

1982 HARRIER II

AT WILLS WING, SOME NEW IDEAS HAVE BEEN AROUND A LONG TIME.



You have probably noticed that suddenly there is a new idea in hang gliding design: a simple, economical, high performance flex-wing that's easy and fun to fly. You may have noticed that suddenly everyone is selling their version of this new idea, and typically everyone is claiming that theirs is the best.

At Wills Wing, we don't think of this as a new idea. For eight years, we've specialized in designing and manufacturing high quality, high performance gliders with exceptionally responsive and pleasant handling characteristics. Wills Wing gliders have traditionally set the standard in the industry for defining quality in handling characteristics.

For 1982, Wills Wing is happy to announce the release of the HARRIER II. Redesigned for this year, the Harrier II is lighter in weight, easier to fly, and easier to land. It is available with or without leading edge mylar, and offers unmatched value to the serious recreational pilot from advanced novice through expert.

SPECIFICATIONS

	187	177	147
SPAN	34'8"	33'4"	30'
GLIDER WEIGHT (With/Without Mylar)	66/62 LBS.	57/53 LBS.	51/48 LBS.
PILOT WEIGHT	165-265 LBS.	150-250 LBS.	110-210 LBS.
PILOT SKILL	II	II	II
PRICE (With/Without Mylar)	\$1795/\$1675	\$1795/\$1675	\$1795/\$1675

May/June 1982

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WHOLE AIR

The International Magazine for Sport Pilots

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FOURTH ANNIVERSARY ISSUE



JAVELIN

SPECIFICATIONS

JAVELIN 168

Leading Edge	18 Feet
Keel	12 Feet
Span	31 Feet 8 Inches
Nose Angle	122 Degrees
Sail Area	168 Square Feet
Aspect Ratio	6.1
No. of Ribs Per Side	7
Sail Billow	0 Degrees
Pilot Weight Range	115-195 Pounds

JAVELIN 208

Leading Edge	18 Feet 4 Inches
Keel	12 Feet
Span	32 Feet 2 Inches
Nose Angle	122 Degrees
Sail Area	207 Square Feet
Aspect Ratio	5.2
No. of Ribs Per Side	7
Billow	0 Degrees
Pilot Weight Range	160-240 Pounds



JUST

WHEN YOU THOUGHT . . .

. . . that a glider couldn't be lighter — Flight Designs releases the JAVELIN. At 54 pounds flying weight, it is 14% lighter than the very popular Super Lancer series.

. . . that new gliders were getting too hard to land — Flight Designs presents the JAVELIN. State-of-the-art in every respect except one, it lands easily. Probably more so than your old intermediate does.

. . . that gliders got more complex as they developed — Flight Designs engineered the JAVELIN. Quick(est) set up going boasts an Easy-Slide, shifting crossbar, with all pip pins and no tensioners.

. . . that a glider which performed well could not also handle lightly — Flight Designs unveils the JAVELIN. Light as a hawk's feather, yet with a wide speed range. Optimized for sink rate performance, with its pre-formed ribs, 35% double surface, and spanwise sail cut, you'll just thermal and thermal.

. . . that new designs needed a few weeks to "get the bugs out," and even more time to reach stock levels — Flight Designs offers the JAVELIN, proven through the winter (at a number of our most professional dealers) and ready today for immediate delivery.

The JAVELIN is NOT just a cheaper version of the Flight Designs high performance glider. It IS a high performing glider that is deluxe in every way — like you have come to expect from Flight Designs.



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SEEDWINGS

Photos courtesy of Bettina Gray. Pilot: Jeff Burnett.
HGMA Certified

PARASENSE vs. PARASTUPIDITY

"The BRS, which I have witnessed deployed successfully at flying altitudes on an ultralight, is one of the most important safety items yet developed for the ultralight industry."

John Lasko of Eipper Formance

"I have personally deployed the BRS from a hang glider and an ultralight, and have found that it dramatically reduces deployment time. When you need the 'chute the most, you need it the quickest. The altitude lost before deployment is significantly lower than hand thrown 'chutes. All serious pilots should consider this system."

Rob Kells of Wills Wing

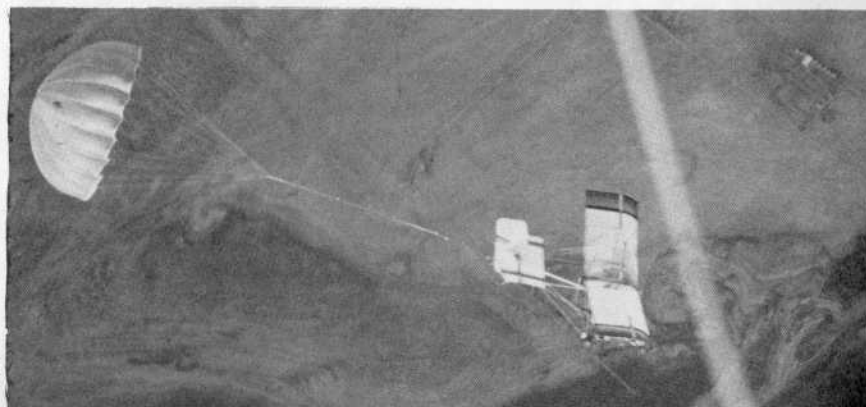
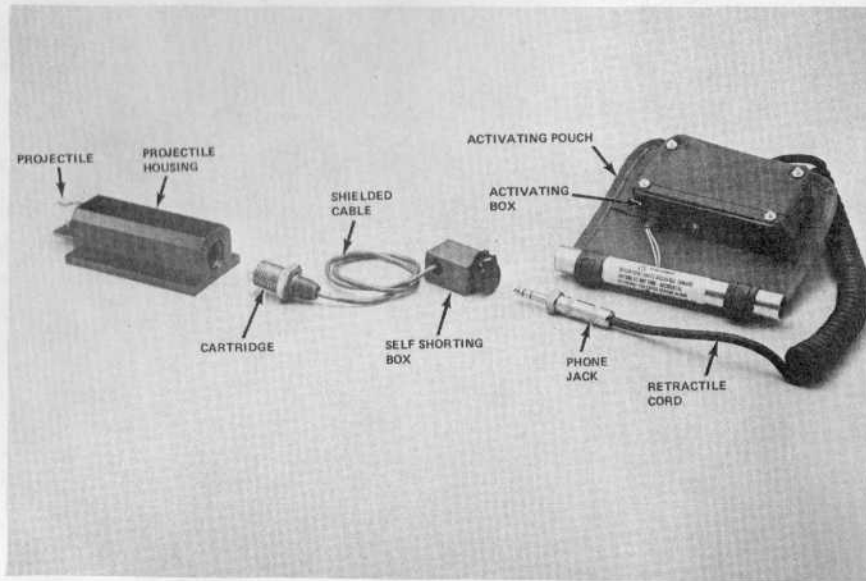
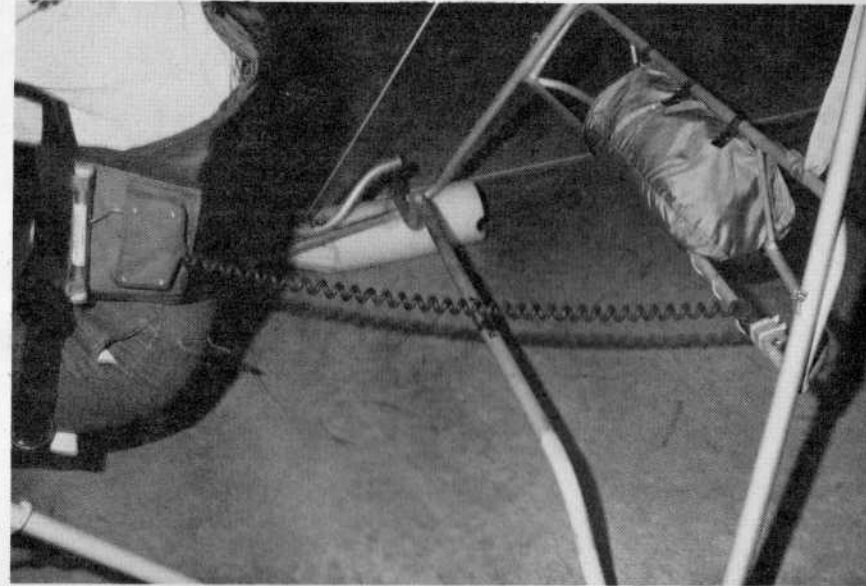
"I really like the concept of the BRS. Since it is ballistically deployed, deployment is instantaneous. When I fly with a 'chute, I want to know it will deploy when I really need it. I believe it's a must for any ultralight pilot."

Larry Newman of American Aerolights

"I'd own a parachute but I've never needed one yet..."

"I'd buy a parachute but they deploy too slowly, and I'd never get it clear of the glider in time..."

Surely, you are not the pilot making these statements? Are you?!



BRS

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NOW AVAILABLE

NOW . . . you can have instantaneous deployment, with documented full deployment times under 1.50 seconds. This compares to 7.48 seconds for hand deployments (average figures from the Chattanooga Real Air Deployment Seminar).

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TODAY . . . you can own the most sophisticated life-saving system in the world. The BRS is an electronic system that greatly decreases any chance of malfunction or inadvertent deployment.

Concerns over system failure are totally resolved as you can manually deploy the BRS as well. Military contractors have been employed in the seven years of intensive development. A program of check, re-check, and check again assures that the BRS provides the highest quality and certainty of performance when you need it.

