a hang glider once again rose to the surface.' That winter he learned the basic details of a Rogallo wing, and the following summer built a design study of one.

I was running a parachute loft at the Oakland Airport when in walked Miller in early 1964 searching for materials for his 'Bamboo Butterfly'. This particularly literate sky dreamer knew where he was going, but I am not sure he knew how he was going to get there. He was intensely interesting and we talked of numerous forms of aviation. He returned again about three weeks later all battered and bruised and announced: 'I'm learning how to fly!' His craft was mostly bamboo reinforced with fibreglass, and a six-millimetre polyethylene sail, twelve feet square with grommets along the side for attachment. The crossbar was a warren-truss affair. Later Miller went on to become editor of *Soaring* magazine, to do a great deal of writing and to inspire many others to dream and fly.

Others were equally impressed with the Rogallo concept, among them the US Government, who in July 1963 presented the inventors with the largest cash award ever made by NASA for a scientific contribution. (Rogallo recalls: 'This award was contested by the Internal Revenue Service, however, and after final settlement ten years later, the Federal and State income taxes and interest and legal expenses just about equalled the amount of the award.') During the space race in 1966, NASA was working on three deployable gliders for manned spacecraft recovery: The Rogallo Para Wing, the Jalbert Para Foil and the Barish Sail Wing. They were in a hurry and they poured in the money. (There is a story that compares NASA's approach to development with making nine women pregnant—in order to produce a baby in one month.) Dave Barish foot-launched his sail wing as a testing method. I worked for Barish at the time, tried the wing, liked it and wrote about it. The army looked into a personnel version of the delta wing and several were quickly produced by Pioneer Parachute Co. and Irvin Industries for tests. Irvin went on to manufacture them and they were marketed to the sport through Steve Snyder Enterprises as the 'Delta II Para Wing' in 1969.

Another to have read some NASA reports, and to have heard of Barry Palmer's work, was Jim Natland, but he was not aware of any other Rogallo activity. He is credited with building and flying the first Rogallo hang glider made of aircraft-type materials, which he did in Rolling Hills, southern California. The glider is now on display at the Aerospace Museum, Balboa Park, San Diego. In 1966-7, he moved his activities to the tenth green of the Huntsville Golf Course in Alabama. He says of his flying: 'I worked alone on it for about two years and was pretty much ridiculed by spectators and became kind of a local nut because of it.' Natland made many long ground skinning flights; often 150 feet long and between three and seven feet high.

In 1967, Bill Moyes launched on snow skis from Australia's Mount Crackenback and glided more than five miles, for another of the sport's 'firsts'. Then he released from 1,000 feet after a tow lift. Bill Bennett, who worked with Moyes, brought the first water ski Rogallo kite to the US in April, 1969, while Moyes took his kite and toured Europe. Dave Kilbourne, a water skier/kiter, met Bennett at Marine World and provided the boat for several demonstration flights in San Francisco Bay. Bennett went on to tour the US and then decided to settle and start a kite manufacturing business in the Los Angeles area. Bennett's kite was smaller and it supported the flyer in a seat, while most of the foot-launched people were hanging by their arms from parallel bars and shifting their weight to guide their craft. It never occurred to them to control the kite any other way. Dave Kilbourne, recognizing the superiority of the Australian water ski kite control system, took the glider out and foot-launched it. He became the first to foot-launch a Rogallo with the triangular control frame and swing seat system.

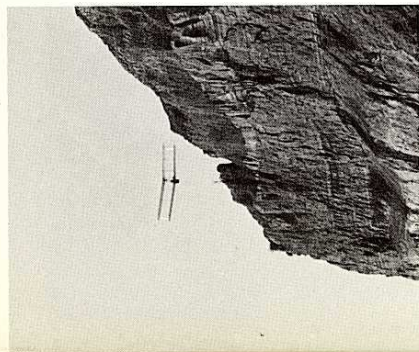


Two of the great pioneers, both Australian water-ski enthusiasts who came to the States: Bill Bennett and Bill Moyes. Both kites use floats; Moyes, above, has extra buoyancy on the keel tip.

