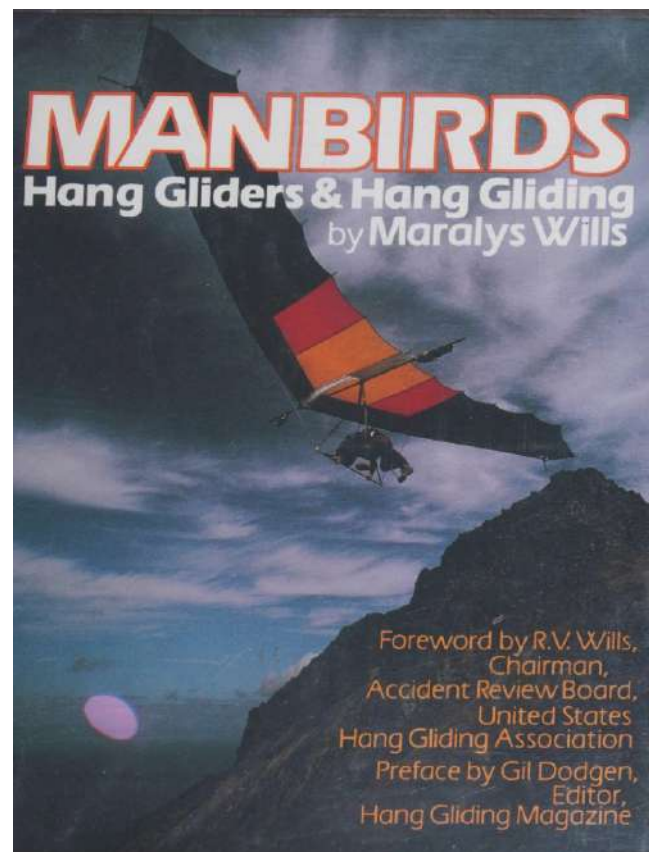
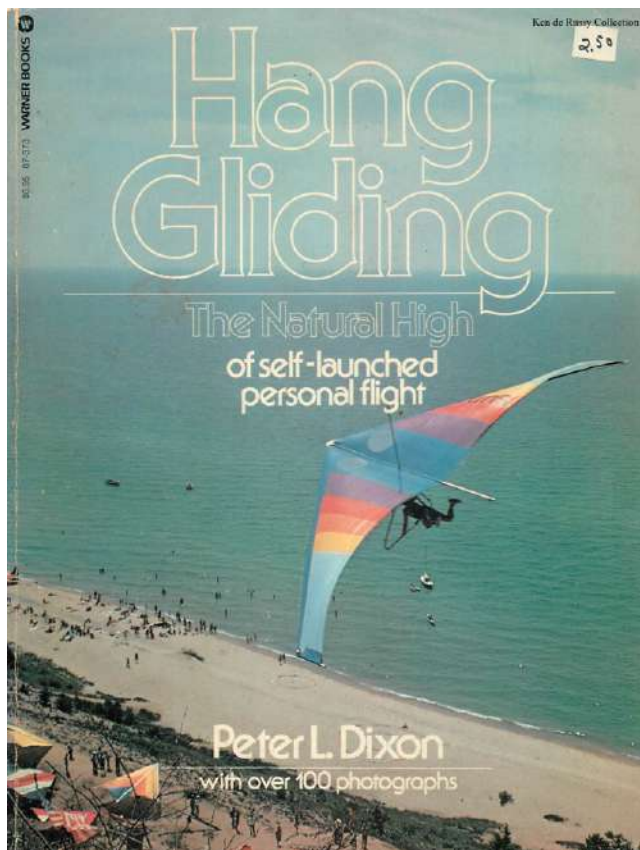
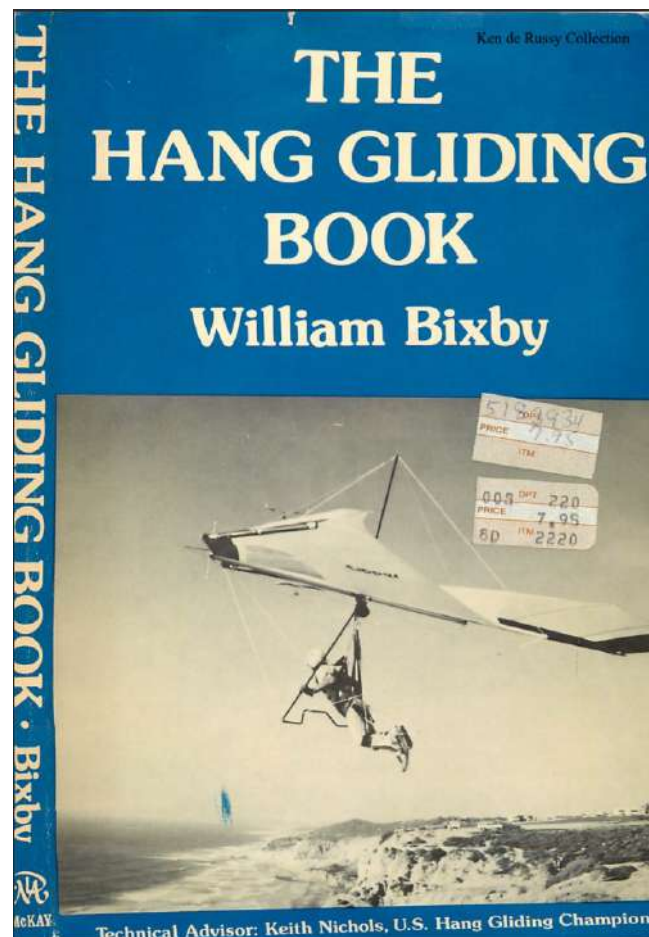
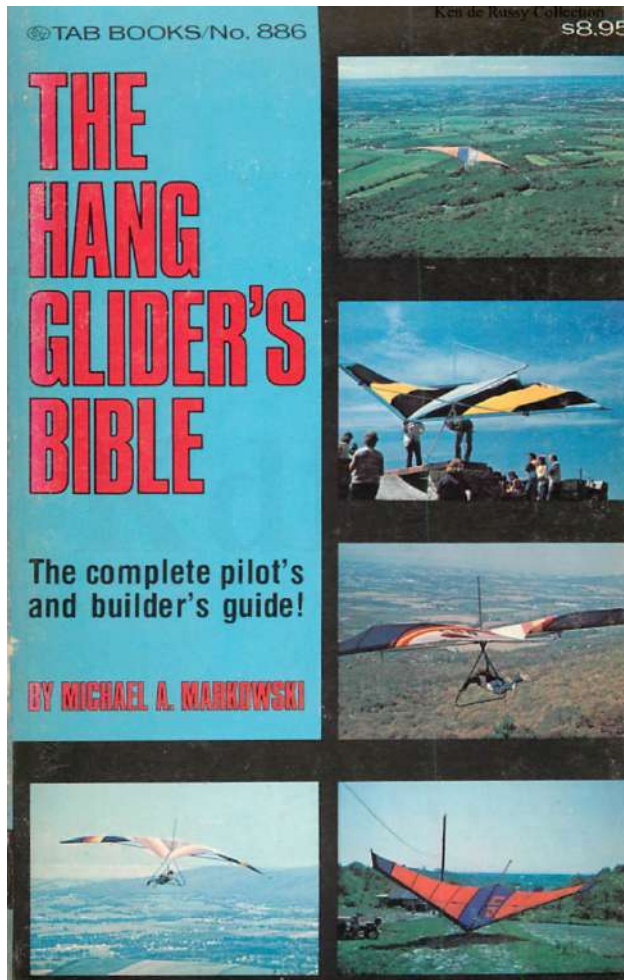




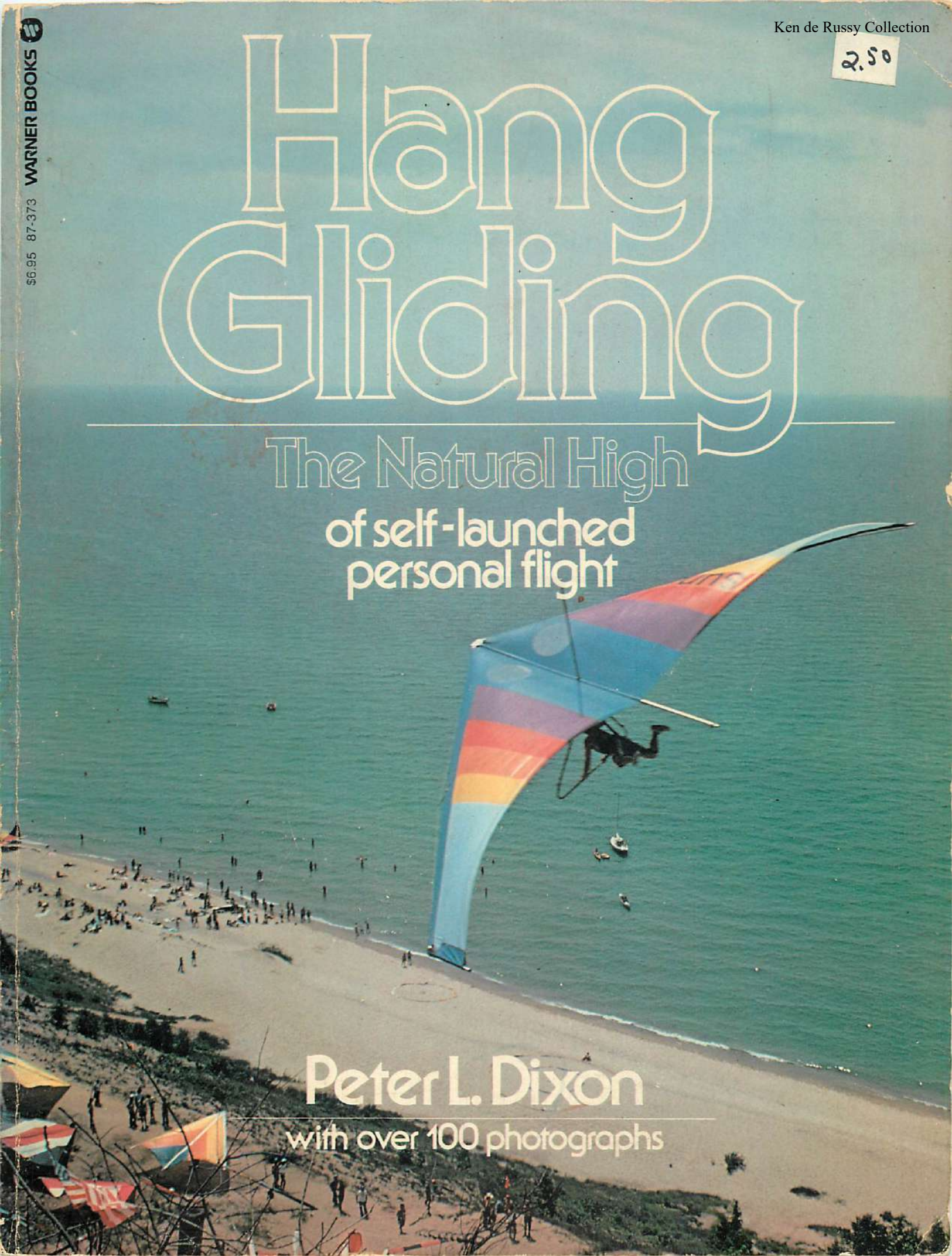
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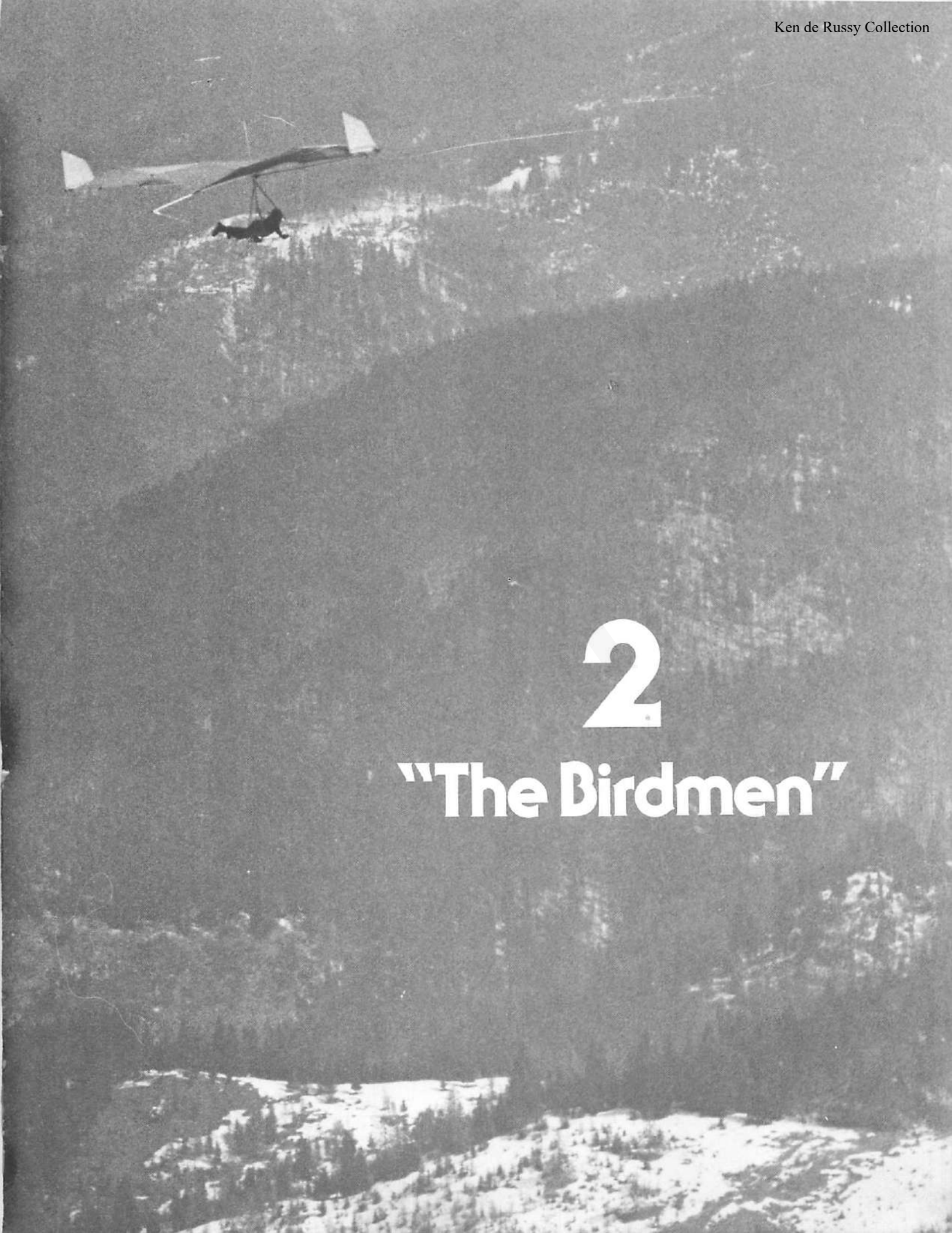
Hang Gliding

The Natural High
of self-launched
personal flight

Peter L. Dixon

with over 100 photographs





2

"The Birdmen"

From the very beginnings of civilization man has looked skyward, envied the birds, and then dreamed of himself soaring through the air. From the earliest bits and pieces of recorded history this has proven so. Archeologists digging in the ruins of ancient Babylon uncovered what may be the first legend of man's dream of flight. Cuneiform symbols, etched in stone, tell the story of the shepherd Etana and his flight on the feathered back of a giant eagle.