The BRS has a low weight of 6-9 pounds, depending on the 'chute and type of support frame selected. The cost? A very reasonable \$690 with parachute... or with the hand deploy 'chute you already own, \$490.

TODAY . . . contact BRS Inc., for the pinnacle in life-saving technology. Which is it for you? . . . Parastupidity or Parasense . . . the BRS, Ballistic Recovery System.

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WHOLE AIR

ISSUE NO. 24, VOLUME NO. 5, NO. 2, 1982

PILOT'S PERSPECTIVE

- 24 HANG GLIDER EMPORIUM
An on-going Mini-feature in *Whole Air* which will take a look at all the major National Class hang glider shops.
- 26 THE YORKSHIRE AMERICAN CUP
Noel Whittall gives us a briefing on the upcoming American Cup, this year in England.

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ISSUE NO. 24

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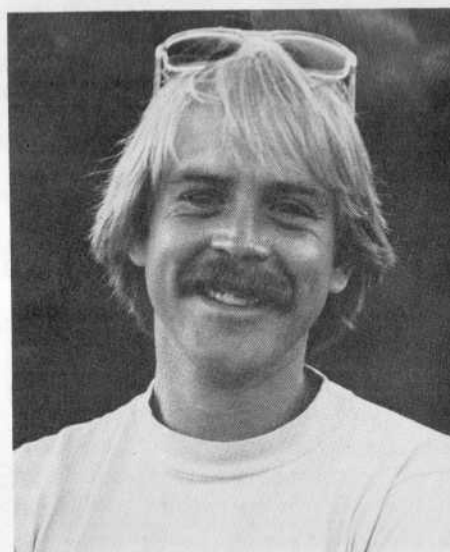
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Doug Barnette

On The Cover:

Energy is the theme of the 1982 World's Fair and the Sunsphere is the focal point. Doug Barnette (foreground) and Tom Phillips took to the sky above downtown Knoxville, Tennessee for this one-of-a-kind aerial perspective of the only World Fair of the '80's. The Fair opens May 1st, and runs for six months.

Publisher's Column



As our March/April Season Opener issue went on sale quite some time after our November/December offering, we received a number of letters asking about subscription interruptions. While most of those inquiries got answered by the arrival of the "Stonehenge" issue in mailboxes around the country and globe, we want all of you to know how things work here at *Whole Air*. And we want you to know how much we care about each name on our growing list.

While time simply will no longer allow us to respond to each and every card or letter we receive, each has special meaning to us, and we certainly want you to "keep 'em coming!" If you miss a copy, we want to send you a replacement. If you seem to have fallen from our list, yet have paid for a subscription, we definitely want you to get and read every issue.

We feel most of the problems with delivery lie with the besieged Postal Service, nevertheless, to be extra sure we have our act together, we recently began using a computer to maintain our list, and to help us track down problems. It works. But most of you will know that computers can also create new problems. *Absolutely*, if you are *not* getting your *Whole Air*, let us know. Provide us with your name, the number in the upper left of your mailing label, your expiration numbers/letters (see info, pg. 5), and your zip code. If you have no label from which to read this, send us your name, zip code, and the date you ordered your subscription.

When sending a new subscription, be sure to include your address. Surely this seems obvious, but some come through

with only money and a name. We need the money, but we also need you to read and respond to *Whole Air*, so help us get them to you.

If you have a change of address, it is *vital* that we know where you *were* as well as where you *are* now. An old mailing label is easiest. Remember, we *do* want you to get and read your magazines.

INTRODUCING...

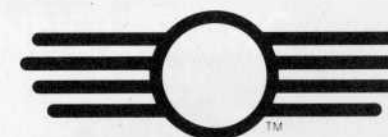
A new page appears opposite this column. It is AERO MARKET PLACES. These ten shops were carefully selected from the many fine businesses in the country.

All have what we call "national impact," so they are, by our definition, National Class Shops. All have been in business at least five years (the SBA says only 10% of all businesses make it past this point). All have schools and full-time shops with storefronts. All have solid management and nationally recognized skills, either have developed new training programs, new hardware or soft good ideas, professional level contest abilities, national promotional contacts, or a form of marketing outreach that draws customers from far out of their immediate locales.

It is to say a very prestigious group of businesses; we did not accept all who asked to be included. We encourage you to patronize them, and to help you know more about them, we will be presenting a review of one shop per issue; this time it is Ken de Russey's Hang Glider Emporium on page 24. Just as innovative manufacturers deserve your consumer support, so do these outfits capable of providing National Class retail level professionalism. Seek the best!

Thanks,
Dan Johnson

AERO MARKET PLACES



Hang Glider Emporium

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Come Visit Us!



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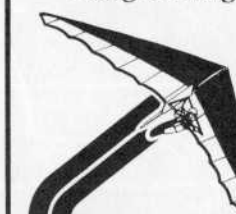
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FORUM

Dear Editor:

What a perfect time to print Richard Miller's "End Play" as the Sensor 510 was pilot reported. My hat is off to the editor for her fine timing. I am sure we are going to hear much more about this fine ship as the prime flying season grows nearer.

Carl Boddie

Dear Editor:

Your publication is like a breath of fresh air in an otherwise polluted, confusing glut of periodicals dealing with ultralights.

Keep it up!!

B. Dahle

Dear Editor:

Your magazine is now the best in the sport. You cover all aspects the way my interest in flying is. I fly planes, hang gliders, and someday ultralights. Safety and progress in equipment is good reading.

Donald Morrison

Dear Editor:

I am enjoying reading about foot-launched soaring again. I knew that there was activity and ideas still alive... post-motors.

How about some articles on soaring and cross-country technique (not macho, competitive type) by some contemporary, accomplished pilots. I appreciated honest reporting on "Sensor 510." It is a good ship, but not for everyone.

Scott Whittet

Dear Editor:

I love your magazine, your

emphasis on (un-powered) soaring, your glider and product evaluations, articles like "Cocoon Harnesses??" etc. It is all very informative. Keep it up.

Bob Langer

Dear Editor:

Donnell Hewett's article was excellent. I know Donnell and he is too modest to brag so I will do it for him. This is the best tow system available. It appears to be lockout-proof!

Knowledgeable people in towing have tried to go into a lockout even with an Oly, and could not! I highly recommend anyone truly interested in towing to get Donnell's publication.

Henry M. Wise

Dear Editor:

Due to your last (Reader Response) card, I've just had my chute re-packed and inspected by an FAA Rigger. I also turned in an accident report on myself to Hildreath. Keep it going, folks!

I look forward to each issue and read over 95% of it with thought.

Joel W. Howard

Dear Editor:

I am glad you are covering "triking." It is really big in England, according to my issues of *Wings!*

Most flyers here feel it is not that safe. Are not the British doing okay, accident-wise, with regard to the number of trikes and accumulated air time?

Dick Fortner

(We will contact our British Editor,

Noel Whittall for some facts and perspective on English "triking." —Ed.)

Dear Editor:

It is still impossible to accurately rate or judge relative performance in ultralights from all the articles and ads in all the magazines. We desperately need contests to prove existing differences in performance.

George Worthington

(Owner Surveys, to the orientation of those compiled by Glenn Brinks, however, do go a long way in differentiating ultralights. See the July/August *Whole Air*. —Ed.)

Dear Editor:

Good magazine. I'd like more quantitative glider reports — probably best done by having a team do comparative evaluations of several gliders.

William M. Chambers

(Bet you thought we got your suggestion before this issue... do enjoy the "Face-Off" piece. —Ed.)

Dear Editor:

We need more technical articles written by qualified "experts" in the field of hang gliding, aerodynamic, and micrometeorology. People are still dying unnecessarily. Everyone needs more understanding of the complex variables.

Tom Morgan

Dear Editor:

I am curious to know whether one can do some serious cross country with a trike. At present I

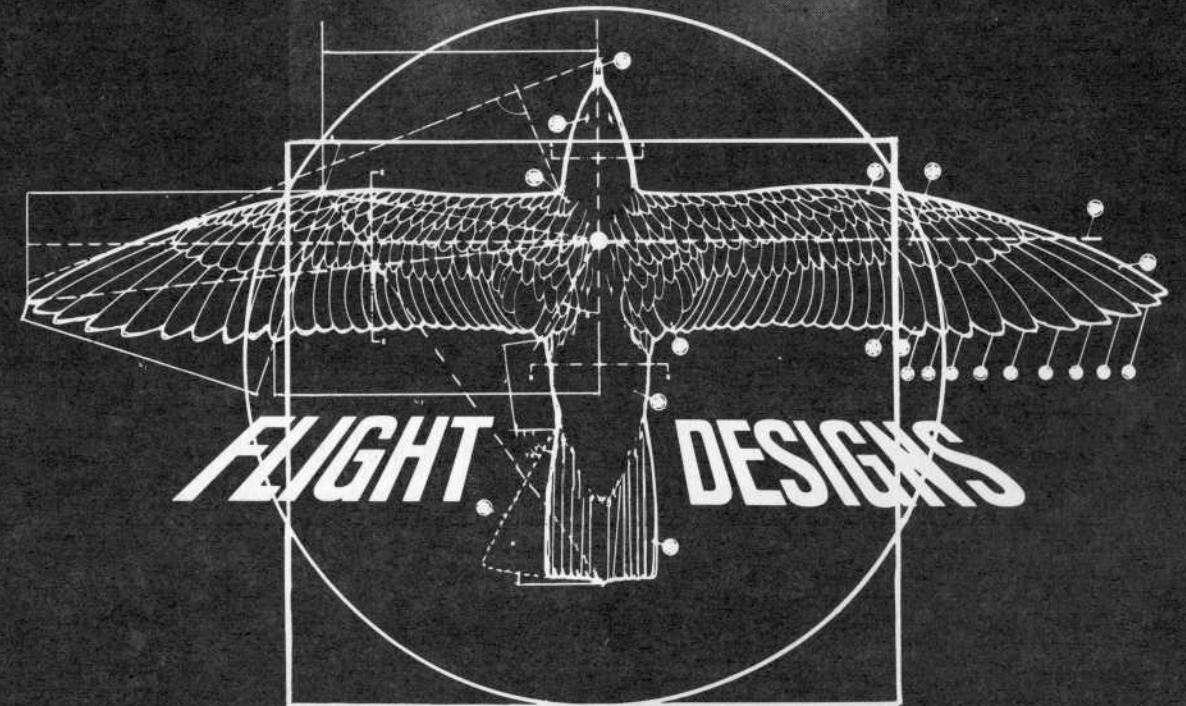
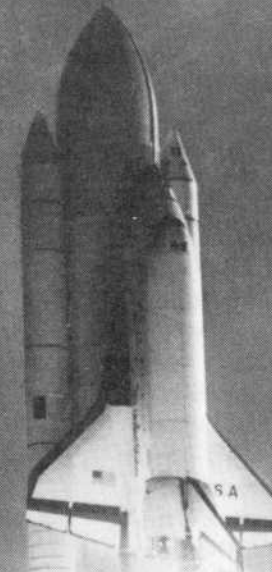
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ANNOUNCING A NEW AIR FORCE.

