



CASCADE INC ULTRALITES

HOME OF THE
KASPERWING

INTRODUCTION

Thank you for your interest in the Kasperwing 1-80 Ultralight Motorglider. The purpose of this info packet is to further familiarize you with the Kasperwing concept, give you some insight into the exciting new field of extended aerodynamics and provide you with the necessary tools and information in which to order a Kasperwing in either complete or kit form.

HISTORY

It all started about 1937 in Poland. Witold Kasper, expert soaring pilot, flight instructor, and director of the Polish School of Soaring, decided to fly a glider cross-country to a family reunion instead of taking the train. Upon completion of the 150 mile flight, he set up a landing approach, opened the spoilers, then suddenly stalled and side-slipped into the ground from an altitude of about 300 feet. Luckily, although the glider was totally destroyed, Witold escaped with only minor injuries. He thought to himself, "If a crash like this can happen to me, a pilot of great experience, what chance do my students have of avoiding such a mistake?"

In a way this crash was fortunate. It set Witold to thinking of a way to eliminate the undesirable characteristics common to all our conventional aircraft designs, including the notorious stall/spin accident which has killed so many pilots in the past. In his search for a safer machine, Kasper poured through volumes of literature. He studied everything which had been written or theorized in connection with flying wings, including all the experiments which dealt with those machines up to that time. Frustrated, not finding the answers he was looking for in the textbooks and experiments of other modern day aerodynamicists, he turned to nature. He observed the bird to seek the answer to its success, hoping to find the key for the design of a truly safe airplane.

Being an engineer and aerodynamicist of considerable abilities allowed Kasper to discard the principles of conventional aerodynamics in favor of what he calls, "extended aerodynamics", that unwritten, untested realm of flight which birds have exploited, by the nature of their design, since the beginning of recorded history. This new realm of extended aerodynamics includes those natural occurrences which cannot be explained by the laws found in aeronautical textbooks, including the phenomena of "vortex lift", first theorized and later proven by Kasper in the design and testing of his BKB-1A sailplane.

The coming of W.W. II forced Kasper to temporarily abandon his investigations as he was eventually forced to flee his homeland and settle in Canada, where he was employed by Canadair as a design and liaison engineer until 1958. It was during this time that Kasper began to design and build the BKB-1A aerobatic sailplane in order to further prove his theories.

After several years Kasper eventually moved to the U.S. where he was employed as an engineer for the Boeing Airplane Co. in which he was an expert on all those devices that come popping, whirring, and clanking out of the wings of 727's, 737's, and 747's to slow things down for landing.

Finally, he was able to finish construction of the BKB-1A in the workshop adjacent to his home in Bellevue, Washington and began flight testing the machine in the early 1960's. The glider flew so well and proved Kasper's theories so thoroughly that he was soon flying and demonstrating his wing all over the Northwest and Canada for all the local airshows and fly-ins, where it acquired a great reputation as being a machine of unique and extraordinary capabilities.

It was because of this reputation that some of the more proficient local hanglider pilots became aware of the Kasperwing concept, and as a result the Kasperwing 1-80 Ultralight Motorglider has emerged. This newest Kasperwing fuses the latest ultralight aircraft technology together with Kasper's principles of extended aerodynamics. The result is a **superb** ultralight which carries on a tradition of performance and stability that is bound to have profound implications throughout the the light aircraft industry, and could also play a part someday in reshaping the face of the entire aviation world.

THE DESIGN

The Kasperwing 1-80 Ultralight is a direct descendant of the famous Kasper BKB Sailplane, invented and patented by Witold Kasper during the late 1950's and early 1960's. The Kasperwing ultralight was designed by veteran hanglider pilot, Steve Grossruck, who worked in close conjunction with Witold Kasper to produce a machine which was capable of exhibiting those features of extended aerodynamics as were applicable to its realm of flight. It has proven itself capable in all respects and we feel it comes closer than any machine in the history of aviation to duplicating the method of control practiced by those original masters of the sky, the birds.

The airframe was originally based on the popular Fledgling hangglider, which was chosen as a test and research vehicle because of its simplicity, high strength, portability, and ease of modification or repair. It proved to be highly capable of fulfilling its purpose.

