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Pilot

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Flying for Business and Pleasure

The ancient new sport of hang-gliding

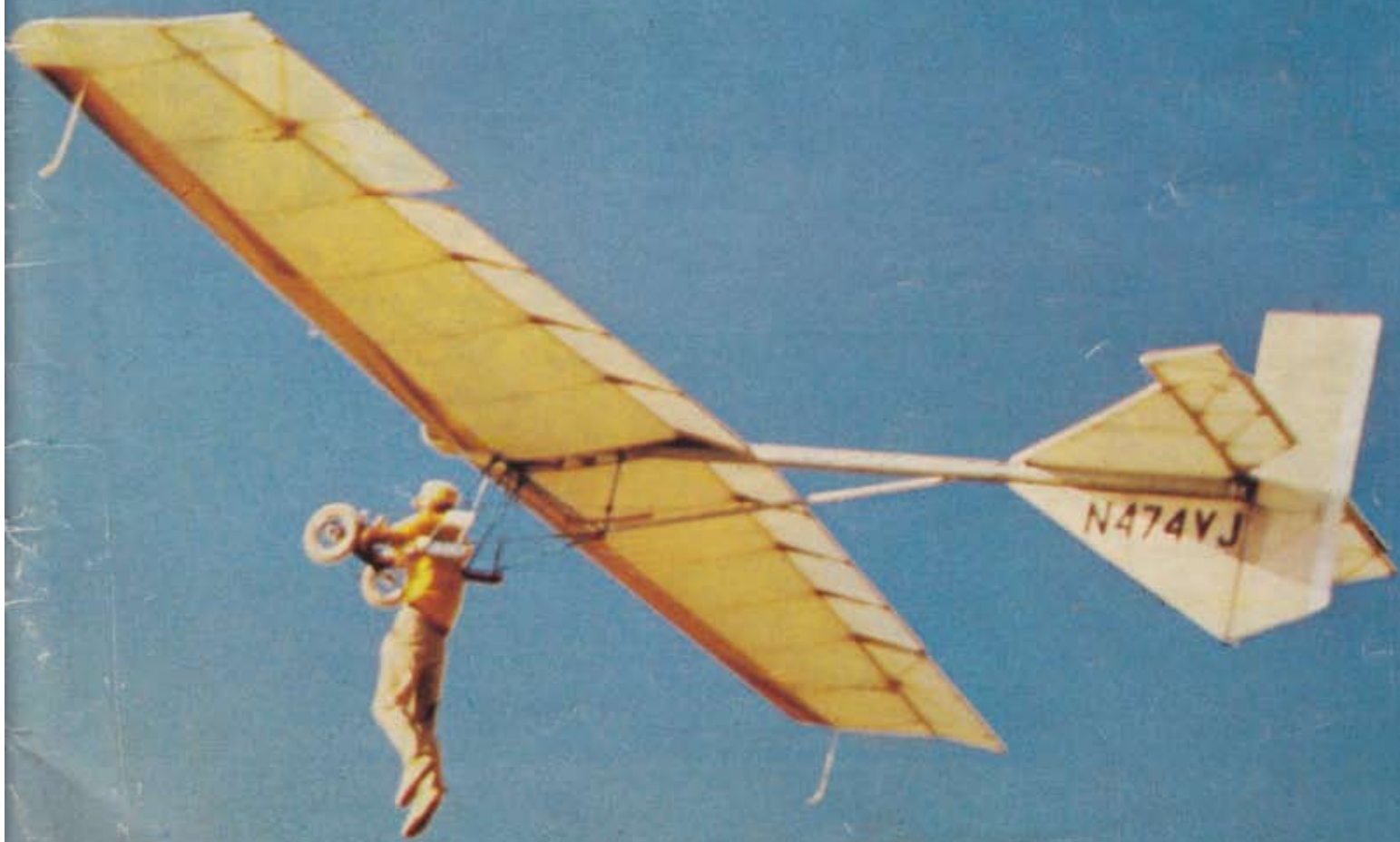
(it's fun, inexpensive, and dangerous)

Pierre Robin's new 320 hp retractable

(it's fast)

Flying the 1909 Avro Triplane

(it's diabolical)