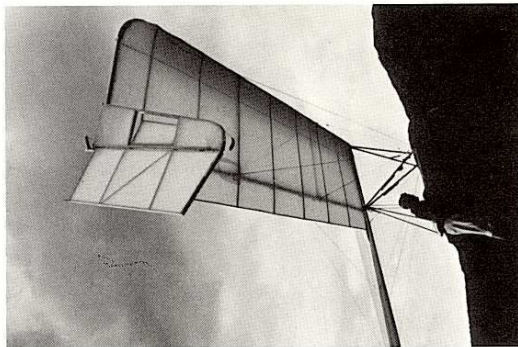


Later in 1969, Moyes became the first to soar. He foot-launched near Sydney and stayed aloft some 32 minutes, flying back and forth on the uprising air. Also that same year, he towed to 2,870 feet over Lake Ellesmere in New Zealand on 12,000 feet of cable payed out from a winch. After Bennett's early 1970 visit to Cypress Gardens, the Rogallo glider displaced the flat kite in the four-times-daily ski show. Bennett demonstrated the flying ability of the new kite by climbing up behind the ski boat to release and go into free flight. After several fantastic manoeuvres, he made a perfect landing on the beach, to everyone's amazement.

All this time, Terry Sweeney was building and gliding biplanes in the mountains of New Hampshire; more than a dozen of them. He had no knowledge of the flying being done in the 'outside world'. He thought he was the only one. It was Tom Peghiny who 'rescued' him and turned him on to Rogallos. Tom and Terry continued to work together designing better gliders. It was 6 September, 1971, when Dave Kilbourne foot-launched

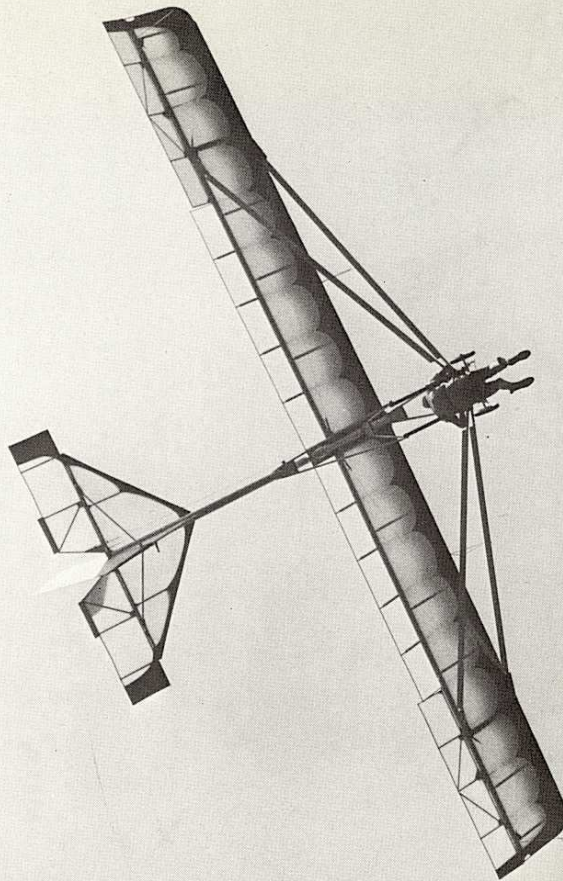
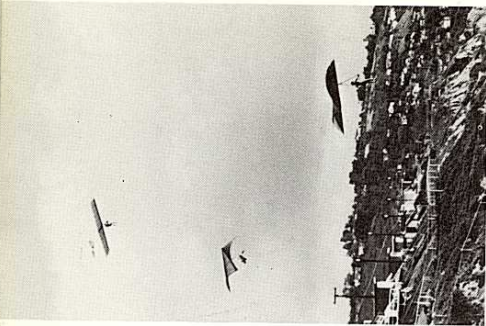