The original prototype airframe was built from scratch during mid-1976 and utilized the stock sweep, dihedral, and airfoil configuration of the Fledgling, with the exception of the wingtip controls, which were designed around the aerodynamic principles suggested by Witold Kasper. It was decided to modify the Fledgling slowly, one step at a time, so that each minor change could be thoroughly tested and an evaluation made as to the effectiveness of that change prior to moving on to the next modification. In this manner we could avoid an accumulation of improvements or errors, and could more clearly understand the significance that each small part of the Kasper system contributed to the overall performance of the machine.

After extensive flight testing and modification a design was finally produced which satisfied all the requirements we felt were necessary to achieve a machine of total performance and practicality. Finally we had a wing which:

- Would not stall
- Would not spin
- Had excellent stability in all 3 axis at high or low speed
- Had a roll rate from 45° - 45° of 3 seconds or less
- Had a glide ratio of approximately 14/1
- Had a minimum sink rate of 160 f.p.m. with 150 lb. pilot
- Could be foot launched by the pilot with little or no assistance
- Was foldable and portable on the pilot's shoulder
- Could be easily repaired

Most important of all, it could be flown with hands-off stability in a vertical descent or mush, sustained by what has come to be known as "vortex lift". The glider maintained control in the yaw and roll axis totally independent of the forward speed of the craft! The vertical mush proved beyond a doubt Kasper's theories of extended aerodynamics, including the formation of a lift-producing vortex on the upper surface of the wing which he discovered earlier on his BKB sailplane.

After 2-1/2 years and over 150 hours of actual flight testing under a variety of thermal and ridge-soaring conditions, the accumulation of the dozen or so plan-form changes began to payoff. The glider won every regional hang-gliding contest it was ever entered in. We now had a high performance, super stable soaring machine with extraordinary secondary features and it was time to move on to the next step.

POWER POD

Having made the initial decision to motorize, a wooden mock-up was built to determine the physical requirements for the pilot, engine, and landing gear configuration.

It was opted to go for as low a thrust line as could be tolerated in order to minimize the problem of pitch-overs aggravated by the thrust of the engine when flying through turbulence. At the same time we wanted to keep the pilot as close as possible to the wing in order to keep the overall center of mass and center of drag as close together as possible. A tubular prototype was constructed, tested and proved to be quite effective as the machine was flown under full power into strong turbulence without encountering any thrust-induced pitch oscillations. A minimum amount of pilot movement was all that was required to correct for gusts. The machine felt very stable and secure, even when powering into strong thermals. The low thrust line, high center of mass configuration also allowed for a much lower overall profile which made ground handling a lot easier and also minimized drag.

ENGINE

The first engine we tried on the Kasperwing was a Soarmaster unit, incorporating a Chrysler 320 engine of approximately 10 h.p. It was noisy, leaked oil, and proved only sufficient in getting our wing off the ground. The static thrust when new was 75-80 pounds. This gave the Kasperwing a climb rate of about 250 f.p.m. After 25 hours of airtime it developed a spiral fracture in its reduction shaft and could not be counted on to produce consistent performance. Clearly, we need a better engine.

A quick survey of all the small go-cart, motorcycle and industrial engines was made and we settled on the 100 cc Yamaha cart engine of 15 h.p., with c.d.i. ignition. With a 3.33/1 reduction ratio and a 48 X 24 wood prop we got 120 lb. static thrust. This gave the wing a realistic climb rate of about 350 f.p.m. and about 40 hours was put on the airframe in a matter of weeks. The only complaint we had with the Yamaha 100 was it required about 1/2 hour of maintenance for every 10 hours of air time to keep it running perfectly. A super quiet muffler was added to this system without compromising power and the machine won the "Best Power Pack" award at the Easter Fly-In at Porterville, California.

Currently we are using the 250 cc Honda Odyssey engine of about 24 h.p. It delivers a whopping 150-170 lbs. thrust with a 50 X 24 prop at 3000 r.p.m. This combination pushes the little wing around at 60 m.p.h. tops, giving it a rate of climb at 550-650 f.p.m. The average engine life with this machine is 100+ hours, depending on how much time you spend running around the sky wide open. It is possible to extend the engine life much longer by flying conservatively, using it only for climb or cruise. The glider was designed primarily as a soaring machine and soars very well with power off, but also retains impressive airplane capabilities.