Man's dream to fly is as strong today as it was in the days of Icarus. Unfortunately, many of the devices designed to help you do it often seem as unreliable as feathers and wax. Until now.

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FORUM

COMING NEXT ISSUE . . .



Evaluating some new Super-Intermediate craft for the foot-launch reader and candid replies from owners on the Eagle, Weedhopper, and Pterodactyl for the ultralight shopper. Plus, pointing to a new direction for

foot-launch readers looking hard at what power might do to extend their soaring desires, while ultralight pilots consider what hang gliding technology might do for them.



Swiss Alp Hang Gliding Safari

During the Summer of 1982 we again take to the road in our Safari Bus so that you may encounter the rapture of soaring the Swiss Alps; each day bringing new challenges and peak-experiences.

From the summit of carefully selected mountains, a view of 1000 snow covered peaks, sun drenched granite walls, glimmering mountain lakes, spectacular water falls, and peaceful alpine meadows.

I invite qualified pilots to join us in 1982, on one of our exceptional Swiss Alp Safaris.

Ron Hurst
Ron Hurst, Zürich

For complete documentation of our high adventure Swiss Alp Hang Gliding Safaris send \$ 5.00 to cover airmail postage to:

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CALENDAR ITEMS

MAY 8th & 9th — Leon's Sawmill Ultralight Fly-in held at Hartzel Colorado. Entry Fee. Camping facilities. For information call 303/632-4959.

MAY 8th — The Fifth Annual Fly-A-Thon by the Santa Barbara Hang Gliding Association will be held Saturday, May 8 to benefit the Memorial Rehabilitation Foundation of Santa Barbara. Launch will be from LaCumbre Peak, elevation 3,985 ASL. Businesses and individuals are encouraged to sponsor a pilot by contacting the SBHGA or Ken de Russey's Hang Glider Emporium at 613 N. Milpas, Santa Barbara, CA 93103; 805/965-3733.

MAY 14, 15, & 16 — Tenth Annual Gliding Spectacular. America's oldest continuously held hang gliding competition. As always this event will be a lot of fun whether you come to watch or enter. Novice through Master pilots welcome. Contact Kitty Hawk Kites East; 919/441-7575 or 441-6094.

MAY 15 & 16 — Flight Design Demo Days at Kitty Hawk Kites West; 408/384-2622.

JUNE 1 — Kitty Hawk Kites East Anniversary Celebration. Third year in new building. Free Champagne served on Deck.

JUNE 2-4 — Instructor Certification Program at Kitty Hawk Kites East. Contact Mark Airey for application. 919/441-7575 or 441-6094.

JUNE 11-13 — 7th Annual East Coast Championships. White Lake, North Carolina. Tow Meet — Limited entries. Contact Tommy Faircloth, 5217 Hornbeam Rd., Fayetteville, N.C. 28304; 919/424-4302.

JUNE 12 — Parachute Clinic at Kitty Hawk Kites West; 408/384-2622.

JUNE 25-27 — Region 2 Instructor Certification Program. For information and registration application, contact: Lowell Levinger, Hang Gliders West, 20-A Pamaron Way, Ignacio, CA 94947; 415/883-3494.

JUNE 26 — Hang III Field Trip and Thermal Soaring Clinic at Kitty Hawk Kites West; 408/384-2622.

JUNE 11-13 — XC Challenge Race (A).

JUNE 18-20 — XC Challenge Race (B).

JUNE 25-27 — XC Challenge Race (C).

XC Challenge Races are 3-day weekend meets with entries limited to 25 pilots per event. The rules and format are essentially the same as the XC OPEN 81 and XC CLASSIC 81 & 82. Entry is on a first come-first served basis and the top three pilots from each race will be eligible to enter in the XC CLASSIC 82 if they wish. The entry fee is \$110, and includes all transportation and trophies for all first place pilots. Owen's Valley Hang Gliding Center, 714/873-4434, Star Route 4, Box 3A, Bishop, CA 93514.

JUNE 26-27 — Mountain Fly-in and Frisbee Exhibition. Enjoy the early summer thermals and watch the frisbee pros in action. Contact Mark Airey, Kitty Hawk Kites East; 919/441-7575.

JULY 1-2 — XC Classic official practice days.

JULY 3-10 — XC Classic Contest Flying.

JULY 11 — XC Classic Fly-in, awards ceremony, barbeque.

XC Classic 82. Entries are restricted to 50 pilots this year. The top 18 pilots from the XC Classic 81 and the top three rigid wing pilots from the XC Open 81 are eligible for entry. There are 20 invitational positions open and 9 positions from the top pilots in the 82 Challenge Races. Glider qualifications for the Classic have been a bit of a problem. Originally announcing that entry for gliders was unlimited, Owen's Valley HG Center has decided to qualify that statement with the requirement that the gliders *must* fold in some fashion so that they fit on our transportation vehicles. The entry fee this year is \$475. Transportation will be provided, and trophies will be awarded for the top three positions. Contact Don Partridge, Tom Kreyche or Mark Axen at 714/873-4434, Owen's Valley Hang Gliding Center, Star Route 4, Box 3A, Bishop, CA 93514.

JULY 4 — Target Competition and Cookout, Kitty Hawk Kites West; 408/384-2622.

JULY 12 - SEPT 5 — Owen's Valley Horizon Cup. This will be awarded to the pilot making the longest Open Distance flight originating in the Owen's Valley. The contest begins immediately after the XC Classic, and runs through the Labor Day weekend. Pilots may enter at any time before their intended flights, and the \$90 entry fee includes either 1 ride to Cerro Gordo with unlimited retrieval, or 3 rides to our Piute launch site. Cameras will be required for landing site

CRYSTAL



The Bunkhaus

THINKING ABOUT OUR Fly-Work Program? Here's the deal:

First to explain the busy part: We require 15 hours of work per week (on non-flyable days), in exchange for a bunk in our flier's BUNKHAUS. The type of work is in accordance with your skills as the maintenance of our resort requires many talented hands.

We also ask for a 'happiness deposit,' (we're happy to get it and you're happy to get it back), of one month's rent, \$120, that is promptly refunded on a weekly basis or end of the month basis, as your hours are completed. Please, we ask that your stay with us be a minimum of one month.

Now for the picturesque part: Our BUNKHAUS is a spacious 12 bunk room with two complete shower/toilets, with color T.V. and In Room Movies! Our resort is located in Raccoon Mtn Valley, surrounded by mountain ranges. We are situated on 6 acres of uniquely terraced land, one of the highest points is located in the BUNKHAUS; 4 acres are made up of densely wooded terrain. We are even considered in the 'country,' yet we are only 10 minutes from beautiful downtown Chattanooga via expressway.

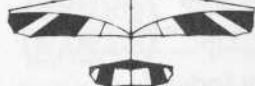
Crystal Flight Resort is within walking distance as is the new Alpine Slide, Water Slide, and Horseback Riding.

Since the Fly-Work Program was initiated, many of the fliers that have permanently made Chattanooga their home, have stayed and worked with us, while getting themselves situated job-wise in nearby areas.

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POSITIVELY, AS IN absolutely... guaranteed. And we mean it. Positively, you'll be stimulated on the Crystal Hang Glider Simulator. Stimulated to learn the wonder of flight, but all in complete safety. The Crystal Hang Glider Simulator is our one-of-a-kind, patent pending, revolution in training.

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Crystal had its best year, safety-wise, in 1981, and that's while sales grew an unprecedented 45 percent. More students graduated from Raccoon Mountain in less time and with more knowledge than ever before.

So you see, we're positively stimulating. Positively also means beneficial or helpful. Stimulating simulation, that's the Crystal Hang Glider Simulator.

"Crystal" is also sales, services, repairs, ratings, gliders, trikes, ultralights, and accessories. All our brand names are the most respected in sport flying. Crystal... professionals since 1974...

Call 615/825-1995 today or write: Route Four, Cummings Hwy., Chattanooga, TN 37409. (Notice: National marketing of Crystal's Simulator is now underway. If your shop is interested in this system, contact Tom Phillips ASAP.)