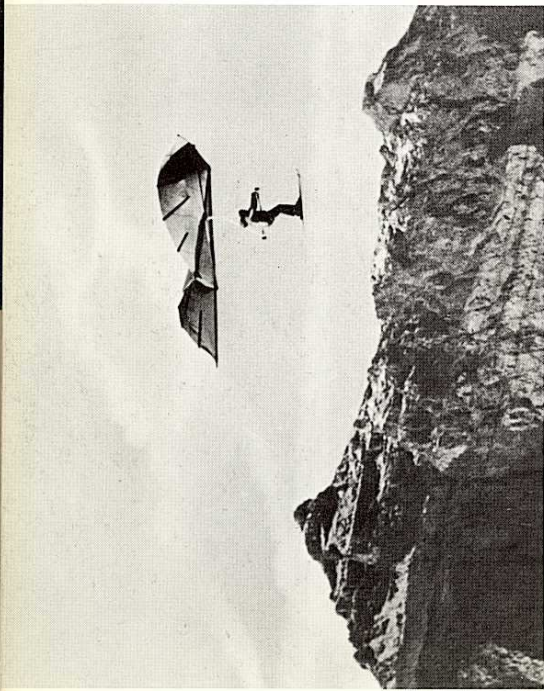
The most technically advanced hang gliders use wings that are more rigid than flexible, making folding and transport difficult. These are all models of the Icarus developed by Taras Kiceniuk, shown left in the harness of an Icarus V.



from Mission Peak, near San Francisco, to soar for 1 hour 4 minutes. Taras Kiceniuk quickly followed in his Icarus I biplane. Jack Lambie sponsored a hang-gliding meeting on 23 October, 1971, to honour the birthday of Otto Lilienthal. It brought numerous enthusiasts and some incredible machines together; the movement gathered momentum. Volmer Jensen watched the take-offs (and crashes) and returned for consultations with Irv Culver. The VJ-23, a cantilevered monoplane with three-axis control, was the result.

Below and at the top of the picture, right, another high-performance glider, Volmer Jensen's VJ-23 in a 90 minute flight over Torrance Beach, California, the 62 year old designer at the controls.