Etana's village was punished for some reason by the gods, and suddenly all the women became barren and no children were born. Etana heard of a plant that grew far away which would make the women give birth again. When the shepherd found an injured eagle he realized that here was the living vehicle to carry him in search of the miracle fertility plant. Etana healed the eagle and in return for his kindness the great bird carried the young herdsman to the goddess of birth, where the cure was supposed to be found. But the goddess Ishtan hurled the boy from her temple, and without the eagle's wings he fell to his death.

Greek myths of men trying to fly like the gods usually ended with the mortal falling from the heavens for his audacity—and the famous legend of Daedalus and Icarus certainly points out what happened when man challenged the gods' prerogative of flight.

The ancient dabblers in science, the flight dreamers, and the practical men who saw the sky as an aerial ocean for commerce all considered how to make wings that would flap and fly. Even the genius inventor and dreamer of great dreams Da Vinci was lured onto this false

trail of flapping-wing flight. Quite naturally his designs of flying machines were based on studying birds. The creative Da Vinci also devoted his energies to studying and sketching designs for helicopters and parachutes. Though he never attempted flight, one of his students, another young dreamer of man-flight named Astro, was crippled in an attempt to launch a flying machine he had built from Da Vinci's drawings.

The flapping-wing flying machine builders were given a final sharp setback when the Montgolfier brothers, Joseph and Étienne, sent aloft the first lighter-than-air craft—a paper balloon filled with hot air. Before the Montgolfiers could themselves ascend to the sky they had to overcome tremendous opposition, surmount problems of wind and weather, and secure permission from King Louis XVI of France. On September 19th, 1783, their balloon was ready for demonstration. The King, Marie Antoinette, and the court of France were assembled to witness the first passenger flight—and the passengers were a sheep, a cock, and a duck. As the brightly decorated blue-and-gold sphere fought to rise, three cannon shots exploded over the gardens of Versailles and the balloon winged upward. As it climbed higher and higher, the assembled court found their tongues and a great cheer echoed over the palace.

What of the sheep, the cock, and the duck?

The animals suspended below the balloon climbed swiftly to 1600 feet, drifted with the winds for 20 minutes, and landed gently some two miles away. The three animals were found in sound health, and at last man knew that the upper airs were



Soaring birds can teach us much about motorless flight.

Photo: Peter Dixon

not poisonous. By royal decree the three animals lived out their lives as honored subjects in the King's menagerie.

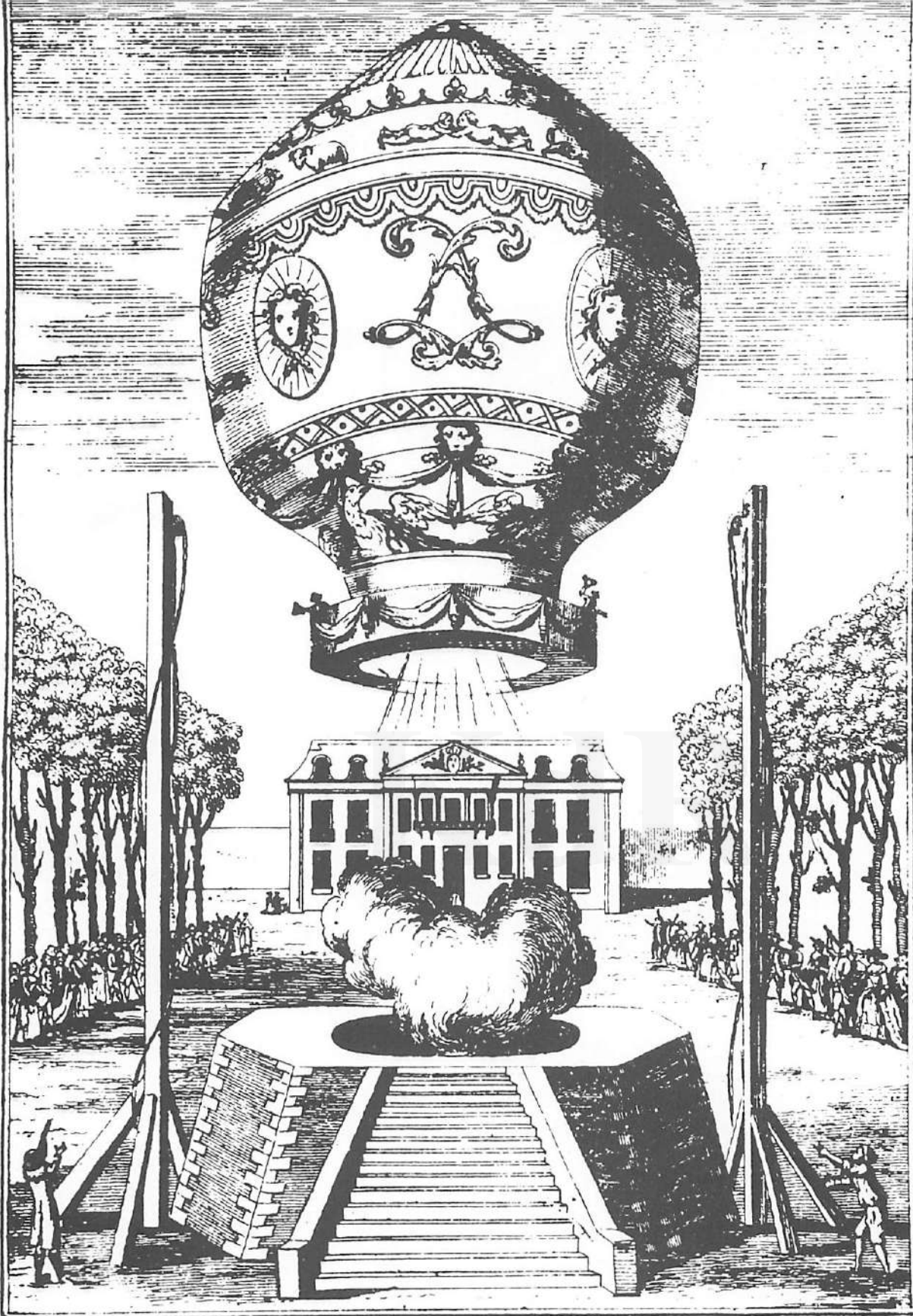
Now the Montgolfiers were ready to prove that a human could fly. For the balloon's pilot they picked the aristocratic François Pilâtre de Rozier, a young Frenchman whose pioneering work with "inflammable air" (hydrogen) led to gas-filled balloons. After many practice flights on a tether line the Montgolfiers decided the time to launch had arrived. Just before the ascension de Rozier's friend, the Marquis d'Arlandes, decided he would accompany the young scientist. When the two men were aboard the gondola and the balloon would contain no more hot air, de Rozier nodded at the Montgolfiers, who cut the taut restraining lines. The day was November 20, 1783. Historic.

It flew. It soared upward. De Rozier and d'Arlandes looked down at the gaping, dumbstruck throng that seemed to be moving away from them. They were flying. The earth dropped away.

Below, among the thousands of spectators was an old and very wise man, Benjamin Franklin, the American ambassador to the court of France. Another observer turned to Franklin and asked, "Of what use is it?"

"Of what use is a baby?" answered Franklin.

The balloon landed safely, and man's first flight ended 9000 yards from launch. The time aloft for de Rozier and the Marquis was just under 25 minutes. Later, during an attempt to fly across the English Channel, de Rozier was killed in the first aircraft "crash" when his combina-

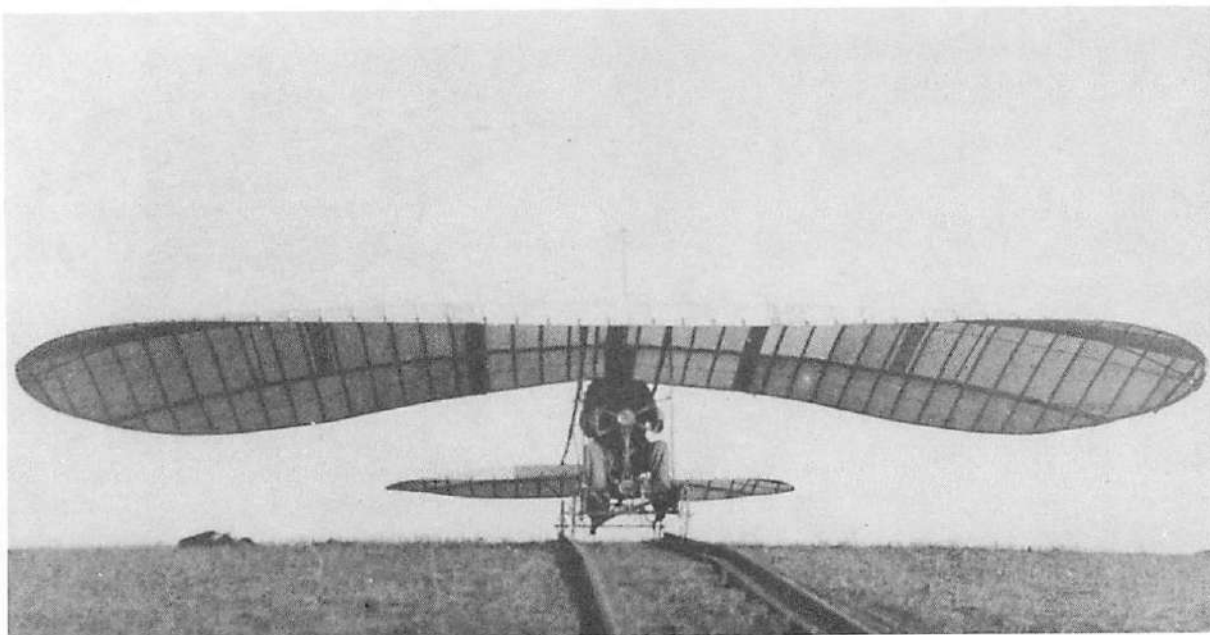


The first man to fly: Pilâtre de Rozier and the Marquis d'Arlande ascend in the Montgolfier balloon from La Mutte, Paris, November 20, 1783.

Filled to approximately 70 percent of capacity, an Alpine Balloon starts on its way over the peaks to Italy.

E. A. Sautter





Univ. of Santa Clara

Joseph Vierra pilots Montgomery's 1911 glider at the Ramada Ranch, California, launch site—now named "Montgomery Hill," a state historical monument.

tion hot-air-and-hydrogen-filled balloon caught fire and he fell to earth. The first man to fly was the first to die in a flying accident.

Balloons dominated flight for the next sixty some odd years. Balloonists brought their gasbags to young America, and the craze began in the new world. Napoleon Bonaparte was the first to make military use of the balloon. By 1835 long drifting flights were being made. The record distance at that time was a flight of 1120 miles from St. Louis to a point near Watertown, New York. Still the proponents of flapping-wing flight persisted, and their contrivances imitating birds continued to crash. What the bird fanciers were overlooking was the shape of the wing. At last George Cayley, a distinguished British scientist, realized in the 1840s that a certain shape of wing would overcome the forces of gravity. Cayley published a

report on aeronautics in which he outlined the basic principles of flight, that is, "to make a surface support a given weight by the application of power to the resistance of air." He was saying that air must be forced over the wing to create lift. By 1848, Cayley had constructed a glider to carry a 10-year-old boy, and it "floated off the ground for several yards on descending a hill..." Sir George also came up with the idea of landing gears for aircraft and launching devices to send gliders aloft.

Was Cayley's 10-year-old test pilot the first hang glider flyer?

The 1890s saw a rush of creative ideas all leading to that moment at Kitty Hawk when the Wright brothers made their powered 12-second conquest of the air.

In Europe, Otto Lilienthal led the way toward successful heavier-than-air flying. Lilienthal had grown up in Germany and had studied the graceful flight of storks.

From the stork he realized that gliding flight should be learned before a hissing steam or snorting gasoline engine could be placed aboard an aircraft. Being persistent and methodical, Otto spent thirty years studying the problems of flight before he built his first glider in 1891. During the next five years he made over 2000 flights of short length and duration.

Photographs of Lilienthal gliding through the air appeared in newspapers throughout the world. His exploits encouraged the Wright brothers, Percy Plicher in England, and the little-known John Montgomery of Otay Mesa near San Diego, California.

Lilienthal's cotton-covered and bam-

boo-framed gliders were making longer and higher flights. Early reports stated that the German was actually rising higher than his starting point, making turns and gliding over a thousand feet. If Lilienthal did climb and fly higher than his point of launch, then he was the first flyer who actually *soared*.

Otto and his brother Gustave finally reached the degree of flying skill where motor-powered flight was the next logical step. By 1896 they had completed a power-driven airplane. On a glider flight to test the controls for the machine-driven plane Otto went into a sharp bank, probably stalled, and failing to recover, crashed and was killed. Heartbroken, Gustave

John Montgomery airborne. Note shadow under glider.

Univ. of Santa Clara



never tried their powered plane. Had Lilienthal survived, the glory that came to the Wright brothers might have been his.

During the same year, Percy Plicher, inspired by Lilienthal's flights, built a series of five gliders and made remarkably long flights over the English countryside. His longest gliding flight took him across a valley for a distance of over 800 feet. His launch was down a hill, and two galloping horses supplied the tow power. Plicher also began work on an engine-driven craft. As he was testing controls on his last and most successful glider, "The Hawk," a guywire snapped, the wings collapsed, and the Englishman lost his life.

On the other side of the world, among the brown and sun-drenched hills of Southern California, John Montgomery studied the blurred photos of Lilienthal in flight and read the sensational accounts of his gliding exploits.

Montgomery began gliding at Otay Mesa just north of the California-Mexico border even before Otto Lilienthal did. At the completion of his first season of experimentation, the Californian claimed to have glided over 600 feet, and this was back in 1883, which would make Montgomery the "father" of gliding. However, his real accomplishments occurred a few years later, just after the turn of the century.

In 1905 Montgomery found a remarkably brave and skilled young man to act as his test pilot. When he teamed up with Dan Maloney, his progress in gliding moved ahead rapidly. Together the two began a series of aerial launches from a hot-air balloon. First drops were made from a height of 800 feet. As experience and confidence developed, Maloney started launching from altitudes of 3000 feet.

Later he increased his drop height to 4000 feet and demonstrated quite remarkable control.

These early flights created a sensation, and Montgomery soon gathered an enthusiastic following of would-be aeronauts. Maloney's flying ended with a fatal crash in 1908, and Montgomery retired from flying for several years.

Montgomery's compulsion to fly overcame his grief, and he returned to his workshop and flying dreams. And out of the shop came the *Evergreen*, his last and best glider. The *Evergreen* flew well. Glides of 9 minutes, which broke the non-powered flight record then held by the Wright brothers, were reported. During a low-speed stall just above the ground, Montgomery's glider caught a wing tip and crashed. The *Evergreen* was hardly damaged, but Montgomery was thrown against the frame; his head struck a bolt which penetrated his skull and the California aviation pioneer died. The *Evergreen* remained in a garage for years until flying buffs from the Lockheed Missile and Space Company rebuilt the glider and donated it to the University of Santa Clara, California, where it can be seen today.