POSITIVELY SIMULATING

verification. Contact Owen's Valley Hang Gliding Center.

JULY 24-25 — Hang III Mountain Rating Clinic. Contact Mark Airey at Kitty Hawk Kites East; 919/441-7575.

AUGUST 15 — 34th Anniversary of invention of Rogallo Wing. Francis Rogallo to speak. Kitty Hawk Kites East; 919/441-7575.

SEPTEMBER 5 — Hang III Competition at Kitty Hawk Kites West; 408/384-2622.

OCTOBER 1-10 — Second Annual Ellenville XC Open. Low entry fee. Cash Prizes. Contact Aerial Techniques, Ellenville, NY 914/647-3344.

OCTOBER 30 — Halloween Party. Kitty Hawk Kites West; 408/384-2622.

OCT - NOV — First Indian Open Hang Gliding Competition organized by the Western Himalayan Hang Gliding Association. To be held in the Kangra Valley of Himachal Pradesh, India. Reply to: Deepak Mahajan, Sita-Nivas, Vallabhahai Rd., Ville Parle (W) Bombay 400056.

INDUSTRY NEWS



Our President, Marty Alameda, is no longer. Marty was killed March 4, 1982 at 8:00 a.m. test flying one of our new ultralight experimental aircraft. He was 32.

For those of you who didn't know Marty, he was the conceiver, founder, and President of the most exciting and fastest growing company in the industry, Flight Designs.

Many of us here came to Salinas to Flight Designs for Marty himself. His ideas, talents, and especially his energy, made Marty deeply loved and respected by every person who had the pleasure of working with him.

Marty's ideas and expectations will always be present here at

Flight Designs. Having lost Marty and his leadership has brought the Flight Designs family even closer together. Together we will continue the challenging task that Marty left us with. We will carry on Marty's commitment to the hang gliding and ultralight community.

Marty's dedication to sport flying is not dead. It will always be present through those who had the chance to follow Marty. And for this, Marty, we love you.

We really want to thank all of Marty's friends throughout the aviation industry for the many messages of sympathy.

Sincerely yours, in Marty's spirit,

Flight Designs

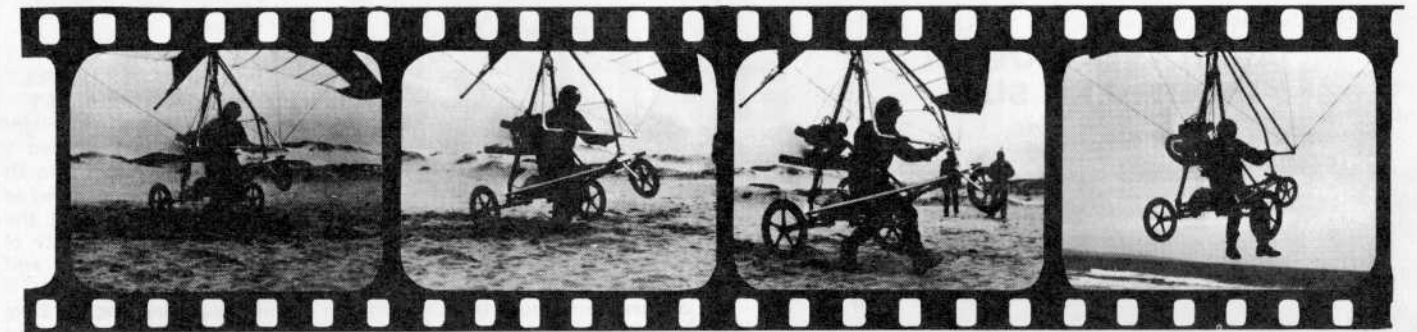
Eagle Tows Comet

Dear Editor:

Here is a report on our first day towing hang gliders with the Eagle. We have since towed many times to an altitude of 2500 feet. We started with 150 feet of tow line but found 300 feet to work better. We had two releases, one on the Eagle and one on the glider. So far the Eagle driver has only had to use his release once to avoid a lockout by the glider. We have towed the Comet and SST 100B very successfully. We find the triangulation of the tow bridle on the hang glider to be very important as the only problem we incurred was if the hang glider climbed faster than the Eagle causing the tow rope to pull the nose of the Eagle down. We find the Eagle to be perfect because the canard gives such excellent stability and the rudders give us excellent control. We find using the stock Zenohair rather than a bigger engine gives us the thrust we need without overpowering the hang glider. Should the hang glider start to go into a lockout, the Eagle just slows down a little.

In closing we wish to stress this is strictly experimental and recommended for advanced pilots only.

Jim LeMieux
Mount Clemens, MI



Foot Launching the Jet Wing ATV

Demon 175 Adjustable Crosstube Plate Consumer Advisory

It has come to Flight Designs' attention that because of improper maintenance and inspection of the internal adjustable crossbar tang, the possibility of fatigue of this component could result. Further testing of this tang has showed the potential problem only to occur when tang is used on its loosest setting (loosest crosstube sweep configuration).

Because of this situation, pilots who are now flying Demon 175's in the above described configuration, are asked to make arrangements to retro-fit the

crosstube support system with a replacement that will not require the attention to inspection and maintenance as the unit now being used in production models. In order to preserve the perfect safety record of Flight Designs' products, and the Demon in particular, please feel free to contact the factory or your Flight Designs' dealer concerning the retro-fit kit which is now being made available at no charge.

Aviation Authors Sought

Ultralight Publications is seeking book length manuscripts for titles in the ultralight, homebuilt, sport and general aviation areas. We are interested

in how-to, technical and reference books of short to medium length that will serve recognized and emerging aviation needs.

Interested persons are urged to contact: Michael A. Markowski, Ultralight Publications, P.O. Box 234W, Hummelstown, PA 17036.

Brazilian National Championship Results

(Here) are the results from the Brazilian Nationals. This is a five series meet, each round four or five days in a different state. It is a semi government sponsored series to determine the official Brazilian for international events.

ROUND ONE
1- Ricardo Campos (Comet).... 6677 points
2- Julio Tedesco (Comet) .6201
3- Daniel Sabah (Comet) ..6198
4- Carlos Niemeyer (Comet) 5978
5- David Street (Comet) ...5954

ROUND TWO
1- Carlos Niemeyer (Comet) 5716 points
2- Mario Panuzzio (Comet) 5505
3- Otavio Pias (Comet) ...5257
4- Julio Tedesco (Comet) .5205
5- Carlos Schmitz (Comet) 5097

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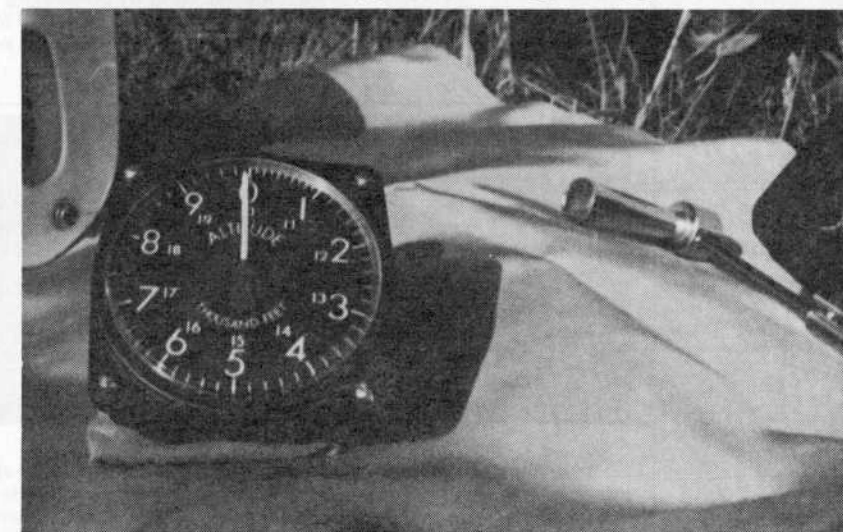
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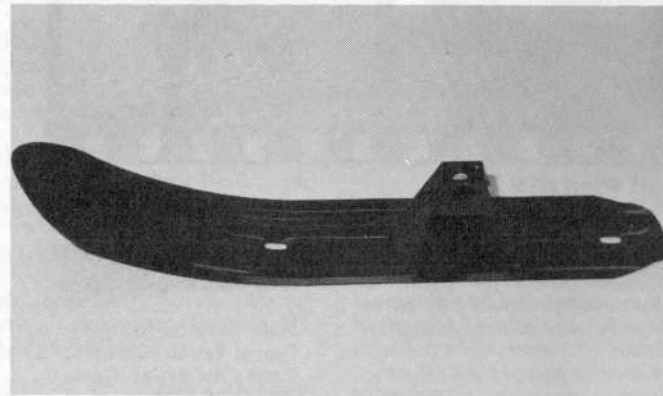
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NEWS

Ultralight Crop Dusters GOLD DUSTER UNVEILED AT NAAA CONVENTION

Cutting the cost of aerial spraying is the over-riding factor in the development of new crop dusting techniques that combine a slightly modified Goldwing ultralight with a Micronair ultra-low volume spraying system. Four Goldwing factory representatives recently attended the National Agriculture Aviation Association convention in Las Vegas to introduce their new crop duster to the agricultural community.

Brian Glenn, President of the Jackson, California manufacturing firm recently announced completion of feasibility studies and flight testing of the Gold Duster model which will be sold as a homebuilt kit for about \$6500, or ready-to-fly for about \$9000.