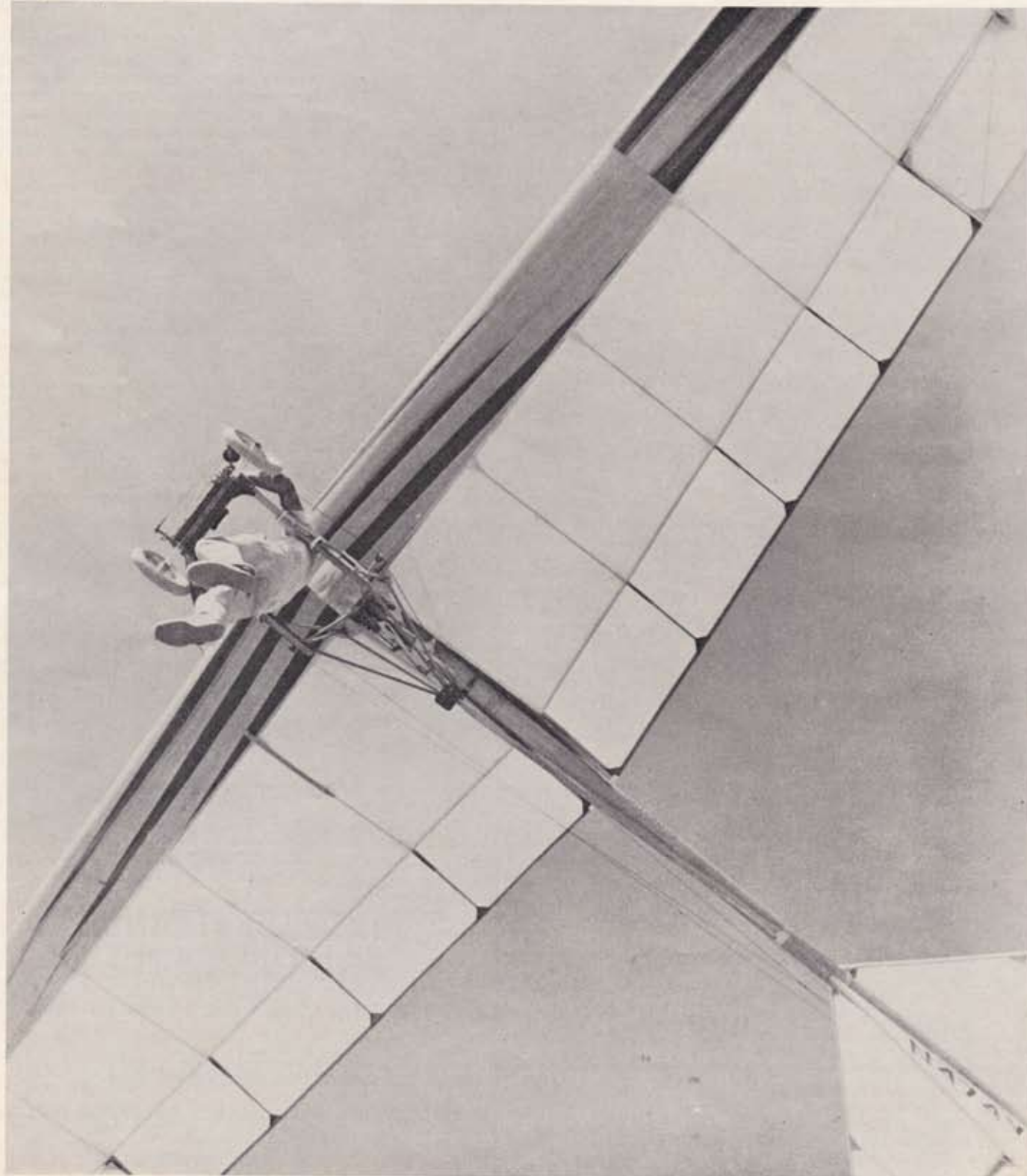


ON GOSSAMER WINGS

The way man first flew in the 1890s is making a comeback — in Southern California, where else? Hang-gliding or sky surfing is the cheapest, simplest aerial sport yet.

by David Esler (with photos mostly by the author)

Douglas Morgan



Freud never mentioned anything about an "Icarus Complex," a compulsion to don rickety sets of wings and launch oneself aloft from the face of a convenient hillside.