SEATING

Pitch or speed control is sufficiently accomplished by shifting the pilot's weight. Since the pilot would be moving his body fore and aft to change the machine's center of gravity, a proper pilot suspension system was needed. A sling-like hammock was considered for pilot suspension, but a swinging harness arrangement was chosen because the pilot could move the mass of his body much faster if he were suspended in a harness instead of sliding in a hammock. Also, the harness could be used in a free-fall situation with a parachute if it ever became necessary to exit the machine in case of fire, etc. Another advantage of the pilot swinging suspension system is that the pilot can move the suspension point in flight, allowing for C.G. trim as is the case with most modern aircraft, but is not the case when the pilot sits in a hammock-type seat.

CONTROLS

Control of the wingtips was originally achieved with twist grips or dual control sticks, but this arrangement proved awkward or confusing to some pilots. A butterfly wheel steering yoke was designed, which incorporated all the functions of two independent control systems in one unit, and has the added feature of positively opening or closing the tips at any airspeed or attitude.

The engine, throttle and mixture controls are located in a quadrant on the right side of the pilot frame, and the kill-switch is mounted on the steering yoke.

FAIRING

The butterfly wheel allows the pilot to keep his arms, elbows and hands within the confines of the airframe, which permits the use of a highly streamlined pod or fairing, if desired. The understructure was designed intentionally with the idea of incorporating a super-sleek pilot fairing arrangement, therefore the overall dimensions were kept as small, neat and functional as possible.

LANDING GEAR

Various types of bungee, spring, or shock-cord landing gear devices were tried with varying degrees of success, but the small, light, simple, rigid-type using very soft pneumatic tires proved to be sufficient suspension as well as being the cleanest aerodynamically.

SAFETY AND "THE VORTEX"

Aside from the overall performance and handling characteristics of the Kasperwing, its most unique and valuable safety feature is its ability to "mush" or fly below the stall without spinning or dropping the nose. The machine can literally "parachute" straight down at about 600-800 f.p.m. riding on a circular vortex of air which shears off at the leading edge of the wing and forms a low pressure area which is referred to as "vortex lift".

Because of the sophistication of the wingtip design the machine can be turned and controlled while in a vortex descent, the control system working independent of the forward speed of the machine!! This is the same thing which birds do when they approach to land on a branch and just seem to "hover down". It cannot be over-emphasized how important this feature can be if the pilot is ever faced with an engine failure just after take-off. It is actually possible to "mush" the machine onto the top of a flat-roofed building or into some other small, confined area if the situation demands. This virtually eliminates the notorious stall/spin accident which has claimed so many pilots in the past.

In the event of a crash or hard landing, the pilot is protected by a framework of tubing which will collapse progressively around him/her, gradually absorbing the shock of impact. In one inadvertent test, the pilot was practicing a vertical descent before attending an airshow. He forgot to move forward, build speed and flare prior to landing and actually pancaked the machine, impacting in the horizontal position. The tires, frame and pilot suspension system absorbed so much of the impact that all the pilot felt was a hard jolt, about like falling off of a chair at the dinner table instead of sustaining possible serious injuries had his body actually contacted the solid ground. The only damage the glider received was a compression buckling of one landing gear strut, which was replaced in about 5 minutes with a spare, using only common hand tools. The G-meter mounted on the machine registered +12 G's!!

PERFORMANCE AND PILOT REQUIREMENTS

The KASPERWING 1-80 Motorglider is a high performance soaring machine with outstanding airplane capabilities. Because of this we don't suggest you learn to fly on yours, and in fact, our policy is not to sell machines to "green" non-pilots because of the obvious danger to themselves or others. Instead, we suggest lessons in a hangglider (non-powered), sailplane, or regular aircraft flight training program in order to become familiar with flight in general and the F.A.R.'s in particular. After you have learned the basics of flight, powered or otherwise, you can easily make the transition to the Kasperwing in the course of one afternoon. Currently, no license is required to fly a Kasperwing as the aircraft is foot-launchable and as such, exempt from F.A.A. registration or restrictions. One must still abide by the applicable F.A.R.'s such as not flying in restricted or controlled airspace and, some kind of prior flight experience is mandatory.

The wing is very forgiving and can easily be flown in strong lift and turbulent conditions with complete confidence. The rate of climb at sea level has been measured at 650 f.p.m. with a 150 lb. pilot, and once you learn to fly yours, you will be able to take off in fifty feet or less and climb at angles in excess of 30° to as high as 15,000+ feet without help from Mother Nature. The main purpose of the machine, however, is for soaring and once you have climbed to altitude the engine can be shut off and you can soar for hours for just pennies. The glider can be restarted in the air by pulling on the pull-starter, located between the pilot's feet, so that its possible to alternately soar and motor for several hundreds of miles on just 2-1/2 gallons of gas.