The new crop duster is basically a high performance rigid wing ultralight aircraft that has been modified structurally in order to increase its useful load to 350 pounds. A 15-gallon hopper and 2 Micronair Mini-Atomizers, along with several variable restrictors, gate valves, a fan-driven pump, and optional flow-meter round out the package that now offers the farming industries an attractive alternate to conventional spraying techniques.

A complete information package on the new Gold Duster is available for \$6.00, or a free info sheet may be obtained by writing to P.O. Box 1123W, Jackson, CA 95642.



MITCHELL WING AG-PLANE

Porterville, CA — The breakthrough that the farmers and ranchers have been looking for was announced this month at Mitchell Aircraft.

A small ultralight full three-axis control airplane, able to carry the pilot and 15 gallons of pesticide or herbicide for low volume application, fence patrol, irrigation surveillance, powered

JET WING ULTRALIGHT AIRCRAFT PROVIDES USEFUL MOBILITY IN RURAL AREAS
Salinas, California — Flight Designs, Inc., has introduced a versatile, new ultralight aircraft called the Jet Wing. Described as an All Terrain Vehicle (ATV), the Jet Wing has a wide variety of applications for farms and ranches.

Costing less than one-third the price of a new pick-up, rugged Jet Wing offers countryside mobility that no four-wheel drive vehicle can match. The Jet Wing is launchable from a 100-foot section of dirt road or open field.

Pilot and plane can cruise between 30 to 40 miles per hour, burning about two gallons of gas in the process. They can be flown over rangeland or fields that are inaccessible by truck, horse, snowmobile or boat.

Ideally suited for surveying livestock, crops, irrigation systems and harvesting activity, Jet Wings offer economical, time-saving transportation on any spread. Their usefulness is enhanced where lands are divided by rivers or other barriers to land travel.

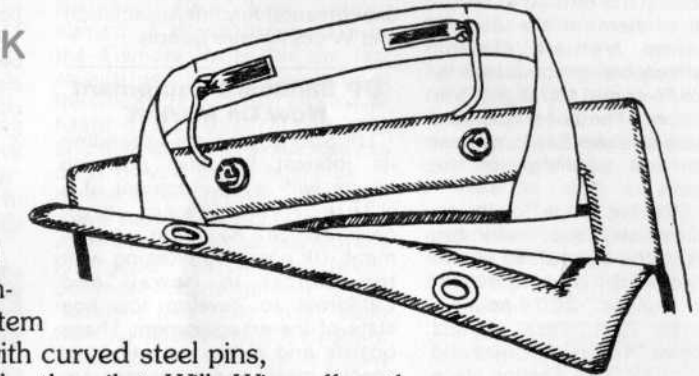
Jet Wings, which can be flown without a pilot's license or vehicle license, require less paperwork to own than a motorcycle or tractor. Flight Designs does require all people purchasing a Jet Wing to complete a brief training program.

Wings can be removed to turn the ATV into a ground vehicle and floats can be added to make an airboat or amphibious airplane.

Free information is available on the Jet Wing by contacting Flight Designs, Inc., P.O. Box 1503-R, Salinas, CA 93902; phone 408/758-6896.

WILLS WING FLIGHT ACCESSORIES

PARACHUTE SAFETY LOCK

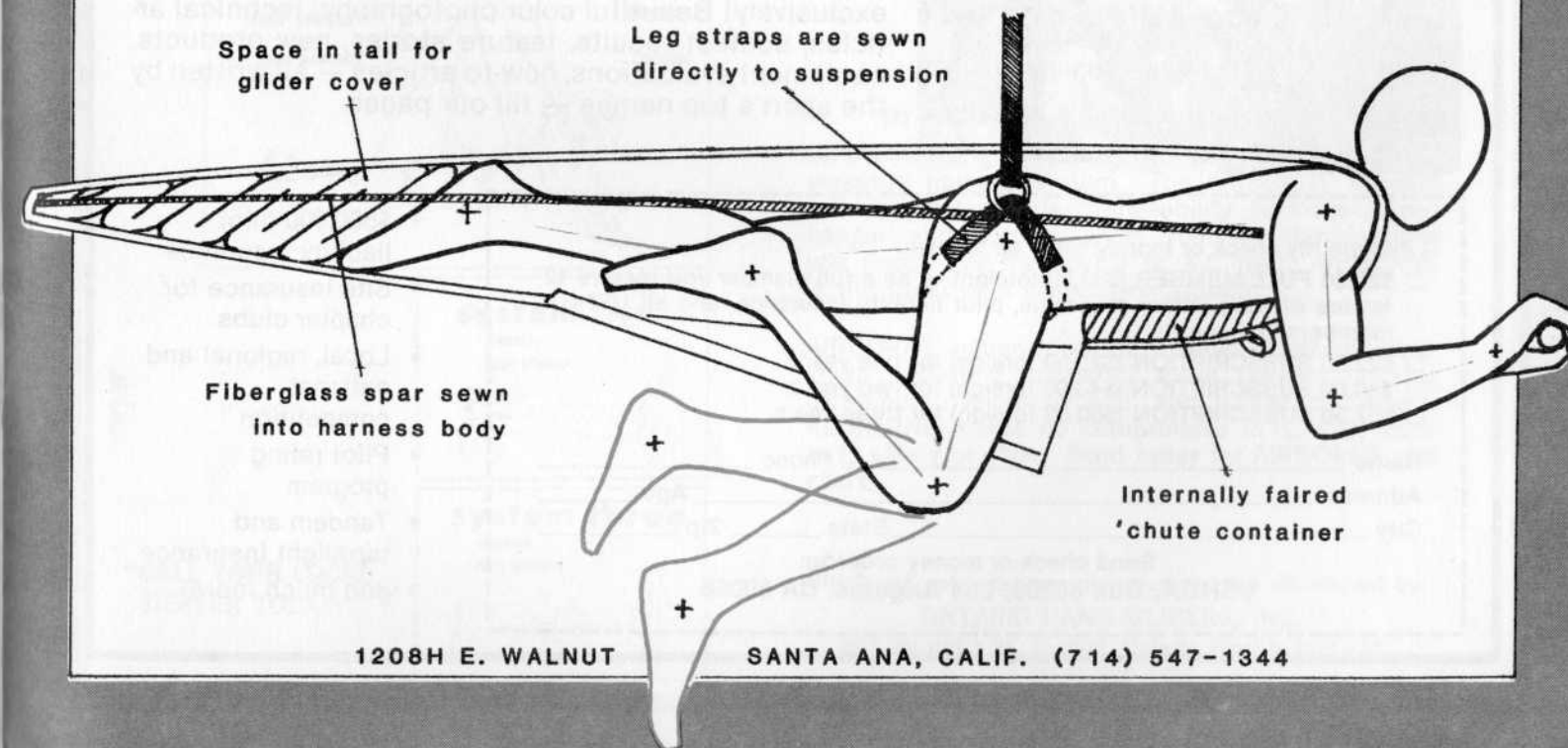


Whether due to the extra loads on the harness during high "G" maneuvers or improper packing, the risk of accidental deployment is a real hazard to both competition and recreational pilots. This system locks the deployment bag to the harness with curved steel pins, which can only be released with a firm pull by the pilot. Wills Wing offers the Safety Lock as standard equipment on the BULLETMAN and ENCLOSED 'CHUTE harnesses, and will install one on most deployment-bag containers for a charge of only \$10.00.

BULLETMAN BODY FAIRING

\$349.00

Developed for Wills Wing by Pfeiffer, the BULLETMAN body fairing is a practical, comfortable solution to the problem of pilot drag. Twin fiberglass spars are sewn into the sides of the harness offer total support with the use of only two main suspension lines. Entry and exit are less bothersome than with conventional designs, and the extra roomy tail section allows you to store things inside, out of the airstream. Drag tests of the BULLETMAN indicate a significant performance advantage can be obtained. Standard equipment includes the Parachute Safety Lock and a unique storage/transport cover with a special sleeve for battens and room for helmet, instruments, and et cetera.



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NEWS

Kevlar Prize Established for ARV Design Competition

Tacoma, Washington — The Du Pont Company's "Kevlar" organization has offered \$10,000 for the winners in the Aircraft Recreation Vehicle Design Competition being conducted by *Western Flyer* and *Ultralight Flyer* publications. The announcement was made by Dave Sclair, contest director and publisher of the newspapers.

The "Kevlar Prize" will be divided among the three top finalists in the light plane (under 350 pounds) and ultralight aircraft (under 220 pounds) categories. First place winners will receive "Kevlar" trophies and checks for \$3,000. Second place winners will get checks for \$1,500 and those finishing third will be awarded \$500 checks.

The *Western Flyer/Ultralight Flyer* ARV Design Competition was established to stimulate new designs in light and ultralight aircraft. Anyone may enter by writing: ARV Design Competition,

Box 98786, Tacoma, Washington 98499. Application forms, three-view drawings, renderings and design specs must be submitted by July 4, 1982. A design fly-off will be held at EAA's Oshkosh facilities in June, 1983.

Associate sponsors of the contest include the Aircraft Owners and Pilots Association, AOPA Air Safety Foundation, Cuyuna Development Corp., Experimental Aircraft Association and Wicks Aircraft Supply.

UP Sailboard Equipment Now On Market

UP Sports has been expanding its interest in solar powered sports with a development of a whole new line of high performance sailboard equipment. UP has been working with top sailors in Hawaii and California to develop top line state-of-the-art equipment. These boards and sails, rigs and even special masts and harnesses are now available from UP.