And yet heavier-than-air flight can mark its origins in feats such as this, among the windy hills of Germany, and Kitty Hawk, and San Diego. But who *remembers*? The accomplishments of Lilienthal and Montgomery were quickly forgotten when the internal combustion engine rendered the Wright Brothers' glider a viable aircraft, and the technology of low-speed aerodynamics stagnated for 70 years.

Who remembers? Across the United States thousands of aviation enthusiasts—most of them young people—are reviving the sport of ultra-light soaring, or "hang-gliding". And in their pursuit of the elusive "perfect" lift-to-drag ratio, these novice engineers are pushing forward the frontier of knowledge in the relatively unexplored field of low-velocity aerodynamics.

Hang-gliding, sky surfing, or as the Soaring Society of America prefers to call it, ultra-light gliding, represents the closest approach to "popular aviation" yet to materialize in this country.

As one enthusiast said recently: "Private flying is still a rich man's sport, and it's conceivable it probably always *will* be. The high cost of relatively low-volume aircraft production, increased operating expenses, and just inflation in general, have all mitigated to keep pleasure flying beyond the economic grasp of the average man."

(Left) Volmer Jensen's Swingwing has an incredibly thick airfoil. It lifts airborne with its pilot merely walking a few steps upwind!
(Below) Swing-seat Rogallo. The pilot has pulled himself forward to bring the nose down.

But with the mean cost of a good Rogallo parasail hovering in the neighbourhood of \$75 (£30), nearly anyone can experience the joys of soaring *à la* hang-glider.

Hang-gliding as a recent movement got started in California, that land of golden hills and smog which seems so often in the vanguard of social phenomena. A Los Angeles school teacher named Jack Lambie developed a Chanute-type rigid glider as a summertime science project for his students. Constructed of door-jamb wood, bailing wire, and polyethylene plastic, the creaky boxkite was based on plans Lambie had seen in a 1909 science magazine. Lambie's junior high students assembled their creation under Jack's tutelage, then christened the machine *Hang Loose*.

"No one was more surprised than me when it flew," says Lambie, a 4,000-hour sailplane pilot/instructor. *Hang Loose* was a true hang-glider, since its pilot suspended himself from a horizontal frame which extended fore and aft under his armpits. "We found we could control the plane by shifting our bodies in a roughly circular range of movement," continued Lambie, "thus adjusting the craft's centre of gravity." Average flights into a two- or three-knot wind lasted only a few seconds, but everyone had such a good time Lambie was convinced there was a future in ultra-light soaring. So in 1970 he began to grind out mimeographed sets of plans for *Hang Loose*, and soon several of the rickety gliders were plying the wispy breezes among the grassy hills of Southern California. →



ON GOSSAMER WINGS CONTINUED:

(Below) Ron Klemmedson's rigid biplane glider bears a staggering resemblance to one of the Wright Brothers' machines. It even employs wing-warping for roll control!

(Below, right) Two enthusiasts disassemble their Rogallos at the end of a morning soaring.