Along the shores of Lake Michigan, America's outstanding railroad and bridge engineer was also pioneering glider flight. In 1896 Octave Chanute, at age sixty, left his construction engineering to turn to heavier-than-air flying. His achievements in a biplane glider were remarkable. After careful research in his Chicago laboratory, Chanute and his team established a Lake Michigan gliding camp and began a series of experimental flights which proved his glider airworthy. By the time Chanute had reached age

sixty-five he had completed some 2000 accident-free gliding flights.

Chanute brought out a remarkable book, *The Progress of Flying*, which the Wrights used heavily in their initial study of aviation. His efforts and those of the Wrights took place at about the same time, and the two groups corresponded and shared information. It was Octave Chanute who suggested the Atlantic Coast areas of the Carolinas or Georgia as a suitable location to conduct glider tests. This advice led the Wrights to Kitty Hawk, North Carolina, and to their 12-second powered flight that certainly was the major flying event of the twentieth century. Not even the moon landing of

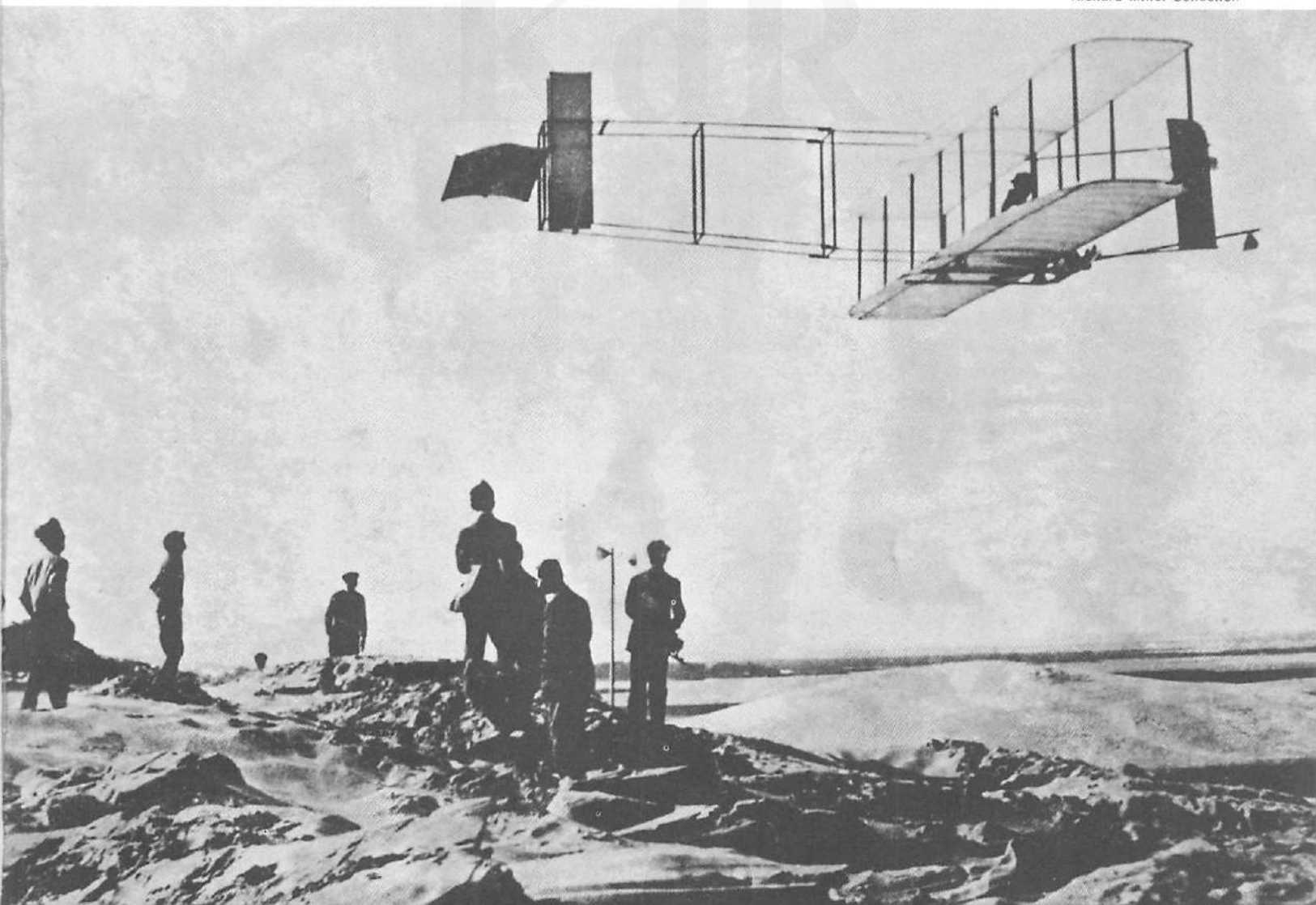
1969 matched this first staggering hurtle into the air.

The beginnings of both true flight and successful gliding must be credited to Wilbur and Orville Wright. The story of this young team of bicycle-builders from Dayton, Ohio, and the first airplane is really the beginning of today's sport of hang gliding.

In 1896, the same year that Lilienthal plunged to his death and Chanute was gliding down the Lake Michigan sand hills, the Wright brothers had begun their own study of the dynamics of manned flight. They spent the next four years studying all available information on flying and planning their own design and test

The 1910 Wright brothers glider. This model set a record of 9¾ minutes aloft which stood for ten years.

Richard Miller Collection



program. The Wrights moved ahead slowly, cautiously, but deliberately. They began by flight-testing tethered and winged kites to study controls. They next invented the wind tunnel in order to observe the flow of air over models of their craft's wings, and in the fall of 1902 the brothers made their second trip to Kitty Hawk to test their prototype flying machine—the first Wright glider.

During that autumn of 1902 the brothers made over a thousand gliding flights. Their glider responded well, full turns were made successfully, and distances of 200 yards and more were flown.

The most important gain from the numerous flights down Kitty Hawk's Kill Devil Hill was actual flying-gliding time. Lilienthal, for all his effort, had managed to amass only 5 hours of flying time in five years of experimentation. The Wrights exceeded this very quickly and grew confident they were on the proper course. The following year the brothers designed and built their own engine, installed it in the craft, and returned to Kitty Hawk. On a cold windy day, December 17, 1903, Orville made the first powered flight—a tiny hop of 12 seconds and 100 feet. By the end of that first historic day, the Wrights had stayed up for a flight of 59 seconds and had flown a distance of almost 1000 feet. Within two years the brothers could fly circles and had set a flight record of 24 miles in 24 minutes.

The bicycle-builders from Dayton continued to fly by power and glide. By 1910 their glider had actually soared and had remained airborne for 9¾ minutes. This flight over the dunes of Kitty Hawk stood as the world soaring record for over ten years. Here's what Orville wrote in 1919

about their soaring attempts:

Our early experiments at Kitty Hawk were conducted for the purpose of developing a method of maintaining equilibrium in the air and also to learn something about soaring flight. It was from Lilienthal's experiments we became interested in this. At Kitty Hawk we had the opportunity of witnessing daily the soaring flights of the buzzards, fish and chicken hawks, and eagles. Attempts to imitate bird flights without a motor have not been very successful, although in 1902 and 1903 we made a dozen or more flights in which we remained in the air for more than a minute with no, or scarcely any, descent; and in 1911 Mr. Alec Ogilvie and I continued the soaring experiments at Kitty Hawk and succeeded in making a number of flights of more than five minutes' duration (the longest of which was nine and three-quarters minutes) without loss of any height at all. In many cases we landed at a higher point than the one from which we started. I see no reason why flights of several hours' duration cannot be made without the use of a motor. But, of course, these flights must be made in rising trends of air—a condition required by all birds for soaring flight.

Orville Wright had observed birds carefully and correctly—for soaring, it was not flapping wing that carried the buzzard or eagle upward, it was lift and the shape of the wing.

After the Wrights demonstrated that flying machines and gliders were practical devices, others took up the attempt to design better machines for motorless flight.

The period between 1911 and the end of World War I saw a refinement of the open biplane glider in which the pilot hung from the fuselage and controlled flight direction through body movement and weight-shifting. Controls and instruments were nonexistent and pilots cast their frail gliders into the winds from hills, sand dunes, and off any handy cliff or barn

roof. Flights were short, landings hard, and minor injuries frequent. These "hang-type" gliders gave early pilots their basic experience—experience and confidence that would lead to true soaring flight in the years immediately after the first World War.

Soaring then came of age in Germany with the end of the Great War. The defeated Germans still retained an aircraft industry and a cadre of skilled pilots. Under the terms of surrender the Germans were forced to dismantle their wartime aviation industry, the means to build powered fighter and bombing planes. However, the flyers remained, and gliders could still be operated.

Tony Fokker, who had built great numbers of successful fighters for the German air force, returned to his native Holland when the Allies marched in to occupy Germany. Trying to save his aircraft factory, Fokker loaded his machines and what aircraft he could save on two trains and rolled into neutral Holland. He was soon back to building planes and gliders.

Fokker's first glider was a converted World War I D-8 fighter without machine guns and motor. It still looked warlike because of the fast paint job which didn't quite cover the camouflage or the black German Air Force cross on the wings. Tony Fokker was one of the first to launch by aerial tow, using another Fokker fighter to pull his conversion aloft. Later he took his pontoon-fitted glider off from a Dutch canal with the aid of a speedboat tug, another first.

In central Germany, not far from the present East German border, the high rolling hills around Wasserkuppe became



Richard Miller Collection

The *Blau Maus* of the early 1920s gliding over the Wasserkuppe, Germany.

the staging area for the final assault to capture the art of slope and ridge soaring. The German flyers, prohibited by the Versailles Treaty from operating conventional aircraft, took to gliders. At the time they were not interested in training for another war—they simply wanted to fly again, and at Wasserkuppe soaring and modern sailplanes literally took off.



Back in August of 1929, the *National Geographic* carried a photo article titled, "On the Wing of the Wind." This report by Howard Siepen was the first printed story to deal with modern gliding on the Wasserkuppe.

"In Germany today hundreds of school boys are flying," Siepen wrote. "Three thousand took official instruction in 1928.... In the plane of the German boy there is no engine, it is true; yet he actually flies!... Any school boys of fourteen years may enroll. Instruction is free...."

Even then there was a sharp distinction between gliding and "sail flying." The secret of thermal soaring was slowly being revealed. As one pilot of that period said, "Today pilots of highly sensitive sailplanes 'hang' themselves under a cloud and are carried along and even sucked up by the uprising wind. This current may revolutionize the science of gliding, for it may enable a flyer to travel long distances."

From 1920 through 1935 German glider pilots led the way and completely dominated international gliding. They held all the world soaring records from Lillienthal's glide of 1300 feet (the first distance record) in 1891 to Oeltschner's flight of 313 miles in 1935. Only three distance records were held by other nationalities, and these were quickly beaten by German glider pilots.

During the fall of 1920 the first milestone was passed as Wolfgang Klemperer flew 1.13 miles at the first post-World-War-I glider meet at Rhon. Klemperer's ship, the *Schwarzer Teufel* (Black Devil), was the first glider to be launched by a rubber-band-like shock cord (bungee). His ship was a full-skinned monoplane

that showed excellent performance for its day.

Next came the *Vampyr*, another monoplane design considered by many to be the first true soaring aircraft. *Vampyr* was light; loaded, it weighed just over 400 pounds, and the glide ratio allowed the thin plywood flying machine to travel forward sixteen times its height. On Klemperer's first flight his *Vampyr* stayed aloft for over 15 minutes and by the fall of 1922 flights of 3 hours were made. The flights of the *Vampyr* demonstrated to the world that the age of soaring had begun. No longer would glidermen have to coast down the slope of a hill or cast themselves off cliffs. Now they could stay in the air for hours and even go short distances across country. The secret of staying aloft on the rising air pouring up and over the Wasserkuppe hills had been discovered by Klemperer and others. The next secret to uncover was thermal soaring.

Discovering lift has always been the major problem of glider pilots. The senses a human possesses are not sufficiently keen to feel slight lift and sink. A more sensitive instrument than the seat of the pants or the ear and eye is needed—the variometer. With the first variometer aboard his *Rhon Geist*, and a desire to win the \$1200 prize for the first glider flight to exceed 100 kilometers, Robert Kronfeld launched from the Wasserkuppe hill. Kronfeld won the prize, took his money, and had a new glider built. This was the famous *Wien* (Vienna) of 1929 and in it Kronfeld soon was making longer cross-country flights. The following year Kronfeld launched from Wasserkuppe and landed 103 miles from the hill. Kronfeld had mastered ridge and storm-front flying,

but had not yet made use of true thermals.

True thermal soaring came in 1930, but not in Germany. Across the Atlantic, over the fields and gentle mountains of Elmira, New York, Wolf Hirth (yes, another German) was the first to make use of thermal circling technique to soar. Wolf came to the United States with the express purpose of promoting soaring—not gliding, but true soaring.

Soaring in America began with the importation of a gaggle of Germans and their sailplanes. The Germans came to give demonstrations and hunt for the best soaring sites. They also started the first American gliding school at South Wellfleet, Cape Cod. The Germans and their American counterparts, with Wolfgang Klemperer leading, formed the Allegheny Mountains Soaring Exploration Expedition and set out to find good soaring country. Their hunt led them to the area of Elmira, New York, and what has now become the famous Harris Hill soaring site.

On this survey trip Klemperer flew one of the first American-made high-performance gliders built by the Baker McMillen Company. In his *Condor*, Klemperer made several long slope soaring flights. As a result of the explorations around Elmira, Harris Hill was chosen as the site of the first United States soaring championships in 1930, the contest in which the German glider ace Wolf Hirth flew his *Musterle* skyward in a strong thermal and suddenly recognized the potential for using upward-flowing currents of air. Hirth first used this technique of circling upward in a thermal on October 2, 1930, and flew that day from Harris Hill to Apalachin, New York, a distance of slightly over 100 miles,

a remarkable flight for those days. Before he came to the United States, Hirth wrote *The Art of Soaring Flights*, the first modern text on the sport. His book, revised many times, is still in print in Germany.

Fred Harris of Holiday Soaring School grew up right by the base of Harris Hill and remembers clearly Wolf Hirth's first flight. "Like a lot of young boys in those days I was aviation-minded and gliders weren't a new thing to me. I had never seen one before but I knew about them. We were down on the river below the hill launching a racing shell when I happened to look up and see the glider. It was just coming off the hill and a lot of men were pulling on the shock cord. As the cord snapped it lifted off. It was really beautiful. The wings were covered with transparent linen and you could see right through them. The sun coming through the fabric made the wings appear light and delicate and Hirth's glider looked like some giant glowing bird. I was hooked on soaring from that very moment on and I guess I've never yet got unhooked."

From that day on, soaring became an established part of Elmira and Harris Hill, New York. Fred recalls that during the thirties when people didn't have much else to do they would gather by the hundreds to watch the gliders working the slope breezes of the hill. "Sometimes there would be as many as thirty of them flying back and forth, and people would spend all day just watching. The same sort of thing also drew big crowds to Torrey Pines in California."

Harris Hill has become the first museum in the United States devoted to soaring. The field and the 330-acre Harris Hill County Park are open to the public, and

glider flights are offered at \$10 a ride. There's even a special reduced rate "Fall Foliage Flying Festival" held when the fields and woods around Harris Hill are ablaze with the colors of autumn. Within the museum are displays and models of historic gliders and bits and pieces of the history of American soaring. A visit to Harris Hill should be a pilgrimage for all those interested in soaring.