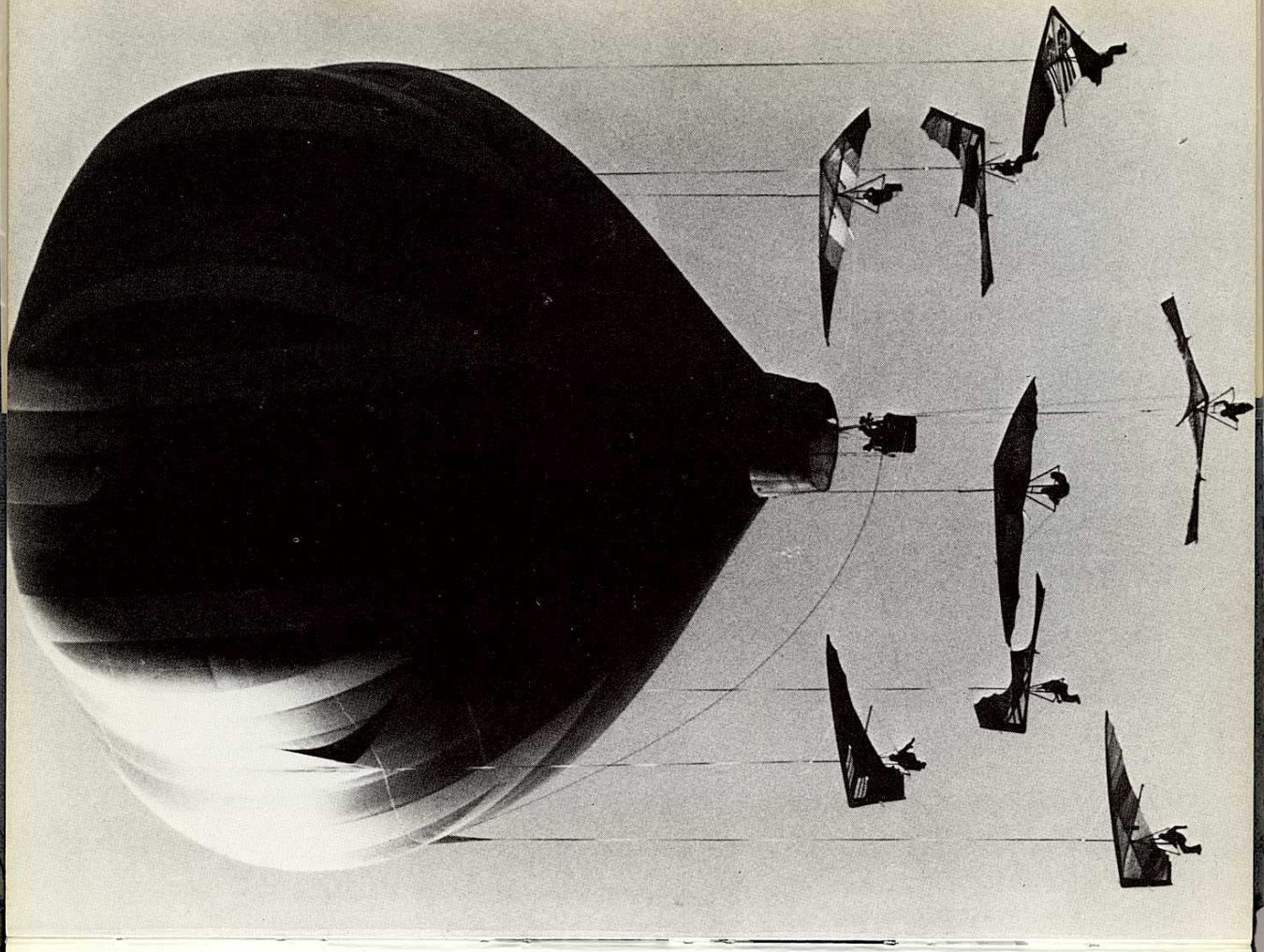




In the early 70's the race was on to see who could go the highest or furthest. In 1970, Bob Kennedy launched from a balloon over Lake Elsinore, California. The next year, Bennett towed to 2,960 feet on a 7,000 feet polyethylene boat-winch line over Lake Havasu in Arizona, in conjunction with the reopening of the transplanted London Bridge. Then Moyes airplane-towed to 8,610 feet over Amery, Wisconsin. Next, Kilbourne balloon-launched from 9,200 feet. In 1972, Moyes towed to 4,750 feet over Lake Ellemere behind a 70 mph jet boat. Later, Bennett and Kennedy made the first two-man flight on the 'Duo-Delta' for a half mile in Mission Bay, San Diego.

The United States Hang Gliding Association began as the 25 member Peninsula Hang Gliding Club in December, 1971, under the leadership of Dick Eipper. It soon attracted membership from neighbouring areas and early in 1972 became the Southern California Hang Gliding Association. A monthly publication, *Ground Skimmer*, started in May of that year. Begun as a news vehicle for the membership, it soon grew to be a comprehensive recording of movement history, technical articles and so on. Though it was probably the first club publication, *Ground Skimmer* was not the first magazine for the hang glider pilot. *Low, Slow and Out of Control* was the first published in March, 1967, but it only survived for six issues. In March, 1971, Joe Faust began publishing a monthly, *Low and Slow*. Subsequent national publicity resulted in an explosion of memberships. By the end of 1973, more

Once in a lifetime? The world's biggest hot-air balloon (310 feet tall) lifts eight Eipper Performance Cumulus VBs, designed by 1975 world champion David Cronk, for a mass drop over California. Cronk is the pilot bottom centre of the picture.