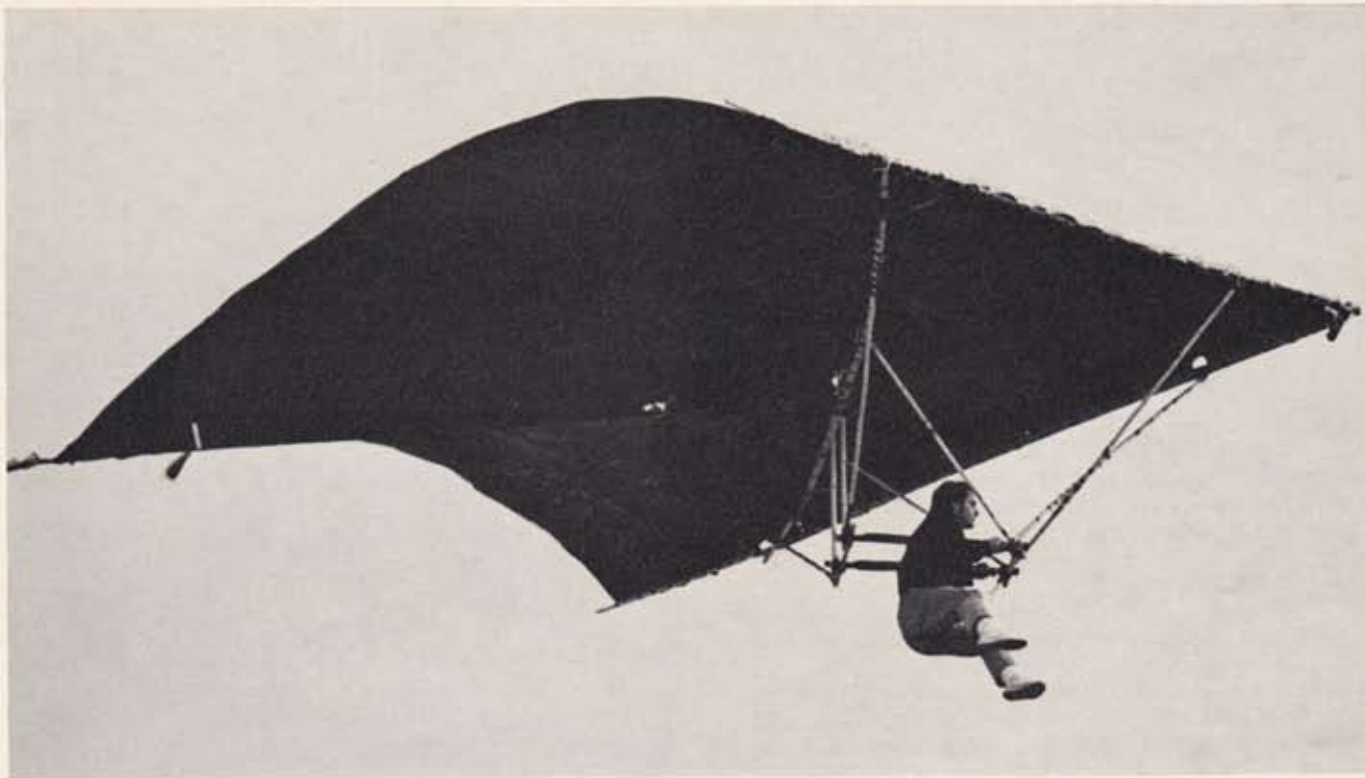


About this time hang-gliding exploits of a different nature began finding their way into the headlines of newspapers and periodicals. Two Australians living in California, Bill Bennett and Bill Moyes; a Washington ski enthusiast named Jeff Jobe; and bearded David Kilbourne of San Jose, California, all working independently, startled the aviation community with astounding flights in semi-rigid Rogallo parasails—originally developed for towing behind speedboats. Bennett and Moyes, billed as the "Australian Birdmen", committed themselves to incredible (and dangerous) stunts like soaring into the Grand Canyon and Death Valley (both descents marking changes in elevation of more than 6,000 feet) and being towed aloft behind aircraft and dragboats. And while Jobe skied into the air from the frozen mountainsides of Washington, Kilbourne perfected the art of ultra-light ridge soaring at 3,500-foot Mission Peak near San Francisco, where he literally blew the minds of Schweizer sailplane pilots encountered aloft.

With other enthusiasts like Dick Eipper of Los Angeles marketing Rogallo plans and kits, hang-gliding began to grow in popularity. Everything came together in the spring of 1971 with the "world's first international hang-gliding meet" in Corona del Mar, held appropriately on the birthday of hang-gliding pioneer Otto Lillenthal. Spurred on by the interest shown at the Lillenthal meet, Eipper and Kilbourne organized clubs at opposite ends of the state, and the Soaring Society of America under the impetus of Executive Director Lloyd Licher provided an unofficial liaison.

Today hang-gliding is growing with lightning rapidity, and has spread to other areas of the US as well.





The 1972 Lilienthal meet produced many participants, several hundred spectators, and several truly impressive flights. "This thing is expanding so fast," says one club member, "that we really have to work hard getting the word out to diverse areas of the country on safety procedures and proper construction methods."

There are two general types of hang-gliders; semi-rigid parasails of the Rogallo *genre*, and rigid aircraft. The former, developed from designs laid down in the early '60s by NASA scientist Dr. F. M. Rogallo as a proposed recovery system for Apollo spacecraft, offer the advantages of low cost and ease of construction, simplicity, portability, and airworthiness. Although rigid hang-gliders, which follow traditional airplane concepts and construction methods, have been overshadowed to a degree by the more versatile Rogallo "kites", most hang-gliding aerodynamicists agree that the future belongs to the rigid glider. As the field of low-speed aerodynamics is more fully explored—after having lain dormant these seventy odd years—new airfoils and aerodynamics devices will be developed allowing the rigid machines to eclipse and surpass the Rogallos in efficiency.