Whelen Introduces "Glide-A-Strobe"

Deep River, CT Whelen Engineering Company, a well known manufacturer of anti-collision strobe lights for general aviation aircraft, has entered the

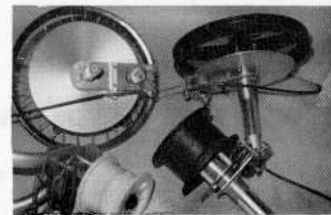
ultralight aftermarket with its new "Glide-A-Strobe" system.

According to the manufacturer, the "Glide-A-Strobe" anti-collision system incorporates general aviation's state of the art optics and strobe technology.

The system consists of a strobe light head, a power supply/battery case (lasting up to 5 hours), and a 12 foot wiring harness, yet weighs just 3.2 pounds.

The self-contained battery can be recharged from a car's cigarette lighter, normal house current or can be charged by your craft's engine (AC charger available as an option). Each "Glide-A-Strobe" system installs in seconds and comes ready to use.

For more information, write or call Whelen Engineering, 3 Winter Avenue, Deep River, CT 06417. Phone 203/526-9504.



Retrofit Disc Brake Kit

Mid-East Ultralights is now offering retrofit disc brake kits for all ultralights. Two models are presently available which will fit any current ultralight. The original model was designed for larger wheels and utilizes a 9/4" diameter rotor with a stamped diameter rotor with a die-cast aluminum caliper. The second model uses a 5" rotor with a stamped steel caliper and was designed for smaller wheels (Quick, Weedhopper).

One hole must be drilled to secure each caliper. Both models are cable actuated by separate hand levers or foot pedals to provide safe, controllable stopping and steering with enough "feel" to avoid wheel lock-up or over control. Total weight per kit is 5 pounds.

It is available from Mid-East Ultralights, P.O. Box 432W, Franklin, NJ 07416; phone 201/827-2835.

NEWS

New Bush Gear for Mitchell Wing B-10

Fiberglass axles and larger tires are the main components for the all terrain "Bush Gear" recently developed by Mitchell Aircraft Corp. for their popular B-10 flying wing.

Designed as a retrofit for the standard tri-gear, the new bush gear adds a great deal of versatility to this high performance ultralight.

For further information, contact: Mitchell Aircraft Corp., 1900 S. Newcomb Blvd., Porterville, CA 93257.



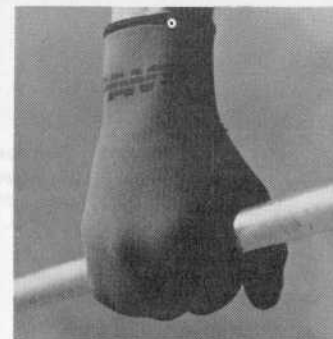
Paws Offer Better Grip

AirZone Mfg. introduces Paws, a unique new sports glove. Constructed in a three finger configuration of eighth inch nylon bonded neoprene with a special tough rubber palm, these materials produce a glove of maximum warmth, dexterity and secure grip with minimal bulk.

Paws seams are glued and stitched to provide a durable glove which maintains its insulative qualities wet or dry.

They are available in blue or black and in sizes small, medium, and large for an introductory price of \$19.95. Dealer inquiries invited.

Contact AirZone Mfg., Dept 1A, 303 Sharpe Rd., Anacortes, WA 98221.



What's up at UP?

ERIC RAYMOND JOINS HAGGARD IN R & D

There's a newer version of the Comet planned but the release date is still not scheduled... Probably early summer. If everything goes right, we'll probably see the preproduction prototypes flying sometime in May. Roy Haggard and Eric Raymond have been testing numerous prototypes high over the Elsinore Valley for the last several months leading to some of the wildest rumors that we've ever heard in this area! I'm sure that Eric Raymond isn't a new name to most of you but it might be in connection with UP. Although we've kept Eric's profile fairly low at UP during the past few months for good reason, it's pretty common knowledge now to the "locals" that Eric has been working closely with Roy Haggard in the development of the new glider. Eric, of course, is probably the foremost designer of ultralight rigid wing gliders in the world. The reason Eric joined the Up design staff is that he finally gave up (the development costs were just too high) on trying to design a rigid wing that worked better than the Comet.

(P.S. The unofficial name of our

new UP glider around the shop is the "12 Guage!"

NEW ERIC RAYMOND HARNESS UP Sports is introducing a new Eric Raymond harness for 1982. The new model called the "Sierra Stirrup" is a shortened version of the famous Eric Raymond full envelope cocoon harness. It will retail for \$155 and has already proven to be a very popular seller for those dealers wise enough to order in the first series. The harness is normally delivered with UP's Pro II bag which raises the price to \$175, however, this represents a considerable savings over buying the bag separately.

There is also an economy version of the "Sierra Stirrup" called the "Econoflite" made with thinner 1/2" foam and no integral parachute container. This unit will retail for \$120.



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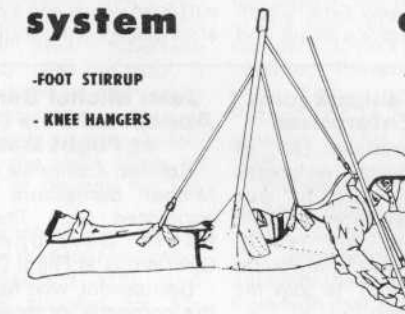
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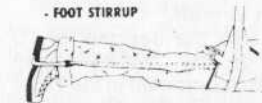
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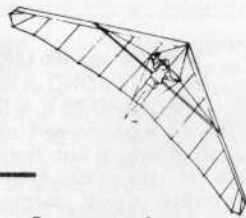
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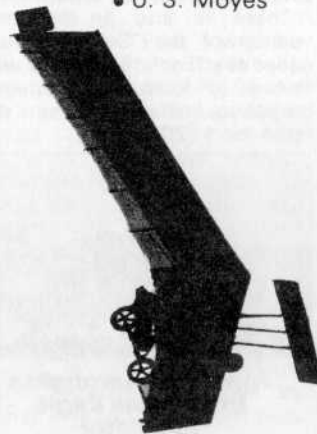
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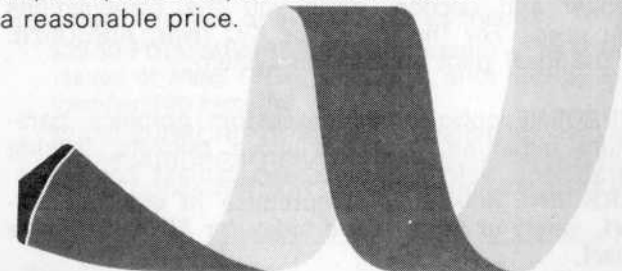
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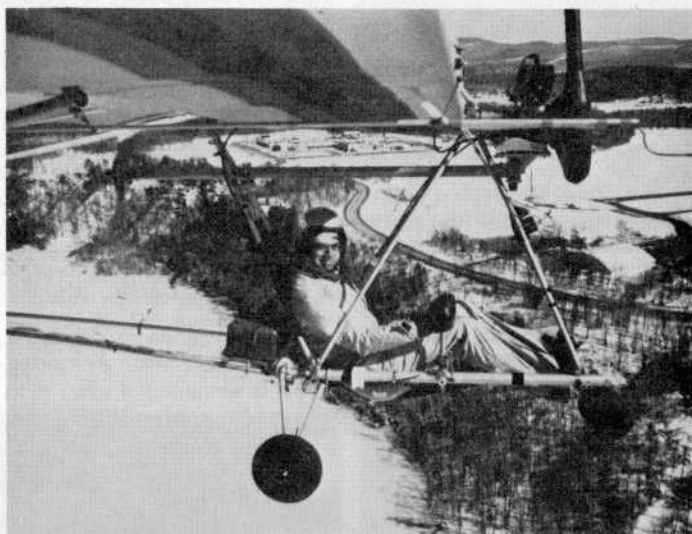
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Aerial Dynamics

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NEWS



Bernt Petterssen, President of Vector, flies a prototype of the new Vector 610.

New Vector 610 Introduced at Sun 'N Fun

Lakeland, Fla., March 14, 1982 — Bernt Petterssen, President of Vector Aircraft, unveiled the new Vector 610 at the EAA Sun 'N Fun Fly-in. The Vector 610, a design refinement based on three years of flight experience with the Vector aircraft, is the work of a design team headed by Mike McCarron, an aeronautical engineer and Vector's Director of Engineering.

The 610 has a new airfoil which improves the Vector's climb and

glide rates without increasing weight or drag. Other advances include: new Fisher tuned exhaust system which markedly increases the thrust output of Vector's Vmax power system; rigid pilot seat and full shoulder harness providing additional pilot protection; and shock-absorbing main gear.

The new Vector 610 is based on an ultralight design first flown by Klaus Hill in 1979. One of the oldest and most extensively flown ultralight designs, the Vector has full 3-axis controls, double-surfaced wings and a conventional airplane configuration.

Vladimir Talanczuk joins Birdman Enterprises

Birdman Enterprises, Ltd., of Edmonton, Alberta welcomes Vladimir Talanczuk to our Research and Development staff. Vladimir and his family emigrated to Canada from Poland via France in 1981 to join his father in Edmonton.

In Poland he earned certification as an A&P technician and inspector, working on MiG 15, 17 and 21's and the AN-2 light transport aircraft.

He is also the designer of 10 models of the "MARS" hang gliders and competed in the 1979 World Hang Gliding Championships at Grenoble with his 9th design, the "Mars' Marta."