Soaring received another boost in 1930 when Charles and Anne Lindbergh temporarily switched from power to sailplane. They both earned their "C" awards (numbers 9 and 10 respectively) flying a Bowlus.

The Bowlus sailplanes, built by Hawley Bowlus, were the first U.S.-designed high-performance craft, and several early records were established in these ships. Bowlus gliders became famous, and Hawley Bowlus pioneered soaring along the slopes fronting the Pacific Ocean in Southern California.

Sports soaring ended abruptly during World War II. Many glider pilots went into the service. Some served aboard military gliders, though most flew combat propeller-driven aircraft. Both German and Allied forces employed gliders in large numbers to carry men and cargo in airborne assaults.

The large numbers of war surplus gliders available to the public at the end of combat helped start a postwar gliding boom that has never slowed. These ex-military ships allowed many new pilots to get their first tastes of soaring. At the first contest held after the war, over two-thirds of all gliders entered were surplus ma-

chines. The numbers of war-built trainers in competition use declined slowly, and finally in 1964 the last of them phased out of national meets.

Soaring buffs predicted an explosive growth in their sport once the war was over. They were wrong. The age of leisure time took twenty years to reach. At Elmira the Schweizer brothers had a tough time surviving the first few postwar years. Gliders were turned out one or two a month at first. Then slowly the tempo of recreational flying picked up. Contests were held again. A few people saw a future in soaring and opened one-man, one-glider soaring schools. Slowly, as people began having a little more time and a little more money to spend on fun, new recreational activities began to catch on. Surfing, skiing, skin diving, and soaring all drew new members. The fifties saw a few more soaring schools opening. Tow planes looked newer, a few new sailplanes appeared on the dirt and grass runways, and the American teams began to travel to international soaring contests.

Suddenly the boom the soaring buffs had predicted was at hand—twenty-five years late. Now the Schweizers, Slingsby of England, Foka of Poland, Diamant of Switzerland, Libelle of Germany, and others began building sailplanes. Orders poured in, and delivery took many months on some models. Contests grew larger, distance and altitude records were broken, and the membership of SSA and clubs began to swell. Commercial operators at last began to make money and happily watched the weekend crowds lining up for tows and rental sailplanes.

The modern sailplane, complex and costly, represents the most advanced powerless flight technique.

Photo: George Uveges

Weekdays were still slack, but customers did come in at odd hours and tow planes were usually started once or twice daily.

While sailplanes and soaring grew more and more expensive and complex, and intense competition replaced recreational flying for many, a lot of potential pilots were turned off by the higher costs and greater commitment. For some, it just wasn't fun any more. There was too much hassle with FAA certification, too many rules and restrictions, too much equipment such as trailers, ground crews, radios, tow planes, clubs, badges to earn, and the increasingly technological orientation of soaring. A lot of pilots dropped out, and a lot didn't get started in soaring. Yet many thousands had that yen to fly, the great longing that must consume every one of us who watched as children a hawk rising on an invisible thermal or gliding along on the air flowing up a ridge.

Then the chance to fly like the birds came again. The whole hang glider love affair had lain dormant for sixty-seventy years, just waiting for a few brave and pioneering pilots to take off where the Wrights, Montgomery, Lilienthal, and Chanute had abandoned their efforts for simple no-motor, man-launched flight. And we shouldn't forget A. Powell Morgan and his 1909 biplane hang glider. Powell could be considered the pioneer of recreational hang gliding. He issued plans for all to use for constructing his simple design and reported, "The expenditure for raw materials varies greatly. It is usually a little less than \$10.00 and should not exceed \$15.00." In Powell's early writings on gliding technique he proved a wise prophet by saying, "The first words which may well be said are to emphasize cau-

tion. By this I do not wish to imply that gliding is exceedingly dangerous. Neither do I by caution mean timidity, but rather judgment and common sense.

"Canoeing is generally considered a safe sport, but who would think of canoeing on the ocean in a storm. It is exactly the same extreme to glide from a very high object, or experiment in a high wind."

Wise words from a pioneer hang glider of almost seventy years ago.

During the 1920s and '30s dozens of backyard flying enthusiasts experimented with building man-lifting kites and slope-riding gliders. Some of the craft magazines such as *Popular Mechanics* published plans for early vintage hang gliders. One serious flying machine designer, Volmer Jenson, built the first effective hang glider biplane in 1940 with three-axis (ailerons, elevators, rudder) controls. Volmer's "ultra-light" VJ-11, the "So-Lo", still flies successfully, and plans are available for home-built construction. The "So-Lo" has a favorable glide ration of 7:1. Jenson went on to team with designer Irv Culver and they produced a highly efficient hang glider, the VJ-23, with its huge single "Swingwing" that has a glide ration of 10:1. Even though Volmer's big hang gliders have rigid wings and require a large trailer to haul, they can be assembled in about 30 minutes. The hang gliding magazine, *Low & Slow*, said of Volmer, "Volmer has been held as the missing link between the soaring youth of today and those who foot-launched in the early days of this century. He is the link between the experimentalist and the theorist. He is, with Irv Culver, the sparking credibility among the sophisticated aviation world."



Volmer Jenson's VJ-23 Swingwing—almost an airplane and first fully controllable in 3 axis high-performance hang glider.

Photo: George Uveges



While the present corps of pioneer hang glider pilots were testing their frail kites on low hills, another group were flying kites towed by speedboats off the still water of Cypress Gardens, Florida. Man-carrying kite exhibitions were an outgrowth of the spectacular water-ski shows that used to draw huge crowds to this tropic aquatic attraction. These kite water launches were filmed again and again, creating much popular interest.

Another development in hang gliding was taking place at the same time on the drawing board of Francis M. Rogallo and his wife, Gertrude, who received Patent No. 2,546,078 in 1951 for their "Flexible Kite." The Rogallos' design evolved through several stages and ultimately became the standard hang glider shape now flown by the majority of pilots. The Rogallo Wing has been used for gliding and soaring, lifting large objects off the ground to be towed through the sky, as steerable high glide ratio recovery parachutes for rocket nose cone recovery, and a whole host of military related projects. The Rogallo Wing concept found its way to Australia and the hands of a young aeronautical engineer, Bill Bennett. Bennett made early experiments with powered kites and kites launched from water skis. In 1969 he went on vacation with his "Delta Wing" kite and while in the United States he gave an exhibition at Cypress Gardens. The public and the management were impressed and kite-flying for shows began. Bill Bennett flew wherever he could draw

Bill Bennett launches from Dantes View, Death Valley, California, February 19, 1972. Millions saw his flight on TV's *Thrill Seekers*, and popular interest in hang gliding soared.

Photo: Delta Wing

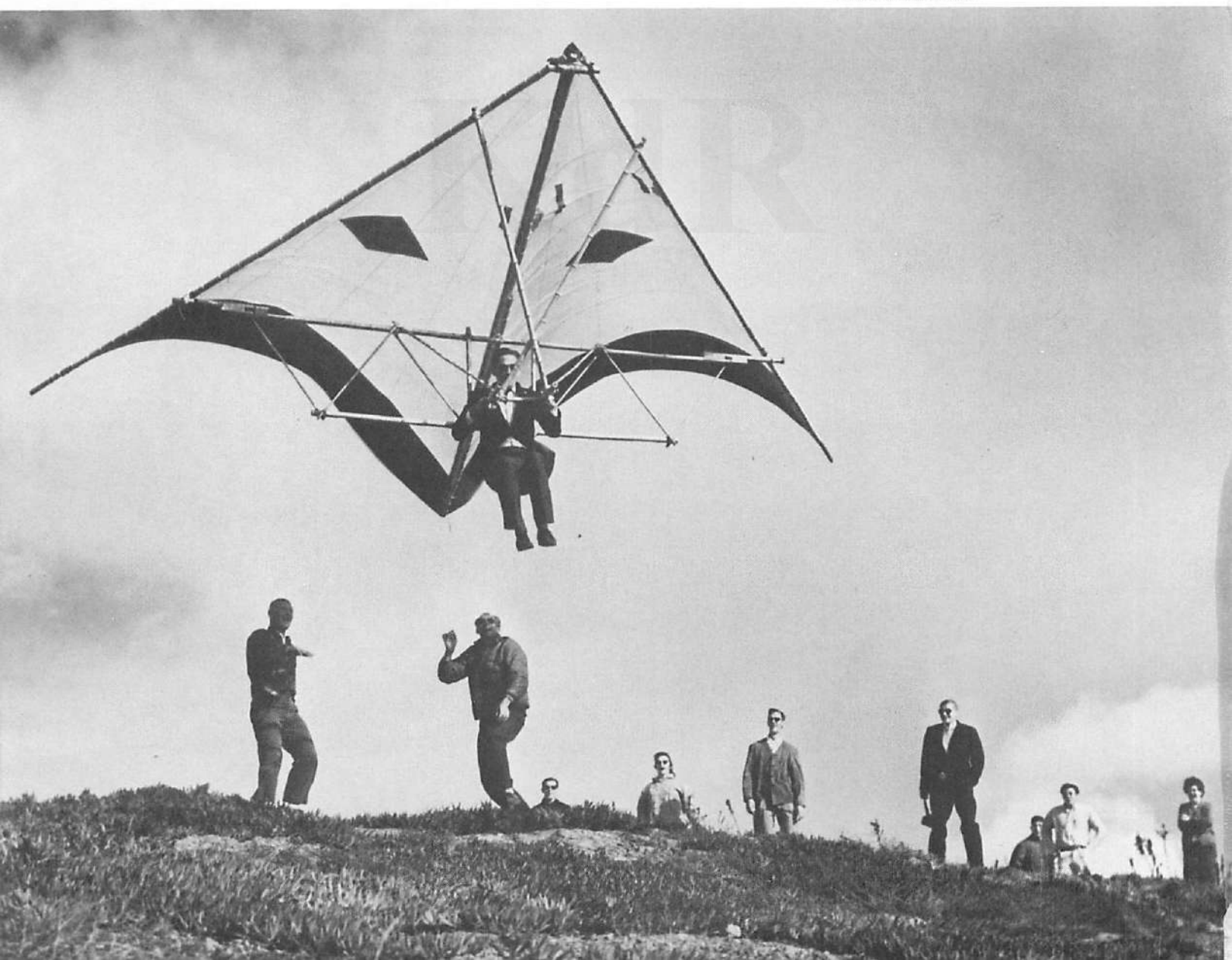


a crowd and bring attention to his Rogallo-type "Delta Wing." He flew over the Golden Gate Bridge and landed on Alcatraz Island, off Lake Tahoe, and made the first hang flight off a snow-covered ski slope. He appeared in many TV commercials, and his early record flight off a high peak over Death Valley was filmed for TV's *Thrill Seekers* and viewed by millions. Suddenly, almost overnight, the public was conscious of hang gliding or, as some called it, "Sky Surfing." The media did it

again. In hundreds of backyard shops young pilots-to-be began building hang gliders. *Low and Slow*, a hang glider newsletter, began publication edited by Joe Faust. Other enthusiast magazines appeared, and then the United States Hang Glider Association was formed in an attempt to bring some unity and organization to the fast-growing accident-prone sport. In Washington, the Federal Aviation Agency (FAA) began sniffing around the perimeter of hang gliding and the self-

In the beginning there was Richard Miller's *Bamboo Butterfly*. Miller, in sunglasses, helps launch as SAS jet pilot on his first hang glider flight.

Photo: George Uveges



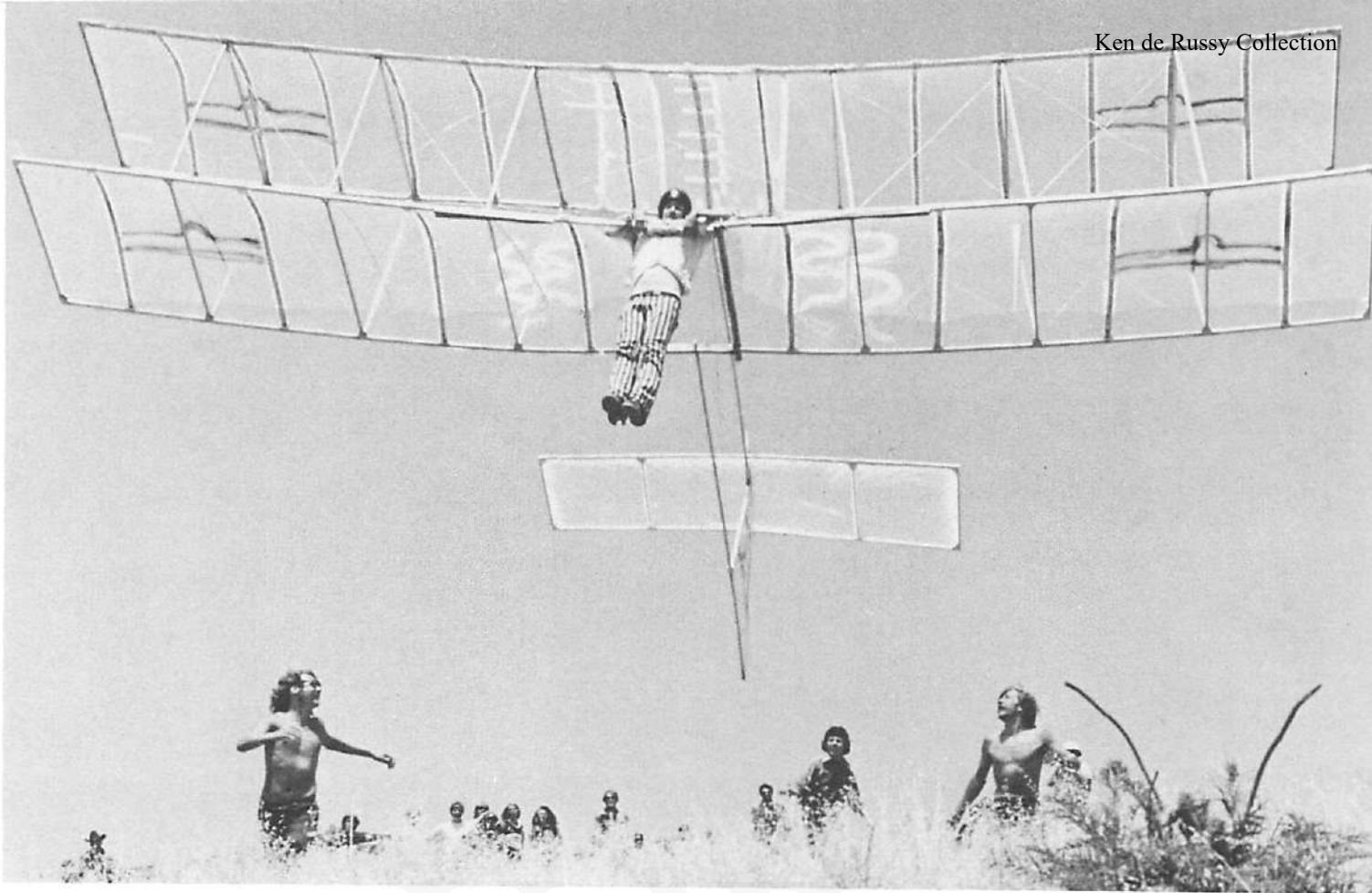


Photo: George Uveges
Jack Lambie's modified Chanute biplane glider was built by his students for less than \$25, and *Hang Loose* really flew. This was the state of the art in 1970.