The Rogallo kite is formed around an A-shaped structure of aluminium tubing with a keel tube extending from the point of the A aft. Size is measured not tip-to-tip as with an airplane wing, but from the tip to the point of the arrow. For example, an "average" Rogallo has a tip-to-point measurement of around 16 feet, and a span of more than 20 feet. Conventional Rogallos feature a convergence angle of the leading edge tubes of approximately 90 degrees; tip the scales at about forty pounds; and develop around one pound per square foot of wing loading with your typical average-size pilot aboard (based on approximately 180 square feet of wing area). A glide ratio of four or five to one is about the maximum which can be expected.

A sail of polyethylene plastic or one of the popular rip-stop synthetics is attached to the leading-edge tubes and along the keel bar, so that with the bird in flight, the unattached aft material "inflates" forming two sections of

(Above and below) An early basic bamboo-and-plastic Rogallo glider. The pilot literally hangs from the framework below the sail.
(Bottom) A more modern Rogallo with a swing seat.



ON GOSSAMER WINGS CONTINUED:

approximate conical shape. The frame is held together with bolts so that the pilot has only to remove them in order to fold everything back along the keel bar for easy transportation back up the hill. (Otto's First Law of Hang-Gliding is, "What floats to the bottom has to be carried back to the top.")

Although early Rogallos featured Hang-Loose-type "cockpit" structures from which the pilot suspended himself (hanging on for dear life), the Australians Bennett and Moyes developed a simple swing-seat strung from the keel on cables. This permits the pilot to sit comfortably during flight, and to control his bird by swinging his body in any desired direction as he pivots against a trapeze bar extended down in front of him by rigid aluminium tubes. Eipper modified this system, supplanting the seat with a harness which allows the pilot to extend himself in a prone position once the glider is airborne. The prone profile generates far less drag, and usually results in flights of longer duration.

Most flights are made in steady winds of less than 15 mph, and the stability and degree of control is surprising, the pilot maneuvering his machine with subtle body movements. Forward speeds average 30 mph, with the margin between cruising velocity and stalling speed usually quite narrow. In an attempt to improve glide ratios, some enthusiasts—especially the Southern California beachcombers—are experimenting with high aspect ratio kites with leading edge convergence angles of up to 180 degrees. Although wing spans are considerably increased, new problems in stability and controllability have been generated (primarily because of the reduction in length of the keel bar). In an attempt to restore aerodynamic integrity, backyard builders are testing all manner of aerodynamic devices—ailerons, flaps, flaperons, spoilers, spoilerons, leading edge slots, cylindrical sail configurations (leading edge tubes bowed upward so sail sections are cylindrical instead of conical), etc.

One's average low-and-slow Rogallo can be constructed from nonexotic materials for about \$75 (£30), sometimes even less. Selection of the sail material can be an important cost factor, however, since many of the more durable fabrics, such as mylar and dacron, can set one's bank account back as much as \$300 (£120). Rogallo parasails intended for high-altitude flights of long duration represent a bird of a much more sophisticated feather, and require construction of aircraft-quality components. Kits for boat-towed ski kites and Kilbourne's ridge-soaring machines cost as much as \$500 (£200).

Rigid hang-gliders tend to test one's loyalty to the discipline of self-soaring, since they represent a much more complex and troublesome approach to the medium. The most highly developed rigid machines have been conceived by two Californians at opposite ends of the age scale: Taras Kiceniuk, a Los Angeles teenager; and Volmer

(Below) A 'conventional' Rogallo, with a convergence angle of about 85° ready to go. (Centre) The same glider in flight, showing how the sail sections become conical in flight. (Bottom) Landing: the pilot leans back, the glider flares, and he touches down at walking speed.





(This page) Taras Kiceniuk, a 17-year old from Los Angeles, and his *Icarus II* tail-less biplane, which holds the hang-gliding endurance record of over an hour. It is built of aluminium tubing with styrofoam ribs. Control is by tip-mounted rudders.