KASPERWING 1-80 ULTRALIGHT MOTORGLIDER

ASSEMBLY TIME

Assembly time on your Kasperwing is approximately 40 hours using common hand tools. All components come cut, bent and drilled. The sail and tips are presewn and fabricated, ready to install.

KIT CONTENTS AND DESCRIPTION

Every kit or complete Kasperwing we build is constructed of only the finest aircraft hardware and construction materials, on precision jigs, utilizing state of the art construction techniques. The combined engineering and construction experience of our staff totals more than 90 years! When it comes to quality and dependability, we don't compromise. We feel this ensures our customers of the best possible product at the lowest possible price.

Each kit or complete Kasperwing contains one each of the following:

Sail and Rudder Bags
Presewn 3.8 oz. dacron wingcover
Fabricated set of wintip controls ready to install
250 CC Honda Oddyssey engine (or optional, depending on availability)
Reduction Unit with all related components including expansion chamber/
muffler, 50" prop, belts, bearings and engine mounts
Fuel system and electrical system, etc.
Airframe assembly including all spars, struts, fittings, control components,
landing gear, wheels, tires, tubes, etc.
Clean coated 3/32 aircraft cable rigging and all necessary stainless
tang, Never Kinks, swajes, thimbles, etc.
100% AN grade aircraft bolts and hardware

All necessary miscellaneous materials and components to completely assemble, rig, and fly your Kasperwing including step-by-step assembly and flying instructions.

NOTE: Kits do not come with seat or instruments.

OPTIONS

As was mentioned earlier in this brochure, the Kasperwing was designed primarily for soaring with the ultimate intent of enclosing the pilot in a stream-lined fairing or pod, to reduce drag and keep the pilot warm during winter flying or high altitude excursions. This fairing will be of the "clam shell" variety, opening and closing via a single hinge in the middle. It will still allow the pilot to put his feet down for use as brakes or when foot launching.

OPTIONS (Cont'd.)

It will be composed of lightweight fibreglass with a lexan wind screen and should weigh, including the mounting hardware, about 6 lbs, which is a small price to pay for an overall increase in performance of 20-30%.

When used in conjunction with the proposed vortex generation devices (still under development) that will attach conveniently to the leading edge of the wing, it should provide the following performance improvements:

<u>CURRENT PERFORMANCE</u>	<u>WITH OPTIONS</u>
<u>(Power Off)</u>	<u>(Power Off)</u>
Max L/D: 10/1 at 23 m.p.h.	15/1 at 27 m.p.h.
Min. Sink Rate: 200 f.p.m.	160 f.p.m.
<u>Cruise (50% power)</u>	<u>Cruise (50% power)</u>
35-30 m.p.h.	40-45 m.p.h.
Fuel consumption: 1 gal/hr.	Same
<u>Full Power</u>	<u>Full Power</u>
(Top speed smooth air) 60 m.p.h.	(Top speed smooth air) 70-75 m.p.h.

of course, the glider will maintain the same inherent stability characteristics and vertical descent capabilities as before. The intent here is to bring the machine to its full potential yet still offer it in its simpler form for those who insist on riding in the open air which can be quite appealing in itself.

The pilot has the choice, as both fairing and vortex generators will be easily removable, bolt-on items which can be replaced or repaired quickly if damaged. Best of all, they will open up an entirely new realm of low-speed, high-performance flight never before experienced by any powered or non-powered ultralight.



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THE ULTIMATE IN STRENGTH
AND COMFORT.