Richard Miller, the California hang gliding pioneer. This picture shows him competing in the First Universal Hang Glider Championships at Corona del Mar in 1971.

Photo: George Uveges





Photo: George Uveges

The 1971 *Icarus II* led the way toward high-performance hang gliding. Taras Kiceniuk shows his energetic style on launch.

soar pilots feared government regulations would restrict their freedom. This fear of losing their self-direction caused a movement for quality standards of manufacturing and training. And so, because of inherent danger, the growing number of hang glider pilots and their fear of FAA regulation, the sport is maturing and coming of age. Almost gone are the early know-nothing leaps off mountain tops. Most pilots are learning to read the weather and understand the physics of flight, and hang gliding is becoming a safer, saner sport.

California had its Kitty Hawk of hang gliding on the sand dunes of Playa del Rey (Dockweiler) beach. In the early 1960s aviation enthusiasts—some called them “dreamers”—gathered on the dunes to launch their frail backyard-built Rogallo-type kites. On the sand slopes George Uveges recalls watching Richard Miller launch his *Bamboo Butterfly*, truly made of bamboo and plastic film. “The flights were short and the plastic kept ripping, but Richard didn’t mind. He’d pull out a roll of tape, cut a patch, stick it on, and we’d fly again. It was kind of funny. His patches all came out like designs on a butterfly wing.”

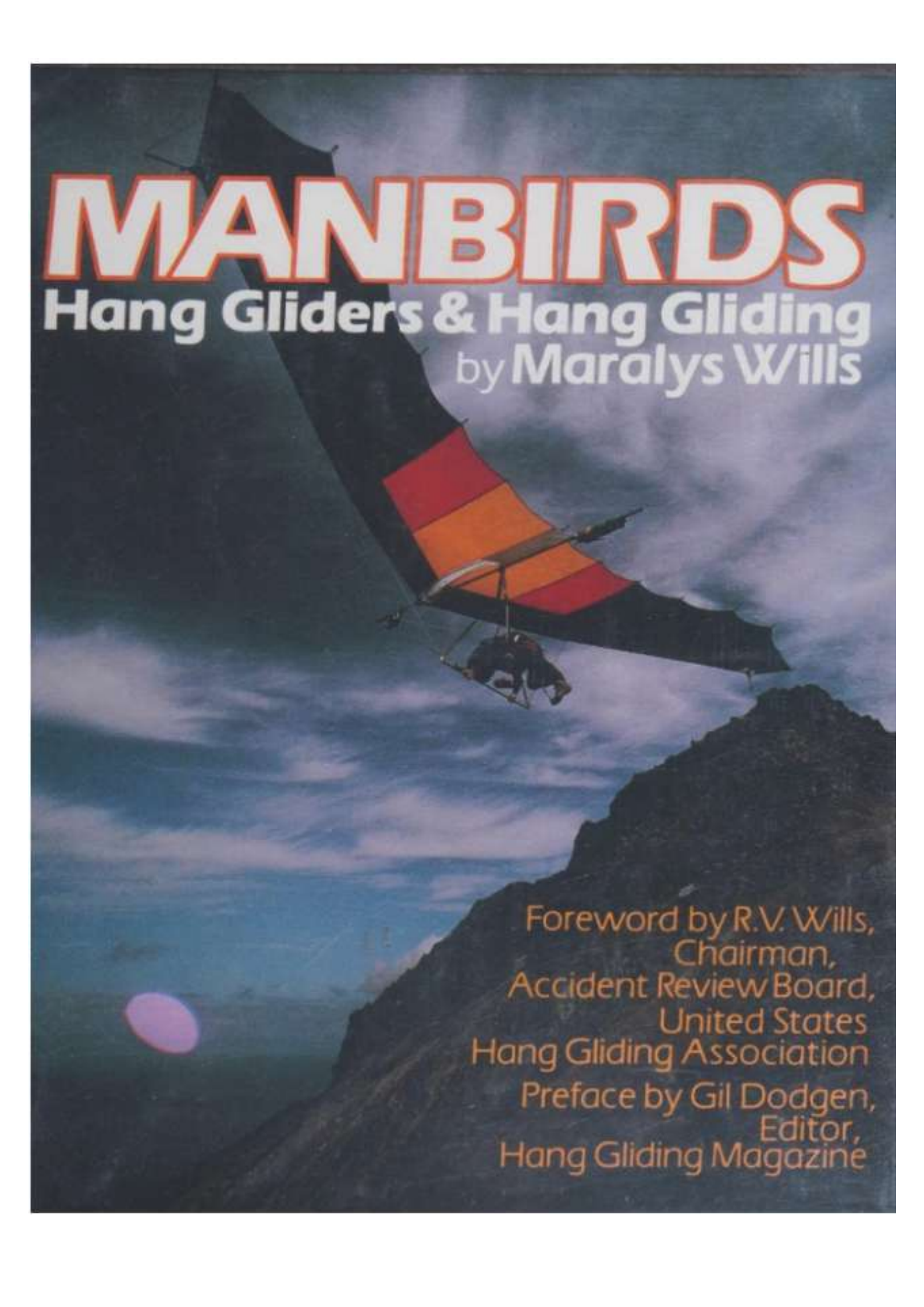
Miller’s soaring spirits infected other early hang glider pioneers, such as Lloyd Licher, Paul MacCready, and Jack Lambie. Lambie, a science teacher, went on to create a replica of Octave Chanute’s original biplane glider which he named *Hang Loose*. These early hang gliders, either Rogallos, monowings, or biplanes, were built inexpensively, and the designers made plans available for home craftsmen. For about a hundred dollars in materials the early hang glider pilot could construct

a craft that would really glide, and sometimes even soar.

The *Icarus* biplane came next. With its swept-back wings and steerable wing tip rudders Taras Kiceniuk’s *Icarus* really flew, turned, and stayed up when the lift was strong. Taras took his biplane to the steep cliffs of Torrey Pines, stepped off into the upwelling of air, and for the next couple of hours remained aloft soaring the cliffs with the sailplane pilots.

The idea of free, foot-launched inexpensive flying grabbed the imagination of young, and not so young, flight fanciers, and the hang glider movement began. More and more pilots strapped folded wings on top of cars and headed off to explore new takeoff spots. With more advanced wing shapes, better designs and construction, and higher lift ratios, hang glider pilots discovered they could soar in thermals, work sheer lift, and fly cross-country. As the sport grew, so did the complexity of equipment and the desire for competition. The first informal hang glider meets were really flying picnics and a lot of fun. With time and increasing numbers of flyers, competitions became more and more organized, with formal classes and awards. Then “nationals” were held, and soon came the First World Hang Gliding Championships held in Kössen, Austria, in the late summer of 1976.

Self-launched soaring has become a fixed part of the world sport aviation scene. It’s here to stay and grow up, and hopefully mature... without falling victim of organizational paralysis... and if pilots continue to show responsibility, they’ll keep their fabulous free-flying machines free.



MANBIRDS

Hang Gliders & Hang Gliding
by Maralys Wills

Foreword by R.V. Wills,
Chairman,
Accident Review Board,
United States
Hang Gliding Association
Preface by Gil Dodgen,
Editor,
Hang Gliding Magazine

space vehicles back to earth, and among the solutions was a flexible, triangular shaped wing with Rogallo's name on it.

The government made tests and wrote reports.

The army snapped to attention. Other uses were found for Rogallo wings. The army wrote reports.

Private contractors jerked to attention. Ryan Aircraft wrote reports.

Enthusiasm for the simple Rogallo flexible wing grew.

Eager men with a yen for flying read the technical reports, none of them secret. They began to see possibilities. It all took ten to twelve years. But by early 1960 hang gliding under a Rogallo-type wing had begun here and there. Crudely at first. Awkwardly at first. Never very high.

And always isolated. A man here, a man there. None of them aware of the others.

At this stage the idea could easily have died and become a funny memory: "Do you recall that fellow who used to run down the hill under a kite kicking his legs?"

But the sport lived. And now, so do the names of the men who did it first. Barry Hill Palmer, a University of California student. Just as Rogallo wings became the hot item with the government and the military, Palmer built himself a personal kite of metal tubing covered with plastic. He made short flights by throwing himself off the nearest sand dunes; as far as anyone knows, there was no one earlier. Later Palmer moved to Miami, where he installed low-horsepower engines on his small craft, wrote a couple of articles for the likes of the Experimental Aircraft Association, and thereafter disappeared into obscurity.

Thomas Purcell, Jr. In 1961 he built a towing-type craft with wheels, then floats, which Francis Rogallo flew in 1965. It was Rogallo's first experience under the canopy that bore his name.

Here and there other early "nutters" picked up the idea. Jim Natland, a Californian, saw the potential, thought it could become an "addictive sport,"²¹ and in 1965 paid to have a Dacron sail professionally sewn for his homemade frame. He kept running off hills near his home in Palos Verdes, California, taking short flights and hoping he'd attract someone with capital for a new venture.

Nobody took him up on it.

Later, having moved to Huntsville, Alabama, Natland flew some off the steep tenth tee of a golf course. About 1973 Jim Natland appeared back on the scene in California when hang gliding was in full swing. By then most manufacturers were too busy turning out hang gliders to pay much attention to this mild man hanging around reminiscing wistfully about the early days when he'd been the only one doing it. It was his luck to have been little more than an oddity at both ends of the story.

Still, in the sixties, the sport was at best a sporadic thing.

With so few flyers around, Francis Rogallo kept abreast of who was doing what and, though he never built a hang glider himself, he took a lively interest in everyone else who did. "Around 1965 or so, I was corresponding with John Dickenson [an engineer from New South Wales, Australia] and he came up with . . . anyway, he sent me photographs and drawings of kites he had made with the control bar." Though Mr. Rogallo didn't know it then—and John Dickenson might only have guessed—it was the marriage of ROGALLO SHAPE to CONTROL BAR that made the whole sport of hang gliding possible.

"THERE HAD TO BE A BETTER WAY TO DIE"

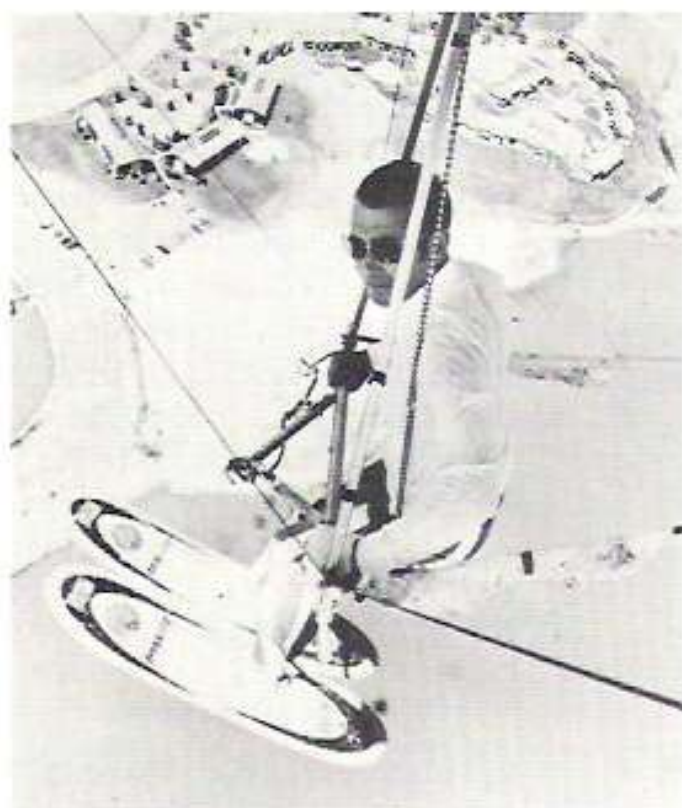
With all the innovations in the world, the sport of hang gliding would have come to nothing without its Great Promoters. And perhaps the ultimate promoter was Bill Bennett.

Short, energetic, with a twinkle in his eye and an Australian accent curling around every word, Bennett began an early career in flying with water skis hooked to his feet and an umbilical cord connected to a fast boat. He and his friends in Australia, for reasons he now wonders at, were engaged in the sport of flat kiting—"An invention of the devil," he says. Though even from the beginning the old flat kites were equipped with control bars ("We called them trapeze bars, because part of flying was doing acrobatic maneuvers on the bar"), control took place only in the horizontal plane, and great strength was everything. With a slight shrug he says, "You weren't controlling the monster . . . it was just being controlled by the speed of the boat." He laughs. "It was a requirement that you had to be strong in the arms and weak in the head."

The old flat kites had all the stability of a towing garage door, and Bennett knew it. "There had to be a better way to die," he says ruefully, but before this eventually caught up with him, friend John Dickenson had already seen the possibilities in the Rogallo shape and performed the famous marriage of twin-lobed Rogallo to flat-kite control bar. While at first the new Rogallo towing kite was not a perfect success—"and we have the scars to prove it"—Bennett and his friend Bill Moyes felt they'd been given a little longer to live.

Apparently neither of them considered the other alternative—giving up the sport.

Flying for fun, profit (they sold kites), and pure gutsy showmanship, Bill Bennett accidentally discovered the forgiving qualities of the Rogallo one day when his towing boat ran into a sandbar on the Hawkesbury River, stopped dead, and left him no alternative except to release at the top of the long line. To his relieved surprise, Bennett was able to guide the new Rogallo in a controlled, smooth glide back to the water. From then on, release at altitude became



Bill Bennett towing over Bridgeport, Texas, 1969. (Bill Bennett)

a scheduled part of the performance.

Though John Dickenson (dubbed Dr. Cyclops by Bennett and Moyes) seemed to play no further role in boat towing, he had done enough; Bill Bennett and Bill Moyes decided to expose their new skills to the world, departing in opposite directions. While Moyes went to Europe, Bennett came to America in 1969, the two of them having agreed, in effect, to "split up the world." Moyes would take Europe and Australia, Bennett could have America.

And "have America" is pretty much what Bennett managed.

Scheduling towing exhibitions—first in Berkeley, California, then in Cypress Gardens, Florida—Bill Bennett created so much hoopla with his spectacular show that he was soon snapped up by a land-development company who could see great possibilities in the Bennett act as a come-on for attracting buyers. On the artificial lakes the company developed around the eastern United States, Bennett gave towing performances that left people gasping. Nobody had seen anything quite like his controlled flights from the top of the magic rope. In a very short time his Rogallo kite had replaced the flat kites used at Cypress Gardens.

It was in Berkeley that Bennett first ran into disapproval for one of his antics. "We cut loose at a thousand feet over Berkeley, and of course not being accustomed to American traffic, I thought it was neat to go out and fly over the freeway, looking at the traffic coming towards me. I wasn't aware that if even one of those people had applied his brakes suddenly there'd have been

the darnedest smashup!" When he came down, he was lectured sternly.

But he wasn't through bedeviling American authorities. On July 4, 1969, Bennett figured the greatest show of all would be a tidy little flight around the Statue of Liberty. The event was publicized on the radio—but too late to alert the New York Harbor authorities in time to stop him. By the time the Harbor Patrol was on its way, Bennett had flown around the outstretched arm and landed on the grass at the lovely lady's feet—only to be met instantly by an irate statue-keeper who hauled him into a building and lectured him for twenty minutes on the various city ordinances prohibiting aircraft from landing on Liberty Island—except for emergencies. Bennett protested, "But it was an emergency." Then, with Australian charm and entirely false innocence, he explained, "All I did was, I went around your beautiful statue and landed on your lawn."