Jensen, whose hang-gliding experience dates from the 1930s. Kiceniuk's *Icarus* tailless biplane is undoubtedly one of the most advanced ultra-lights to date, featuring a sophisticated Eiffel reflex airfoil, pilot-operated moveable control surfaces, and a whole bag of neat aerodynamic and construction techniques.

The combination of *Icarus* and its young pilot has proved to be dynamic, as the 360-degree turn during a one-minute descent from a low (700 feet) hill in Livermore during the '72 Lilienthal meet, and an eighty-minute soaring flight along the Pacific cliffs at Torrey Pines established.

Volmer Jensen sort of got the jump on everyone during World War II, when he engineered a biplane rigid glider which looked vaguely reminiscent of the early Wright powerless ships. Jensen still markets plans for his *VJ-11* which boasts three-axis controls, but lately his emphasis has been placed on a radical monoplane hang-glider, the *VJ-23 Swingwing*.

The *Swingwing's* most notable feature is an incredibly thick airfoil (18 inches at wing root) and a 33-foot span high-aspect-ratio wing. Essentially, the plane is an ultra-light scaled-down sailplane, but its ability to literally soar, *i.e.*, gain or hold altitude, effortlessly, while maintaining phenomenal stability, bodes well for the increasing body of knowledge surrounding low-speed aerodynamics. Whereas many hang-gliders require a good hefty sprint into the wind by their pilots, *Swingwing* lifts airborne with the pilot merely walking a few steps upwind!

Other interesting rigids include a graceful biplane built by Ron Klemmedson which features wing-warping for control; and Bob Lovejoy's *High Tailer*, which as its name implies, exhibits a Learjet-type empennage supported by two impressive dacron-covered vertical surfaces.

The rigids seem to be advancing hang-gliding technology into the realms of the unexplored, but they still require a great deal of attention before and after a day's flying, that is, they've got to be assembled and torn down, and (usually) trailered to and from flying sites. So the parasails still have it all over the rigids in *this* ball park (or cricket green or whatever you Limeys call it).

The actual experience of flying a hang-glider can only be described as transcendental. *Really*. According to Lambie, it's as close to imitating the intuitive flight of

ON GOSSAMER WINGS CONTINUED:

(This page) *Volver Jensen's high-performance VJ-23 Swingwing.*
Notice the very thick airfoil.

Photos this page by Douglas Morgan



birds as man has achieved so far. Unlike flight in powered aircraft or conventional sailplanes, the element of machinery interposing itself between pilot and medium is held to a minimum, and the effect produced is nearly intoxicating.

The level of skill required is far less than that necessary for operation of a powered aircraft. Under the proper wind conditions, and exercising recommended safety procedures and common sense, one can learn to fly the low-and-slow routines in a weekend. Ridge soaring demands a higher level of experience as well as a properly-structured aircraft, however, and it isn't recommended for the novice. Strictly *verboden* are auto tows. Four known fatalities have occurred in hang-glider accidents, all as a result of power tows. Like a motorcycle, a hang-glider offers its occupant little protection in the event of a crash, so Otto's Second Law certainly applies here: "Don't fly higher than you're willing to fall."

You would-be hang-glider enthusiasts in the Old Country can obtain more information on ultra-light soaring, including a list of American firms marketing hang-glider kits and plans, by contacting the Soaring Society of America at Box 6601, Los Angeles, California 90066, USA.

In little more than two years the undulating five-foot-high, ten-second-long flights of Jack Lambie's *Hang Loose* have evolved into hour-long sojourns aloft performed routinely by Kiceniuk and Kilbourne. A new wave of popular aviation is sweeping eastward from the hills of California. Young people are learning that the realm of flight is accessible, that it can be unrestricted by complex machines and cumbersome reams of regulations set down by omnipotent governmental agencies. Hang-glider is a sport characterized by youth and young thinking, which is rather surprising considering it originated in the nineteenth century. □





(Top) Launching a Rogallo that features leading-edge slots for (hopefully) better low-speed manoeuvrability.

(Centre) Crowded skies over Mission Ridge, near San Jose in California. This popular site drops from 3,700 feet almost to sea level.

(Bottom) An English pioneer is Geoff McBroom of Bristol, seen here making an 8½ minute flight from the Westbury White Horse in Wiltshire. The take-off was "two steps at walking pace".