DESIGNED ESPECIALLY FOR
THE KASPER MOTORGLIDER

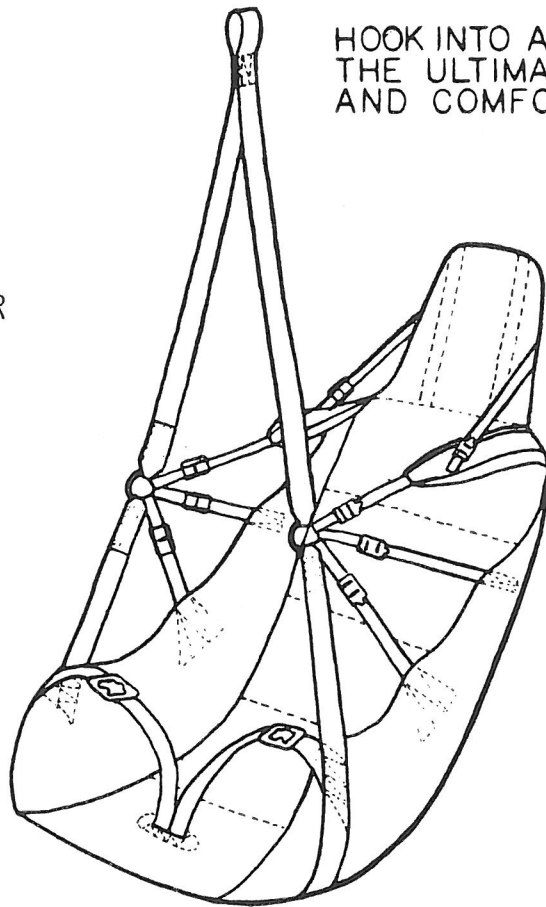
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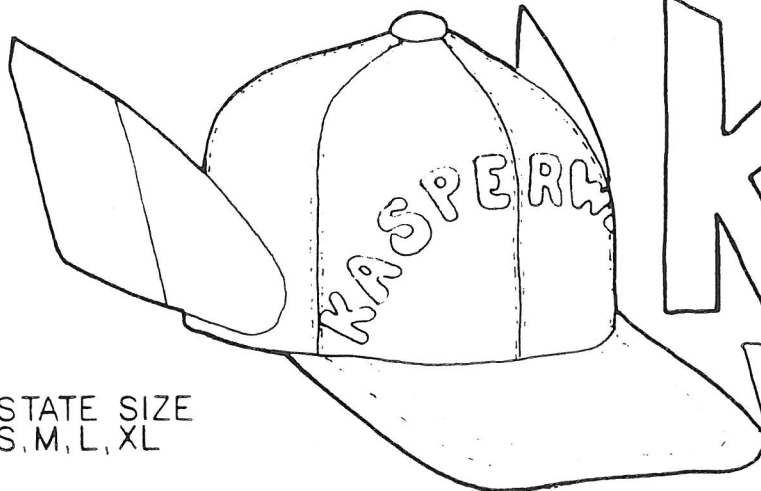


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WING HAT

\$8.00

THE INVENTOR OF THE KASPERWING - WITOLD KASPER

PERSONAL BACKGROUND AND EXPERIENCE HIGHLIGHTS:

Academic: M.S. Mechanical Eng E.T.H., Zurich 1929 - M.S., Aeronautical Engineering Lwow institute of Technologie, Poland 1939 - Assistant Professor L.I.T. 1937-1939 - Research Fellow, Aerodynamic Research Institute, Lwow, Poland, 1938-1939.

Original Design Record - Powered glider, 1937 - Four gliders of different types, 1940-1945. Two flying wing gliders and 2-place flying wing airplane, 1955-1969.

Flying - 1,800 hours in powered aircraft - 2,200 hours in sailplanes - Polish Champion in 1937, 1938, 1939 and 1948. 700 hours military - Night fighter pilot.

Employment - The Boeing Company, 1958-1970, now retired. Jet school instructor, customer operations, scientific and technical translations (from eight languages) Advanced research group - Canadair, Montreal, Canada, 1950-1958. Design Engineer, Liason Engineer. Rumanian State School of Soaring and Light Aircraft Manufacturing Shops, Broasov, Rumania, 1940-1945. General Manger, Training and General Manager of Production and Repairs.

Military - Air Force Officer Pilots Training School, Poland 1937-1939.

THE DESIGNER OF THE KASPERWING 1-80 ULTRALIGHT MOTORGLIDER

STEVE GROSSRUCK

Academic: Mechanical Engineering undergraduate with background in business and aeronautics.

3 years airframe and powerplant experience on turbine engined helicopters, 1970-1973.

Original Design Record - Built and taught himself to fly "Quicksilver" type rigid-wing hang glider in 1974. Built or participated in the design of over 20 different rigid-wing craft from 1974-1980, including Kasper wingtip conversion for the Fledging hang glider and design and production of Kasperwing 1-80 Ultralight Motorglider.

Flying - Accumulated over 500 hours flying powered and non-powered ultralights from 1974-1980.

Competition Record - Finished 1st in 1975 and 1976 - U.S.H.G.A. Region I Hang gliding Championships.

7th in 1976 U.S.H.G.A. National Hang gliding Championships, and 1st in 1977, 1978 and 1979 U.S.H.G.A. Region I Hang gliding Championships.