The reply was, "Yeah, that's another thing . . . there's a sign there that says Keep Off the Grass."

By now the Harbor Patrol had arrived. A stern man charged up to Bennett and said, "Hey . . . is your name Bill Bennett?"

"Yup . . . yes, sir."

"I hear you're going to fly . . . fly all over this place and land on the grass."

Before Bennett could answer, the officer went on quickly, "My advice to you, young man, is to pack up your tent and steal into the night."

To which Bennett did a double take, nodded quickly, said "Yes, sir," and speedily got himself off the island.

"I don't know," he reminisces, "whether he knew I'd already done it and was just carrying out his official duties and being nice. . . . I'll never know, and I never, ever stopped to ask."

The Bennett act continued at fairs and shows around the United States. The towed form of hang gliding was being seen by thousands. When water and a boat weren't available, Bennett towed on foot, pulled aloft by a car. At night he carried flares.

He says now, "I believe I'm the first person to ever do a loop in America," but it was unintentional. He was performing at the Ontario Speedway in front of a quarter of a million people. Just as the kite reached maximum height, it hit the wind shear above the buildings and did a complete rotation, totally out of control, but for some reason put Bennett down right on the finish line. Bennett says with a little laugh, "The audience thought it was part of the act!"

By now Bennett had been joined by water-ski enthusiast Dave Kilbourne, who came along to drive the Bennett boats and learn the skills of tow kiting. Dave Kilbourne was to become a master of hang gliding in his own right, carrying the sport beyond where he'd found it with Bill Bennett.

But nobody can deny that Bennett, with his one-man whirlwind tour, fired

TAB BOOKS/No. 886

THE HANG GLIDER'S BIBLE
MARKOWSKI

THE HANG GLIDER'S BIBLE

The complete pilot's
and builder's guide!

BY MICHAEL A. MARKOWSKI



886



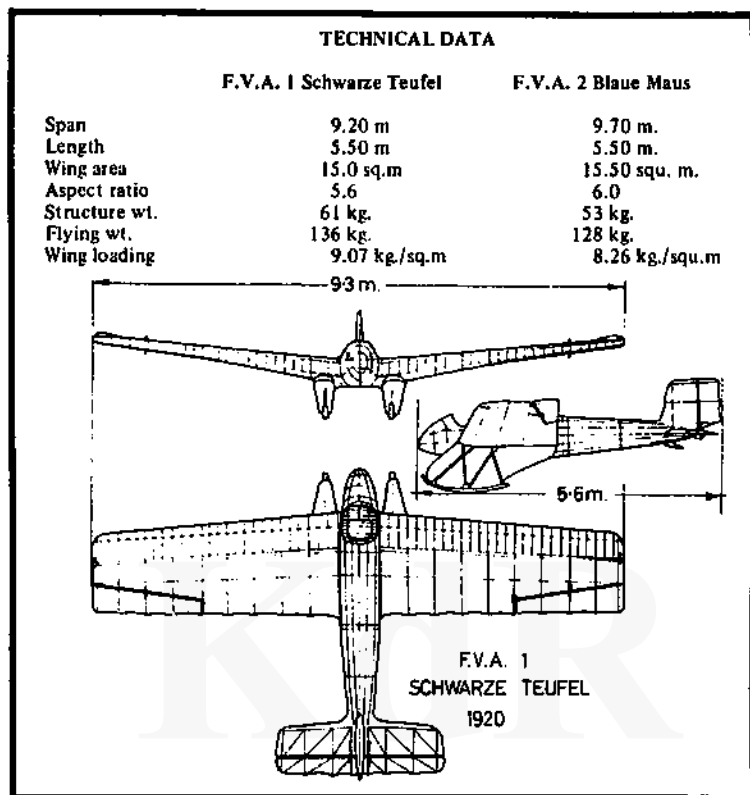


Fig. 1-32. The glider that caused hang gliding to cease in 1922 at the Wasserkuppe.

Sitzgleiter. But in 1970, at the Wasserkuppe again, he took part in the Commemorative meeting fifty years after the first Rhon."

FRANCIS M. ROGALLO

In 1919, when Rogallo was seven years old, an airplane flew over his town (Sanger, California) and he decided to make aeronautics a career. Rogallo is pictured, in Fig. 1-33, flying his original kite, and the patent for this kite is depicted in Fig. 1-34. Around 1925 when he was 13, he saved enough money to buy a ride in a dilapidated Curtiss Jenny in Fresno without first discussing the possibility with his parents. Today he probably wouldn't fly in the same airplane if it were free.

In 1933 and about 1937 he applied for the U.S. Army Air Corps flight training program but was turned down. The Navy turned him down around 1934 because a childhood accident had eliminated the two largest toes on his right foot.

In 1946 Rogallo spent several days in Lock Haven, Pennsylvania, helping the Piper Co. build an experimental airplane with a full-span slotted flap and plug-type spoiler aileron (one of his earlier inventions). Shortly, Meyers, a Piper pilot, gave him about 10 hours of dual instruction and he got a student permit to solo. He had done most of his flying in a

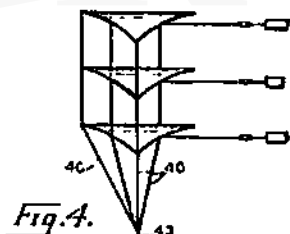
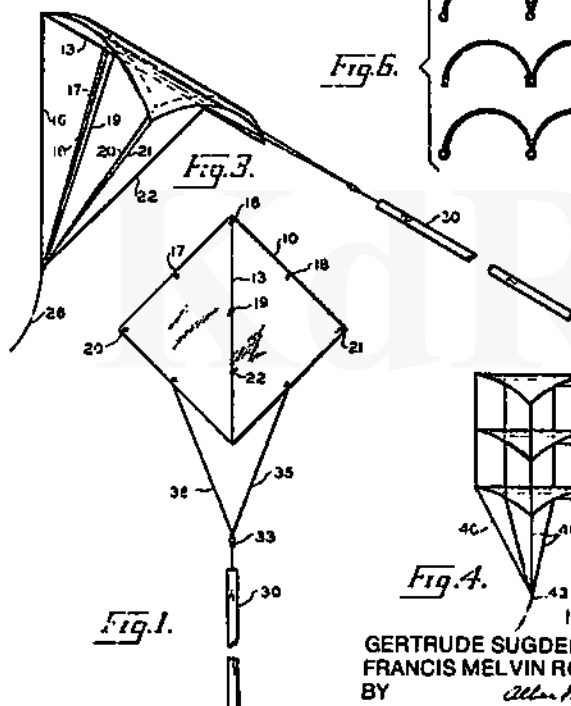
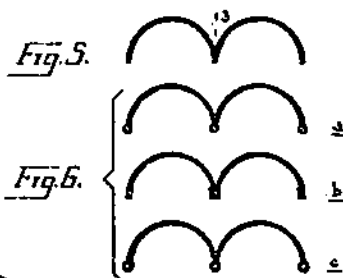
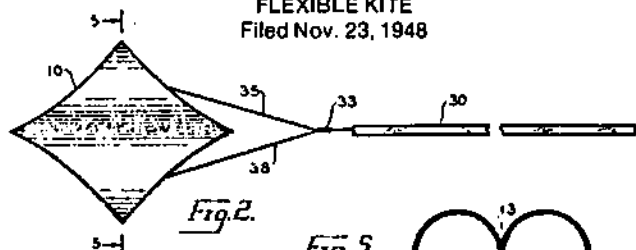


Fig. 1-33. Francis M. Rogallo, the inventor, flying his original all-flexible kite.

March 20, 1951

G.S. ROGALLO ET AL
FLEXIBLE KITE
Filed Nov. 23, 1948

2,546,078



INVENTORS:
GERTRUDE SUGDEN ROGALLO
FRANCIS MELVIN ROGALLO
BY *Allen M. Zellmer*

Fig. 1-34. Rogallo's original flexible kite patent of 1951.

prototype Supercruiser with a 125 hp engine and was going to solo in it on the day before he was to leave Lock Haven. When he arrived at the field he found that the assistant chief

engineer had gotten there a little before and had gone for a flight in the airplane he was to use. The airplane caught fire in the air and crashed, killing the pilot, who was alone. Because of the resulting great confusion following the accident, Rogallo did not solo before leaving Lock Haven and he never got around to soloing any powered aircraft, although he has flown several since then.

Figures 1-35 through 1-38 illustrate a selection of later Rogallo patents and the patent for this kite is depicted in Fig. 1-34.

His first solo flight in a glider was in Tom Purcell's Flight Sail about 10 years ago.

Several years ago, Rogallo (everyone calls him "Rog") designed and built four variations of the all flexible wing, each of about 300 square feet of cloth area. He has flown these on an anchor line on the sea shore and also glided them from the top of the big dunes at Kitty Hawk. Three of his four children and one grandson have also had flights. These wings are marvelous for storage and transportation, and they are unbreakable, but the glide ratio is less than 3 to 1 and it would be difficult to self-launch one. He hasn't flown this type of wing since he got his "standard Rogallo" a couple of years ago with which he has made over 300 flights.

Several Rogallo models are illustrated in Figs. 1-39 through 1-44. In 1945 at the close of World War II, Rogallo and his wife Gertrude thought the NACA should initiate research that would give the average citizen a better opportunity to fly his own airplane by developing a more practical and less expensive airplane. The NACA decided not to undertake such a project, so Gertrude and he decided to work on it at home in their own time. One of their goals was to develop an inexpensive, rugged wing that could be folded easily when the aircraft was on the ground—like a bird or a bat folds its wings.

The March 1951 *Ford Times* story and the November *Ground Skimmer* cover shows one configuration of wing they developed in 1948. There were many others, varying in shape and structure. This work has had much influence on the design of kites, gliders, and parachutes and may someday also influence the design of powered aircraft.

May 27, 1969

F. M. ROGALLO

3,446,458

CONTROL DEVICES FOR FLEXIBLE WING AIRCRAFT

Original Filed Jan. 17, 1964

Sheet 1 of 4

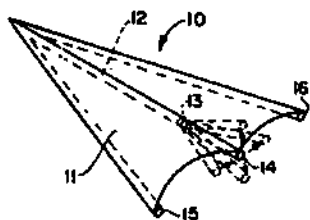


FIG. 1

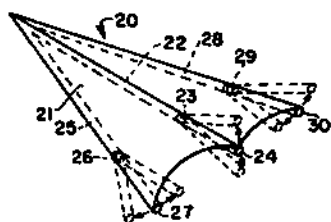


FIG. 2

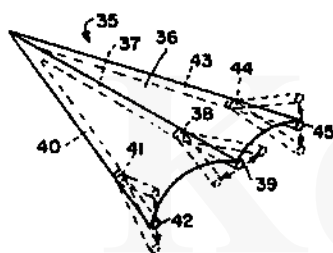


FIG. 3

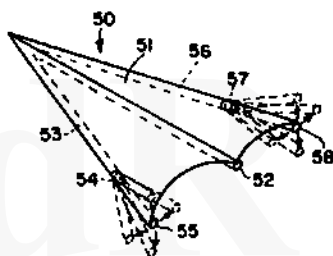


FIG. 4

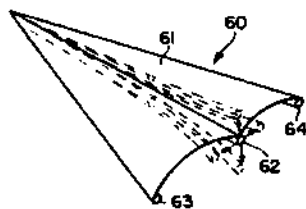


FIG. 5

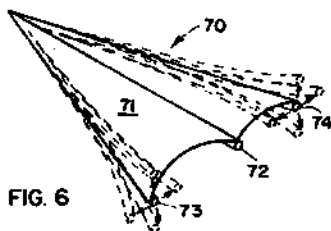


FIG. 6

INVENTOR
FRANCIS M. ROGALLO
BY *[Signature]*
Attorney

Fig. 1-35. A selection of later Rogallo patents.

RECENT HISTORICAL DEVELOPMENTS

After Pelzner did his flying at the Rhon meeting, all hang gliding came to a complete halt. The fantastic performances of

the Schwarze Teufel and Blaue Maus proved the superiority of the gliders with a seated pilot in an enclosed fuselage and monoplane wings. The future of gliding was obvious. It was longer, further, faster and higher.

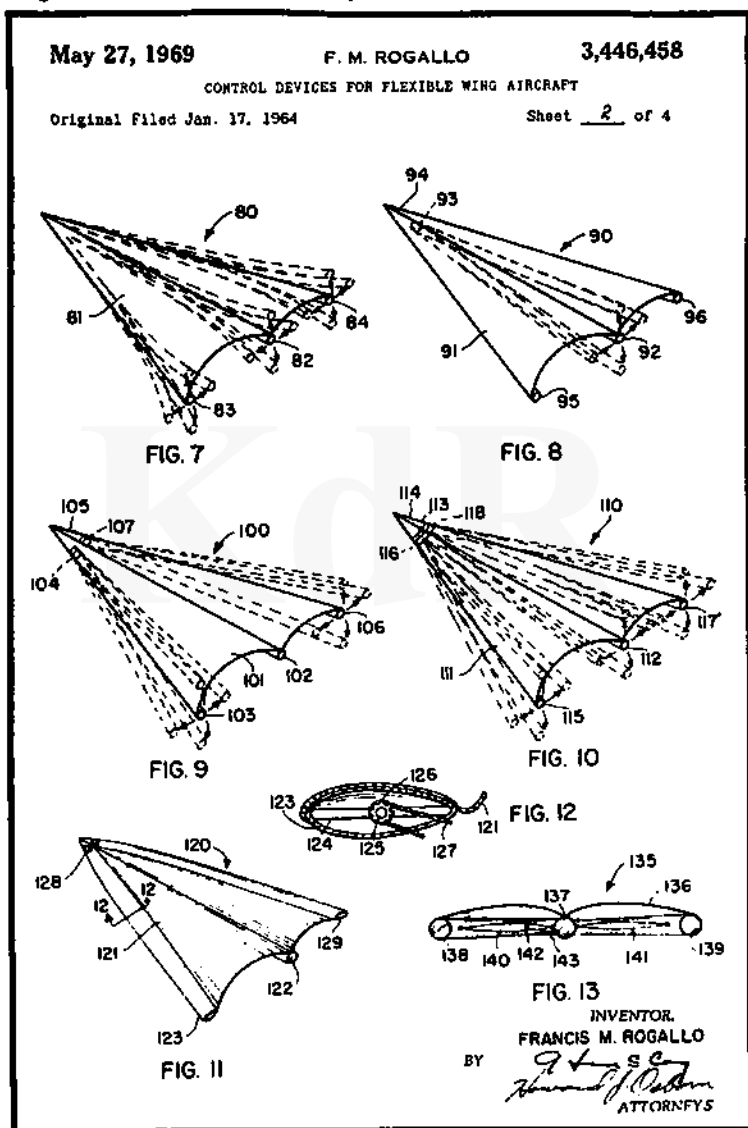


Fig. 1-36. A selection of later Rogallo patents.