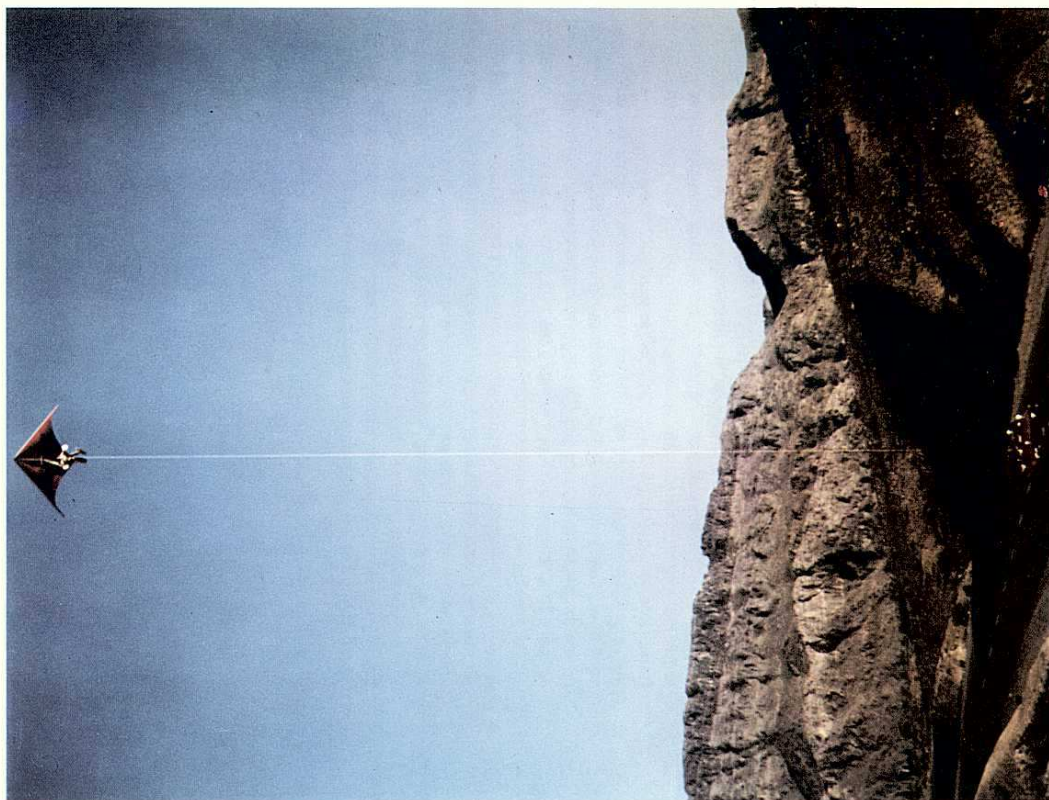
Mont Blanc is 15,766 feet high. About the same altitude is Rudy Kishazy in 1973, with skis and ski sticks in case of need.

than 5,000 were on the rolls and the organization had become truly national in scope. The name was changed to the United States Hang Gliding Association and membership passed 10,000. (There are at the time of writing at least 25,000 hang glider pilots in the States.)

Modern hang gliding began to be publicly noticed when a regular 20-foot sand flying site was established in 1972 at Playa del Rey, on the edge of Los Angeles. To quote Bill Allen: 'It was like any other day, except that if you were at Playa del Rey that weekend in May 1972, you would have seen an unusual assortment of strange flying craft. It was a slice out of the 'old days' of hang gliding, but it also came as growing popularity was changing the sport. Soon it would be no longer just for tinkers and people simply interested in the joy of creativity and flight. Instead, popularity would bring the availability of plans, kits and even complete, ready-to-fly gliders. And with these would come commercialism, with both its benefits and vexations. But on this sunny day, nobody looked at your tee shirt to see what company you were associated with. Nobody criticized your surplus tubing, bamboo, plastic or baling wire. And there was only shared laughter when the aeronauts went home with more pieces than they brought. It was assumed they would be back in a few days with repaired or new gliders—ones which probably would fly better anyway.'

One day that year, the media happened on these happy weekend flyers and suddenly the local Los Angeles pastime excited the nation. George Uveges and Bill Allen supplied the photographs. Between Joe Faust and the SCHGA, people had places to write for more information. Thousands of letters poured in. Information went out and the sport exploded! As more and more people became excited about hang gliding and jumped in (off?) to pioneer the new sport, accidents began to happen at an alarming rate. People were towing kites with automobiles, snowmobiles, dune buggies, motor-cycles or often just an eager bunch of helpers at the other end of the rope. Often they didn't know how to water ski, drive a boat, fly a glider and many did not even make initial towing trials over water. Tow lines were breaking, kites were diving into the ground, and there were structural failures. Foot-launched hang gliding was no safer; it too was expanding faster than the instruction. Anyone could buy a mail order kite—and they did. Anyone could build them—and they did. Anyone could open a school—and they did! The foot-launched kites were not designed for the stresses of towing and their manufacturers justifiably warned against it. The accidents continued and the American Water Ski Association withdrew its support and sanction of any kind, asking the flyers to form their own organization. The SCHGA stood by its Bye-laws and recommended foot-launch only. In some countries, hang gliding is still part of the water ski group.