His invaluable range of technical skills should prove a great asset in the development of the Birdman microlight motor glider, which is scheduled for test flights in the spring and summer of 1982.

Jean Michel Bernasconi Appointed Vice President at Flight Designs

Salinas, California — Mr. Jean Michel Bernasconi has been appointed Vice President for Flight Development and Operations at Flight Designs Inc. Bernasconi, who has been with the company for three years, is a leader in low speed airfoil technology as it applies to hang gliding. He has been heavily involved for the last seven years in designing and refining various hang gliders and ultralight aircraft. A member of the Board of Directors for the Hang Glider Manufacturers Association, Bernasconi is an active participant in general aviation.



NEWS

Mini Moni from Monnett

Oshkosh WI — Now there is a Mini Moni. John Monnett, President of Monnett Experimental Aircraft, has developed a set of short wings that are interchangeable with the long wings on the Moni. There is nearly a 12 foot difference in span and a considerable change in performance, making the Moni two planes in one.

Monnett introduced the long wing Moni at the 1981 EAA Oshkosh Fly-in where it attracted considerable positive response. The short wing version was first flown at Oshkosh in February, 1982 and was publicly debuted at the Sun 'N Fun Fly-in in Lakeland, Florida.

"Given a choice of two sets of wings, a builder might first assemble a Moni kit with its 'long' 27'6" wing span and learn how to fly the plane," said Monnett. "In this configuration the Moni makes an excellent, docile motor glider that can be used for soaring and sport flying. Once the builder gets the long wing version flying, he can use his original wing fixture to make up a set of short wings which will give the Moni a perky 15'8" span." The chord and construction techniques for the short wings are identical to the long wings. Both utilize the same size ribs on the same type of tapered spar.

With its shortened wings and 30-pound weight savings, the Mini Moni will have a maximum speed of 140 miles per hour. It can also be flown for sportsman aerobatics. Defined as an Aircraft Recreational Vehicle, a new breed of airplanes, the Moni offers its owner a lot of options for fun flying.

A complete information packet is available on the Moni and other Monnett aircraft kits and homebuilders' supplies for \$5. Write Monnett Experimental Aircraft, Box 2984R, Oshkosh WI 54903.

Birdman Releases ATLAS

In March of 1981 Birdman Enterprises of Edmonton introduced the 'ATLAS' microlight aircraft to the Canadian public at the National Sportsmans Show in Toronto, Ontario, a ten day public display at the famous Canadian National Exhibition grounds drawing approximately 30,000 people to the 10 acre site.

For the 1982 Sportsmans Show — March 19 to 28 — the Alberta manufacturers display was centered around the highly

refined and redesigned Atlas 215 X-country.

The Atlas-XC combines the design technology of Bob Lovejoy's Quicksilver, Dale Kjellsen's Teratorn and several innovative "Canuck" modifications to produce an aircraft of superior flight characteristics and ease of ground handling.

The Atlas-XC is constructed of 3.8 ounce stabilized dacron, aircraft grade clear and black anodized aluminum tubing and double clinched, coated aircraft cable.

Ballantyne Sells Simulator Rights to Eipper

Ultrasport, Inc., President, John Ballantyne, announced that the exclusive rights to the Ultrasport ultralight flight simulator have been sold to Eipper-formance, Inc. Eipper will offer low cost simulator kits to each of their dealers with the intent of enhancing the effectiveness of their existing training programs.

The Eipper-formance simulator kits will be available for the summer flying season. For further information contact Eipper-formance, 1070 Linda Vista Way, San Marcos, California 92069

CGS Hawk Ready for Production

The CGS Hawk, a revolutionary new ultralight from CGS Aviation is now completing its test flying program. CGS Aviation, a long time pioneer in ultralight flying, has been active for over 10 years in this new field. Founder of the company, Chuck Slusarczyk, who patented "Powered Hang Gliders with Reduction Drive (U.S. Patent #4262863)" is the designer of this new and unique craft.

"We wanted to blend the best of hang glider technology with sound aerodynamic principles and knowledge to create an ultralight that pilots moving down from high cost aviation would feel at home in and ultralight pilots wishing to move up would have a real performance boost," said Slusarczyk.

The Hawk is assembled from a kit requiring approximately 40 hours to build. The price, first quoted at "about \$5200" was reported to be \$4895 at the recent debuting of the craft at EAA's Sun 'N Fun Fly-in. CGS recommends the Hawk for the pilot who has soloed in a conventional aircraft or an ultralight with normal 3 axis controls.

For further information, write CGS Aviation, Inc., 4252 Pearl Road, Cleveland OH 44109-4274W.

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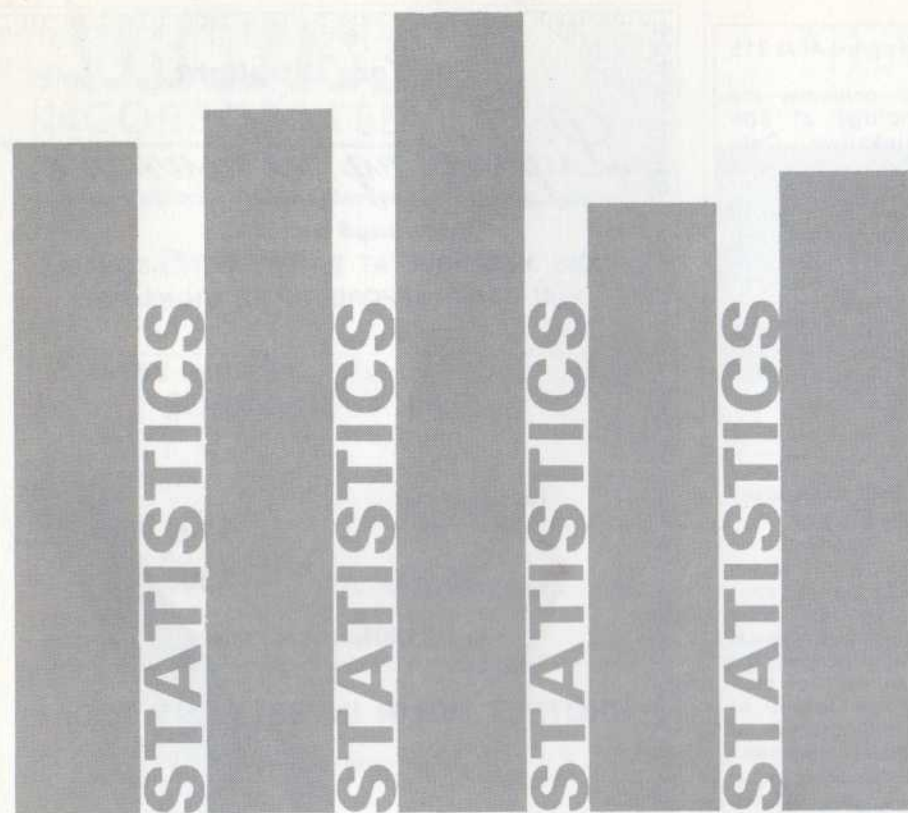
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- ★ Will assemble customer's kits.
- ★ Will fly exhibitions and air show routines.
- ★ We care enough to sell the original Quicksilver, not "Quack."
- ★ Also dealers for Wills Wing, and Moyes hang gliders.

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Every year or so, publications like *Whole Air* must obtain some information on what might be referred to as the "texture" of its readership. Within the industry of advertising these results are called "demographics."

In the recent March/April *Whole Air*, our reader survey asked some questions which will address these demographic information needs. The Reader Response Cards arrived so swiftly that we can already give you some preliminary statistics. Based on one hundred twenty six fully completed surveys (2.8% of the *paid* subscription), we can describe our readers with reasonable accuracy and confidence.

First, 55 percent said they *had* responded to the FAA's Notice of Proposed Rulemaking. If we extrapolate this just to our *paid* distribution, it would seem to identify nearly 2500 letters or other contacts. If correct, that is very encouraging. Thirty nine percent did not respond and six percent did not answer the question.

The age group catalogued "26-35" holds 57% of *Whole Air* readers, with the 26 to 30 group being largest at 32 percent. The scale is greatly weighted to the older end and results showed a respectable eight percent in the 50 and older level. On the other hand, only one percent were under 20 years of age. The mean age was 33.2 years, which agrees with our last survey at 32.8 years.

In asking the number of years you have been involved in the sport we can review which dates seem to have been good "entry years." It is actually quite an even distribution, with 1981, 1979, 1977, and 1975 being particularly good at about 15% per year of our total current readership. Why it is all odd numbered years that stand out is rather hard to ascertain.

This experience indicator combines well with hang rating levels. Forty two percent of our readers are Advanced (Hang IV) or better. Another third are Intermediate, so we can typify our readers as being well beyond average in flying experience and skills. Eighty nine percent of you *are* hang rated, twenty percent are Novices, and four percent are Beginners.

The overall group is overwhelmingly male (98%), but 55% are married so female exposure may still be substantial as *Whole Air* enjoys an active pass-on audience, totalling almost 15,000 readers. Forty five percent are single, and only one percent are dependents.

Sixty one percent of *Whole Air* readers earn over \$20,000 per year, while the single largest category, \$30,000 or more per year, had 32% of the total readership. Another sixth (17%) earn \$15-20,000 and 22% earn \$15,000 or less.

They not only earn a lot, they spend a lot of it furthering their flying, too. Forty four percent spend over \$1500 per year, with eleven percent over \$3,000 annually. The largest single category, however, was \$501-1000, at 27 percent.