May 27, 1969

F. M. ROGALLO

3,446,458

CONTROL DEVICES FOR FLEXIBLE WING AIRCRAFT

Original Filed Jan. 17, 1964

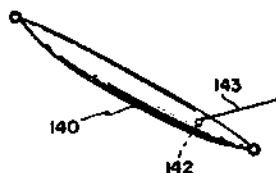
Sheet 3 of 4

FIG. 14

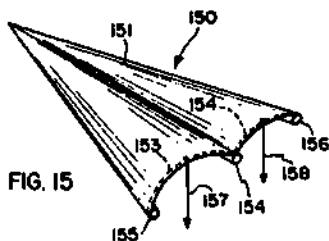


FIG. 15

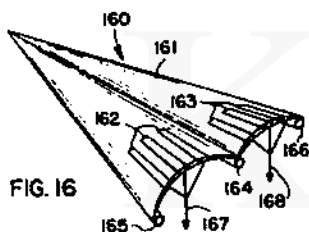


FIG. 16

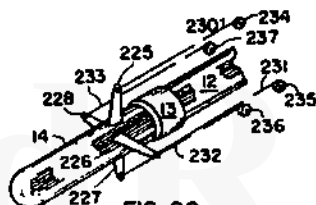


FIG. 22

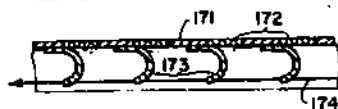


FIG. 18

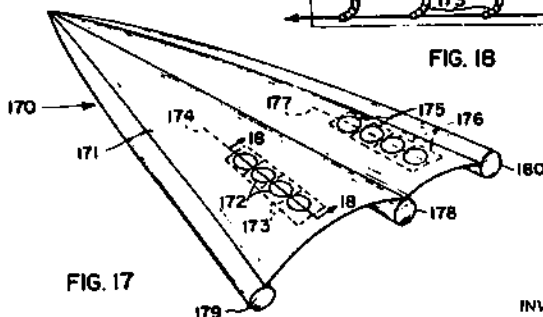


FIG. 17

INVENTOR
FRANCIS M. ROGALLO
BY *Howard & Nelson*
ATTORNEYS

Fig. 1-37. A selection of later Rogallo patents.

May 27, 1969

F. M. ROGALLO

3,446,458

CONTROL DEVICES FOR FLEXIBLE WING AIRCRAFT

Original Filed Jan. 17, 1964

Sheet 4 of 4

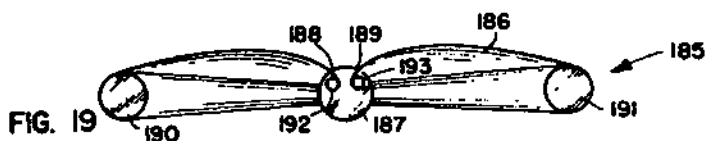


FIG. 19

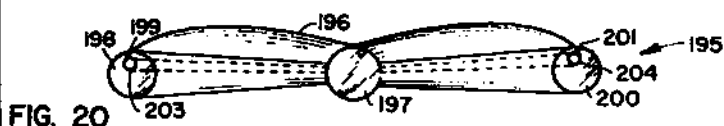


FIG. 20

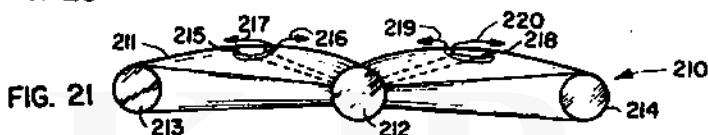


FIG. 21

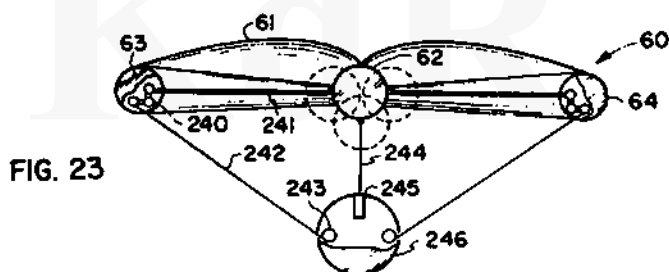


FIG. 23

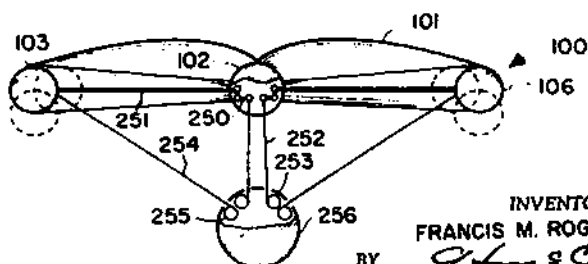


FIG. 24

INVENTOR,
FRANCIS M. ROGALLO
BY *James & Co.*
Harmon & Osborn
ATTORNEYS

Fig. 1-38. A selection of later Rogallo patents.



Fig. 1-39. F.M. Rogallo and his flexible wing model with metal keel and leading edges, but no cross bar in the Langley 7 x 10-foot wind tunnel.

It wasn't until 1941, when the United States placed a wartime ban on civil flying near the coast, that pilot Volmer Jensen became frustrated enough to build a hang glider. It was a Chanute-type with one major difference: it replaced the archaic weight shifting method of control with full three-axis aerodynamic controls (see Fig. 1-45). Mr. Jensen then managed to pacify himself until after the war. Nobody could stop him from hang gliding. After hostilities ended, Volmer went on to build more conventional, powered aircraft that could be built by the enthusiast. It wasn't until 1971 when he came out with his beautiful swingwing that hang gliding would hear from him again.

Then, in 1951, a patent was issued to a Mr. and Mrs. Francis M. Rogallo for a kite they had invented three years



Fig. 1-40. A powered wind tunnel model of a Rogallo wing utility aircraft.

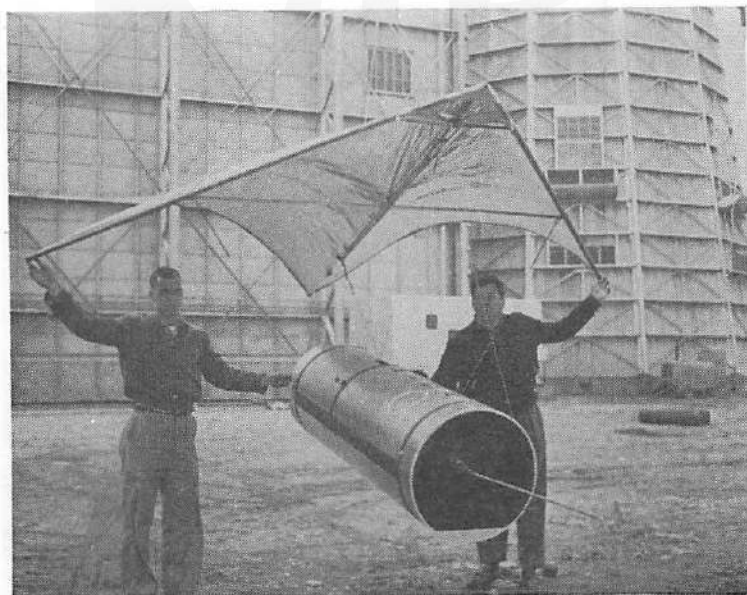


Fig. 1-41. A 1/12th-scale, radio controlled dynamic research model of a Rogallo supported dummy Saturn booster, 1961.

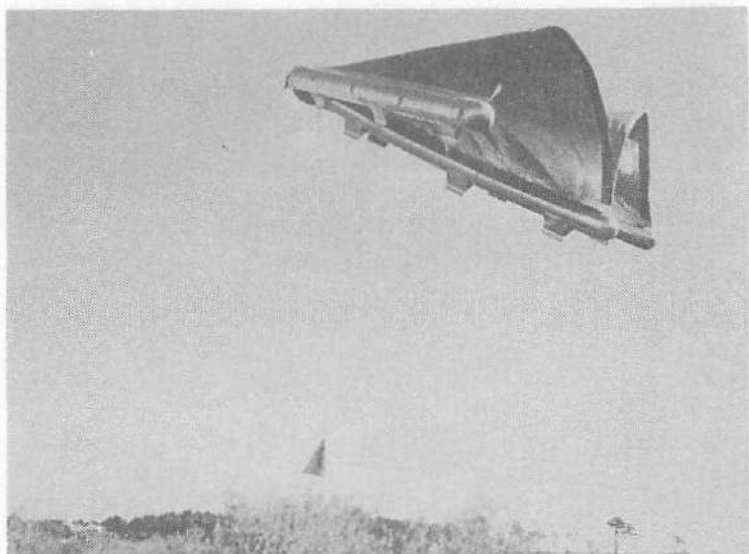


Fig. 1-42. A 50-foot, inflated keel and leading edges Rogallo for space craft recovery. 1961.



Fig. 1-43. A high aspect ratio cylindrical Rogallo in the Langley 7x10-foot transonic wind tunnel.

earlier. It wasn't an ordinary kite either. In fact, it was so revolutionary that the United States government decided to annex Rogallo into the NASA space program. It was thought the new kite could be used to replace the parachute then in use for spacecraft landing. The Rogallo could glide forward and be directed to land at an airport. As it developed however, the project was "scrubbed" during the mid-sixties, after the government had spent millions on wind tunnel research and prototype development. Even so, the Rogallo flexible wing concept worked and several full-size, man-carrying examples were built and successfully flown. It was all so very simple. The kite aircraft could be folded for transport to the airport, opened up like an umbrella and flown away. Man could have flown centuries ago....

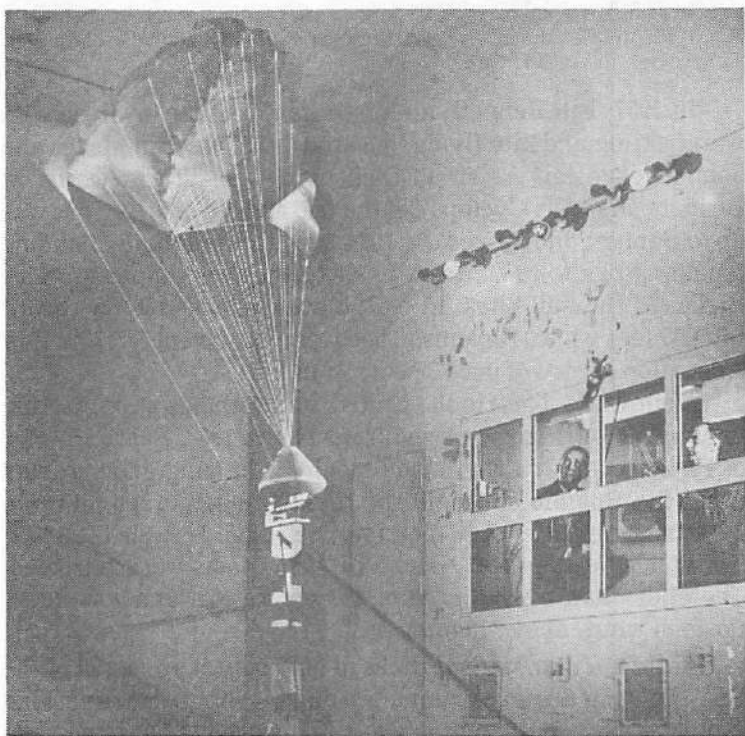


Fig. 1-44. An all-flexible, tension structure Rogallo with Apollo spacecraft in the Langley 7 × 10-foot wind tunnel. 1965.

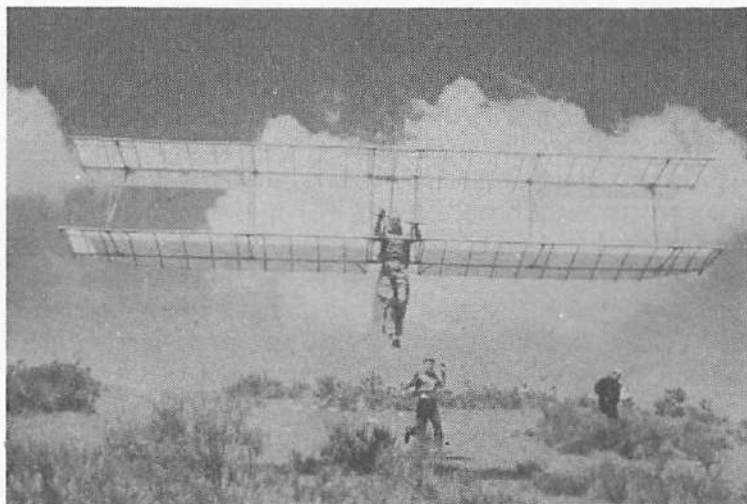


Fig. 1-45. Volmer Jensen's 1941 three-axis, aerodynamically controlled hang glider, the VJ-11 "So-Lo".

In 1957, Bill Bennett, an Australian, became involved with water skiing and kite flying, in association with Bill Moyes and John Dickenson. At first, Dickenson was, in the words of Bennett, the "Dr. Cyclops" of the trio and did not fly. That was up to Bennett and Moyes. By 1964, Moyes was actually building the new Rogallo tow kites for sale as they were quite superior to the old flat sail kites. In 1967, Moyes managed a tow record to 1,000 feet while Dickenson became a proficient flyer and set a duration record of over 3 hours in 1970.

Meanwhile, back in the United States, things were starting to happen. During the period from 1961 to 1963, Barry Palmer of Phoenix and friends, made hundreds of hang glider flights using the Rogallo concept. The flights ranged in length up to 200 yards, altitudes of 80 feet, and overall glide ratio of 4.5 to 1. No injuries except for minor skin lacerations were recorded. The glider had a wing area of 280 square feet and was never flown in winds above 10 mph.

In 1964, a man named Richard Miller, past president of the SSA (Soaring Society of America) and a very literate soaring writer, was vacationing on Cape Cod's great sand dunes and seized the Rogallo idea for his own. "It would be great to skim over those dunes just like the Wright Brothers," he thought.

After he returned to his California home, he teamed up with his good friend, Bruce Carmichael (SSA's aerodynamics chairman) and built a hang glider version of the Rogallo wing. That was in 1966.

The structure of the glider was bamboo with the permanent joints bound and fiberglassed. For assembly the bits and pieces were tied with cord, rope, twine or strips cut from inner tubes, whichever was handiest. The sail was either 4-mil or 6-mil polyethylene sheeting with rows of grommets along the edges and down the center to provide holes for lacing to the keel and leading edges. Its total weight was about 20 pounds and it cost around 40 dollars to build. The glide ratio was only about 3 to 1, but it flew and was it ever fun! Later the glider was improved by using aluminum tubing for increased performance and durability.

Miller and Carmichael let several other people try their hand at flying the new fun flying machine but nobody else took to it. Beach burns, surfers, etc. gave it a whirl but went back to their thing after it was over. The time wasn't right for a movement to begin.

Back in Phoenix again, 1967 finds one Emil Kissel starting to publish a two page, bi-monthly newsletter called *Low, Slow and Out of Control*, devoted to foot launched gliding concepts. This was at the urging of our friend Richard Miller. After four issues the editorship was transferred to Robert Wister, also of Phoenix. By the sixth issue, the little newsletter contained ten pages but then died after reaching a circulation of 100.

In 1969, Bill Bennett went on a vacation with his water-skis kite and gave an exhibition at the National Ski Championships held at Berkeley, California. Here, he met Dave Kilbourne, a water skier, who offered to tow Bennett aloft with his own boat. Bennett accepted and then taught Kilbourne how to fly, who went on to become the first person in history to soar a kite for over an hour, in 1971. After the meet, Bennett went to the east coast and managed to fly over and land at the base of the Statue of Liberty—on July 4, 1969 (see Fig. 1-46). He was promptly apprehended by authorities but the demonstration drew a lot of publicity. Bennett then went to California to settle where he set up manufacturing the ski kites and now hang gliders as well.