It was not until mid-1975 that knowledge caught up with enthusiasm and



Is there no end to it? Bill Bennett (still clad ready for water) takes a trip attached to a car.



Aussie Steve Moyes (son of Bill) about to release his Dragonfly from a tow over Cypress Gardens, Florida, home of much hang gliding competition.

the fatality rate began a welcome decline. Significantly, this coincided with a shake-out in the industry. Purchasers would not settle for just anything that flew. It had to be safe and fly well; they knew the difference. Many manufacturers, schools and dealers closed their doors.

Harry Robb, a retired Air Force colonel, is credited with reunifying foot-launch and tow-launch hang gliding in the US. A well-known water ski judge, Robb directed the Rogallo tow-kite championships at Cypress Gardens. He drafted the competition regulations and set an example for foot-launch. He invited me to judge the 1974 meet. They were so exciting I wrote a book on the sport entitled *Manned Kiting*. Robb wrote articles, educated the USHGA Board of Directors and was eventually successful in having the Bye-law towing exclusion removed. During this time, he was elected to the USHGA Board, was appointed alternate delegate to the Commission Internationale de Vol Libre (Hang Gliding) of the Fédération Aéronautique Internationale, and was then elected Secretary to that body.

In the design field, all were started by Roy Haggard's truncated-tip Dragonfly glider at the January 1975 Nationals at Escape Country. He and his design went to work for Ultralite Products and he demonstrated the new craft to the world at the Alpine Championships in Kossen, Austria, in March. Everyone returned to their drawing boards. Many still thought that tow-kites had to be smaller and that battens were only used to keep poorly-tailored sails quiet. There was a design revolution going on. Early in 1976, gliders with battened radial wing tips made their debut. They were so much more stable in pitch that all previous gliders without the special tips were pronounced dangerous. Through the early seventies, many rigid wings were developed but none sold terribly well. The basic Rogallo shape could always be redesigned to improve the performance far more easily than a rigid could be designed for portability. And Francis Rogallo, retired in Kitty Hawk, North Carolina, smiles and makes another flight.

7 Echoes around the World

Hang gliding grows so fast it is difficult to keep track of the number of its followers even in your own country. A survey in 1975 suggested there were 40,000 hang gliders in the world, of which 25,000 were in the USA. France and the United Kingdom jostled for second place, sharing 6,000, but subsequently Australia claims to have overtaken them both. The speed with which the sport has grown is dramatically illustrated by the situation in Britain, where the first issue of *The Illustrated Monthly Fly Paper* in November, 1973, supposed there were fewer than a hundred fliers in the whole country.

A month later, the National Hang Gliding Association (of which *Fly Paper* was the organ) reported 585 members. In January there were 872, in February 1,130. By May the figure was 1,600 and in November nearly 3,000—an increase, if they were right in the first estimate, of a staggering 2,000 per cent in a year; and an accurate one of 500 per cent in Association members in eleven months.

A second national organization, the British Kite Soaring Association, was formed at the end of 1973, and the NHGA almost immediately began to woo them into amalgamation. They proved to be somewhat reluctant brides. At this time, the NHGA was run virtually single-handed by one enthusiast, John James, and it was not until December, 1974, that a new and more democratic association, the British Hang Gliding Association, was formed from the membership of the two existing bodies. (By that time the Scottish Sailing Association had come into being, but it chose to remain independent until the beginning of 1977, when it joined the BHGA.)

The executive of the new association settled swiftly to serious work, and the monthly magazine changed its name to *Wings* and took a more responsible attitude to its members and the sport. Hitherto the prevailing atmosphere had been understandably light-hearted, if not positively Monty Pythonesque. By the end of the year the Association had drawn up codes of