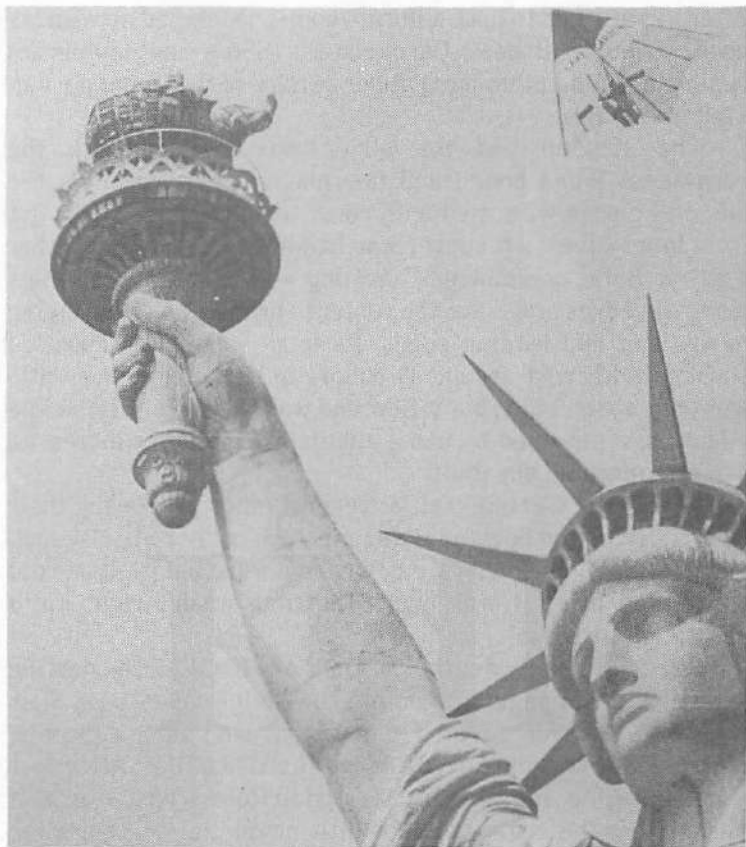


Fig. 1-46. Bill Bennett introduces the Rogallo tow kite to the United States on July 4, 1969.

The February 1971 issue of *Soaring Magazine* published a letter from Joe Faust called "A Different Drummer". It was about hang gliding and created quite a stir. Faust was resurrecting the old Phoenix newsletter into a 20 pager called *Low & Slow*. At about the same time, the Spring 1971 issue of *Sport Planes* carried a story about an outrageously inexpensive airplane: "The \$24.86 Airplane" proclaimed the cover. In fact, Richard Miller was shown flying the glider (see Fig. 1-47), which was dubbed "Hang Loose." Plans were quickly thrown together and Jack Lambie, the designer, sold thousands at \$3.00 a set.

According to Lambie, it all started one day while he was trying to teach his junior high school students about aerodynamics. Well, they didn't dig all those formulas so Jack (a pilot himself) asked the kids if they'd like to build and fly their own airplane and learn by doing. Well, the response was obvious. That did it. The hang gliding movement was about to begin.

Then, sometime during the early spring of 1971, Lambie and Faust teamed up and sponsored "The Great Universal Hang Glider Championships". It was held on Sunday, May 23, in honor of Otto Lilienthal's 123rd birthday. It was unbelievable. Thirteen gliders showed up: a majority of some Rogallos, and a flying wing, by Richard Miller. The "Conduit Condor" is shown in Fig. 1-48, with designer.

Faust was immediately contacted by the Merv Griffin TV talk show, the London Times and CBS as well. The FAA also asked to be kept posted on such future happenings. The twenty page *Low and Slow* newsbooklet began to grow. People all around the world were subscribing. It was coming together. Hang gliding was here to stay.

That first meet contained a potential for danger. "Don't fly higher than you care to fall," became the watchword. While

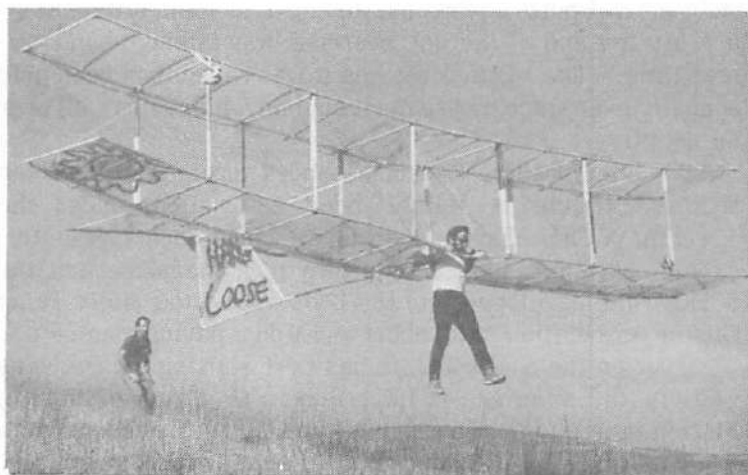


Fig. 1-47. The original "Hang Loose" with designer Jack Lambie hanging on. Fall 1970.



Fig. 1-48. Richard Miller and his "Conduit Condor," the highest performing hang glider at the first Universal Hang Glider Championships of May 23, 1971.

the majority of flights were semi-controlled crashes, some lasted as long as 19 seconds and covered 800 feet. Compared to other active sports like skiing, surfing or football, bruises were few. By the end of the day everyone was talking about "the next time." The "Otto Meet" as it was called, has been held annually ever since, not to mention many, many more all over the country.

By June of 1971, 25 people banded together to form the Southern California Hang Glider Association, under the direction of Dick Eipper and Lloyd Licher. Their newsletter, *Ground Skimmer* has since grown to a magazine and the SCHGA has developed into the USHGA (United States Hang Gliding Association) with about 15,000 dues paying members.

Over on the east coast, things were starting to happen as well. In the summer of 1970, Robert G. Mixon of Miami, Florida built and flew a Chanute-type biplane based on a plan found in a 1909 *Popular Mechanics*. The local paper ran a front page headline "Those Magnificent Men In Their Flying Machine" on June 15, 1970. A local TV station even took some

footage of a cliff launch. Mixon said he did it out of frustration due to the high cost of conventional flying. Later, he even offered plans, because of a large number of requests for his story which appeared in the February 1971 issue of *Sport Aviation*.

Going north, to the ski areas of New England, we find Terry Sweeney (see Fig. 1-49) of New Hampshire experimenting with some Chanute type hang gliders. He and some friends made many, many flights, learned much and had a lot of fun. Their gliders replaced the older airfoils with more modern versions.

Since then, the sport has spread to the interior of the country and around the world. Two full-color magazines have appeared on the scene, giving hang gliding a real professional look. First came *Hang Glider* in the fall of 1974, then *Wings Unlimited* in the winter of 1975. Records of all kinds are being made almost daily. Distance is now held by Rick Poynter of New Zealand who flew a ridge for 50 miles. Altitude drop is held by Dennis Burton who was released from a hot air balloon

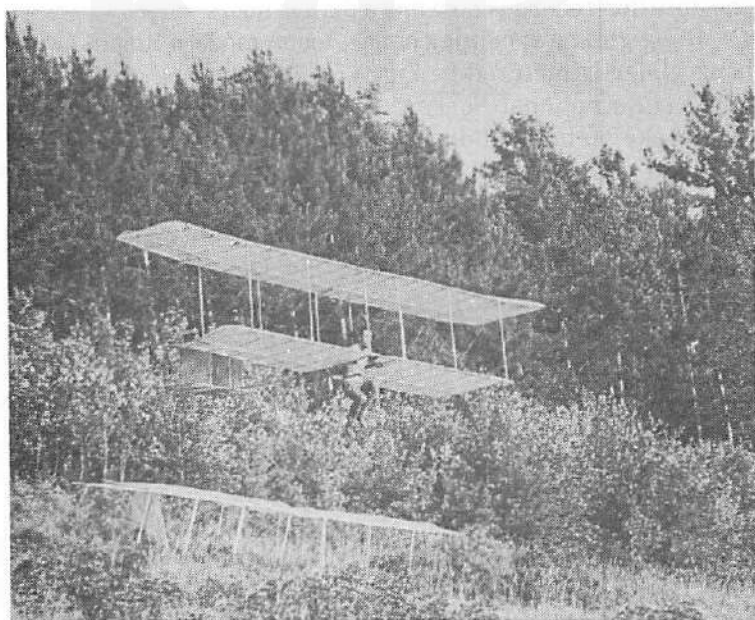


Fig. 1-49. Terry Sweeney flying his "Ariel" in New Hampshire. 1969.

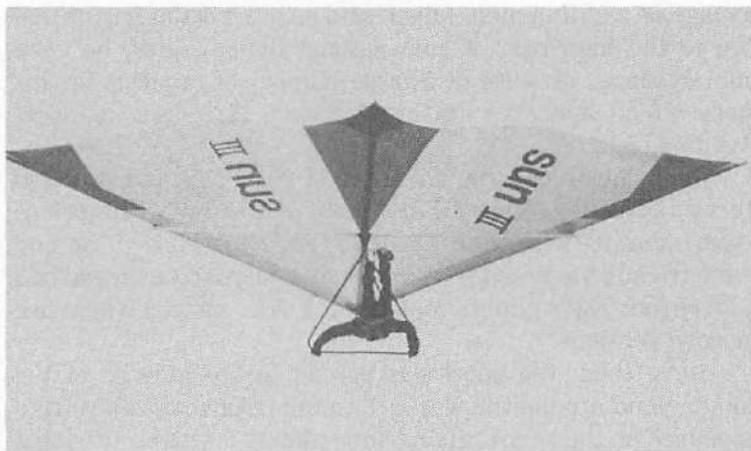


Fig. 1-50. A modern Rogallo wing hang glider.

22,500 feet above the Mojave Desert for a flight that lasted 35 minutes and covered 26 miles. Mark Clarkson went up 5,700 feet above his takeoff point in 1974, for the altitude gain record. The duration record is now more than 15 hours.

Hang gliding is coming of age, too. A modern Rogallo wing hang glider is pictured in Fig. 1-50. In February of 1975, the CIVV (International Soaring Commission) met and decided not to take on hang gliding as a division but to recommend it for a full and separate commission status of its own. Then in June of 1975, the CIVL (International Hang Gliding Commission) held its first meeting. Thirteen countries were represented and a poll taken of the hang gliding activity worldwide. The results indicated that there were almost 40,000 hang glider pilots and over 42,000 hang gliders throughout the world. The USA reported figures of about 25,000 and 30,000 respectively.

In September 1975, a general conference of the FAI (International Aeronautical Federation) which governs world-wide aviation sports, met in Ottawa and gave hang gliding its full commission status. Hang gliding is now an official aviation sport which will be governed by the CIVL and FAI. In the United States it will come under the office of the NAA (National Aeronautic Association), the country's aero club, while other countries have similar organizations.

THE HANG GLIDING BOOK

William Bixby

THE HANG GLIDING BOOK · Bixby

McKAY



Technical Advisor: Keith Nichols, U.S. Hang Gliding Champion

2

The Birth of Hang Gliding

In 1936, Francis Rogallo was working as an aeronautical engineer for the Langley Research Center in Hampton, Virginia. At that time he was testing airplane wings in wind tunnels to find out which shapes gave the most lift to a plane. With his mind on wings, Rogallo began to wonder whether a simple piece of cloth attached to a frame could sail like a kite if the air pushed out the cloth to form a wing like those he had been testing.

The airplane wings he tested every day were shaped with ribs to form curved surfaces. The air flowing over the fixed, or rigid, wings produced lift for the plane. But, Rogallo asked himself, why couldn't a triangular-shaped kite billow up with the air pushing beneath it and produce a curved surface that would produce lift like a regular airplane wing? Rogallo tried it, and it worked.

He used his knowledge of aerodynamics (air in

motion) and his engineering skill to invent what is now called the Rogallo wing, or "kite." At first he wondered what he could do with his invention. He patented it, but nothing much happened. Then, when the National Aeronautics and Space Administration (NASA) came into being, Rogallo went to work for them. He offered NASA his invention on a royalty basis, if they could use it.

Some tests were made with Rogallo's kite, which was used as a kind of parachute to get space vehicles back into the atmosphere. The army found they could drop jeeps with it. But in the midst of the thousands of problems NASA dealt with, the Rogallo kite did not make much of an impression. Except for one thing, Rogallo's invention would have been forgotten: descriptions of the Rogallo wing were published in NASA's periodic reports and sent out to interested people.

One of those interested people was a man living in northern California, Barry Hill Palmer. When he saw the NASA report on the Rogallo wing, he bought materials and built one. Then, by running with it on the sand dunes along the Pacific, he made several short, soaring flights. Barry Hill Palmer is generally credited with being the first hang glider pilot.

Across the country in North Carolina, an engineer, Thomas Purcell, also read the NASA reports. He built a Rogallo wing, which was towed

aloft by an airplane at a local airport. He is considered the first to fly a towed Rogallo.

Francis Rogallo invented the wing (sometimes called the Rogallo standard). Palmer was the first recorded pilot of the wing. But William Bennett, of Australia, really got the sport of hang gliding off the ground. As early as 1956, Bennett and his friend William Moyes were experimenting with a kite of their own invention: cloth stretched as tightly as possible over a winglike frame. They skied furiously downhill with their kite, trying to soar aloft. They also tried to wing it behind motor boats, but the flatness of their kite wing made their glider unstable. They probably would have killed themselves if they had not tumbled into water or snow when the kite tipped over and fell to the ground. Then a friend of theirs from New South Wales received the NASA report on the Rogallo wing. Since the cloth on the Rogallo kite was loose, it filled with air and gave stability to the kite. Bennett and Moyes immediately built one and began soaring. They still got up in the air by being towed, but one day the towline broke. Bennett soared gracefully to earth. Soon both men had become able hang glider pilots. Bennett and Moyes came to the United States, where they startled a great many people. Bennett soared out over San Francisco Bay above the Golden Gate Bridge and landed on Alcatraz Island. In New York, he was



Wilbur Wright flew his early glider at Kitty Hawk, North Carolina, in 1902.

towed above the Statue of Liberty. After he was cut loose, he spiraled around it to the ground. He was also towed (and photographed in flight) behind motorboats in Florida. Then he jumped off a mountain over a mile high in California and glided down to land in Death Valley. His friend Moyes attracted attention when he jumped off the rim of the Grand Canyon and glided to the bottom.

Bennett, more than anyone else except Rogallo, helped give birth to the sport of hang gliding. It caught on rapidly on the West Coast and soon began to spread eastward. In recent years it has become a nationwide and worldwide sport. Even Francis Rogallo himself fell victim to it, and when he was in his early sixties, he took up the pastime at his retirement home near Kitty Hawk, North Carolina.

Kitty Hawk is more than the retirement home of Francis Rogallo. It is the place where the inventors of the airplane, the Wright brothers, made their first successful flights. They began with gliders, much as hang glider pilots are doing today.

Wilbur and Orville Wright were bicycle manufacturers from Dayton, Ohio. They read everything they could find about a German flying inventor, Otto Lilienthal. Lilienthal spent many years trying to realize his dream of man flying. He observed birds flying, and he tried to build a machine with wings that would flap and send him