Grouping occupations has proven difficult in the past, as individuals describe their vocations in many and varied ways. We asked you for general groupings, which we borrowed from other efforts of this type. Here is the table:

Managerial/Professional	19%
Professional/Technical	35%
Clerical/Sales	9%
Craftsman/Foreman	17%
Student	6%
Other	12%

It appears staunchly "white collar" in general terms but this may account for the relatively high earnings figures.

The poll on "most recent glider or ultralight purchased" fell right in where we expected. UP Sports (Comet Mfr.) is the majority market share holder at 32 percent. Wills Wing is No. Two at 22 percent. Moyes surprised us with a distinct No. Three finish, likely attesting to the effect of Bill Moyes long years in the sport and Steve Moyes' remarkable contest abilities.

The next group is less sharply defined, but includes obvious "heavy hitters" like Flight Designs and Bennett Delta Wing, and newcomer, Progressive Aircraft. Then a big drop brings us to the two solid names of Seedwings and Stratus. All the rest trailed far below at minor percentages.

In ultralights the results also paralleled prior information, with Flight Designs and Bennett trikes taking First, followed in order by Quicksilver, Weedhopper, Eagle, Pterodactyl, and Easy Riser.

You must recall, though, that this owner question *also includes used craft!* Since this is so, there may be no absolute correlation to manufacturer delivery rates. However, we think it is a reasonably accurate list, when compared to other findings or estimates.

Eighty six percent made this most recent purchase in the last two years (including through March, 1982). Sixty one percent were bought in the last year, and a significant 20% took delivery in 1982.

Finally, the vote on your one favorite article in the March/April issue also reflects prior readership desires:

- 1st..... "Sensor 510 Pilot Report"
- 2nd..... "Flying the Jet Wing"
- 3rd..... "Cocoon Harness" opinion
- 4th..... Product Lines column
- USHGA Accident Report
- 6th..... "End Play" theoretical
- "Skyting" towing proposal
- 8th..... Ultralight Owners Survey
- 9th..... Statistics column

The Sensor 510 report was one of most well read we have ever presented. Glad you liked it — we *will* keep this type of material coming, even stronger.

Again, thanks for your input. You are helping us to know what you want, so we can do our best to deliver it. Stay with the lift; keep responding.

ProStar

ProStar... the highest performing of all the Progressive Aircraft company gliders. Designed with the high performance needs of the expert and competition pilot in mind, the ProStar can deliver superior sink rate and excellent glide. The handling also assures the most demanding pilot with crisp, precise control and response.

The ProStar features the innovative hardware of the ProAir, but with a sailing of a higher aspect ratio, and lower twist. This is achieved by using a special white sail cloth with a trailing edge reinforcement. Even the keel pocket velcro-closes in front for cross-country flights. Both the ProStar and the recreational ProAir use a heavy 14 mil mylar in the leading edges for precise camber control. All models use interchangeable air frames and break down to just 12 feet for air shipments.

The ProStar, now available in three sizes, 130, 160, and 195. Write for more information today, at Progressive Aircraft Company, 4544 Industrial Street, Simi Valley, California 93063, or call 805/583-1014.

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Sit in our new Quicksilver MX™ and discover the ultimate in microlight aircraft.

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Experienced microlight and conventional aircraft pilots know that performance is what makes an airplane great and that's who we designed the MX for—experienced pilots.

But remember. The performance only begins after you take your seat. See your Eipper Formance dealer today and please . . . be seated.

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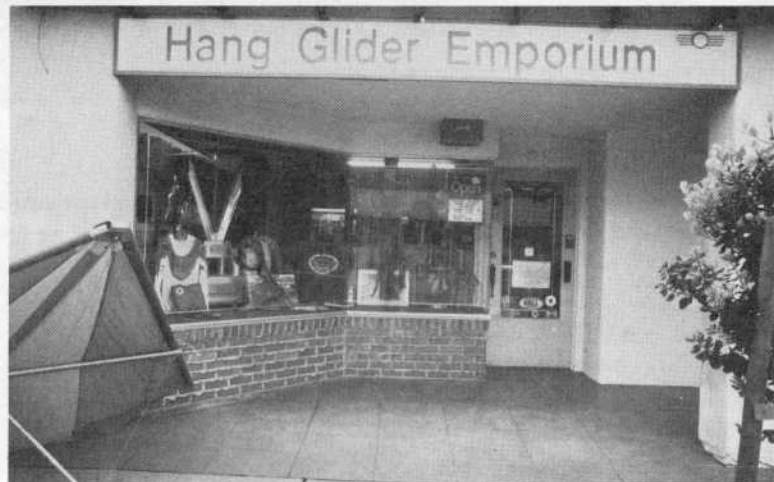
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(714) 744-1514

BLUEBOOK

Edition No. 24

These prices are designed to be guidelines for evaluating your glider or one you wish to buy. We do not intend for these figures to be considered the final authority. Consult your local qualified dealer.

MANUFACTURER	YEAR MODEL	SIZE	CLEAN PRICE	AVG. PRICE	MANUFACTURER	YEAR MODEL	SIZE	CLEAN PRICE	AVG. PRICE
BENNETT DELTA WING	77 Phoenix 6C	Jr.	550	450	SEAGULL AIRCRAFT	77 Seahawk	170	600	450
	77 Phoenix 6C	Sr.	425	400		77 Seahawk	190	550	450
	77 Phoenix 6C	Reg.	500	425		77 10.5 Meter	---	625	525
	77 Phoenix 8	Reg.	650	375		78 Seahawk	140	675	625
	78 Phoenix 8 Super	Reg.	675	450		78 Seahawk	170	675	525
	78 Phoenix 12	Reg.	500	375		78 Seahawk	190	675	450
	79 Phoenix 6D	185	725	650		78 Seagull VII	162	550	500
	79 Lazor I	190	775	625		78 10 Meter	---	800	750
	80 Phoenix 6D	215	875	700		78 10.5 Meter	---	800	750
	80 Lazor II	175	925	725		79 Seahawk	180	850	625
CGS AIRCRAFT	77 Falcon V	185	650	500	79 10 Meter	---	825	700	
	77 Falcon V	220	600	475	79 11 Meter	---	825	700	
	78 Falcon 5½	Med.	700	625	80 11 Meter	---	925	850	
	79 Falcon 8	Med.	900	800	SKY SPORTS	77 Bobcat III	Lg.	675	600
EIPPER FORMANCE	77 Flexi II	185	525	475		77 Merlin	160	600	500
	77 Flexi III	185	575	500		77 Sirocco I	156	600	475
	77 Cumulus 10	Med.	550	525		77 Sirocco I	175	575	400
	78 Flexi III	Lg.	800	600		78 Osprey	175	700	525
	78 Flexi III	Med.	750	600		78 Sirocco II	164	725	600
	78 Cumulus 10	Med.	675	500		79 Eaglet	191	550	425
	78 Antares	Med.	775	600		79 Osprey 2	175	625	550
79 Antares	Med.	825	600	79 Sirocco III		189	850	725	
ELECTRA FLYER	77 Cirrus	3	600	400		UP SPORTS INC (ULTRALIGHT PRODUCTS)	77 Firefly	174	650
	77 Olympus	160	575	525	77 Dragonfly Mk. II		196	700	550
	78 Cirrus 5	C	600	475	78 Firefly		154	800	600
	78 Cirrus 5	B	750	450	78 Spyder		176	850	625
	78 Cirrus 5	A	60	500	78 Condor		178	900	725
	78 Olympus	160	625	550	79 Mosquito		166	800	650
	78 Olympus	180	625	550	80 Firefly 2B		181	775	600
	79 Dove	A	700	575	80 Comet		165	1325	1175
	79 Trainer	---	400	300	81 Comet	165	1575	1450	
	79 Cirrus 5	A	650	625	81 Gemini	164	1450	1325	
	79 Olympus	160	725	650	WILLS WING	77 SST	100C	500	400
	79 Floater	205	775	675		77 SST	100B	500	425
	80 Spirit	200	1050	875		77 Universal	100A	400	350
FLIGHT DESIGNS	79 Lancer	190	900	675		77 X-C	185	525	450
	80 Lancer	175	975	900		78 SST	100C	70½	650
	80 Super Lancer	200	1025	925		78 Alpha	185	825	700
	81 Super Lancer	175	1100	950		78 Alpha	215	825	725
	81 Demon	175	1475	1300		78 X-C	215	800	700
HIGHSTER AIRCRAFT	80 Highster	205	1000	825		79 Alpha	185	800	675
	80 Highster	190	925	825		79 Alpha	215	800	700
MANTA PRODUCTS	79 Fledge	IIB	1200	1000	79 Omega	220	950	825	
	80 Fledge	IIB	1525	1325	79 Omni	187	925	750	
MOYES DELTA WING (U.S. MOYES)	77 Maxi I	200	700	625	79 Raven	209	1075	800	
	78 Maxi II	200	750	700	80 Raven	209	1100	925	
	79 Maxi III	200	875	700	80 Raven	229	1075	925	
	80 Stingray	200	725	725	80 Harrier	177	1375	1150	
	80 Maxi IV	200	825	725	81 Harrier	177	1450	1325	
	80 Mega II	172	1075	850	AMERICAN AEROLIGHTS	80 Quicksilver	CM	3175	2850
PTERODACTYL INC	80 Twin Eagle	---	3125	2875		81 Quicksilver	MX	4100	3725
	81 Eagle, Z-Drive	---	3475	3100		80 Weedhopper	B	3000	2675
	80 Ptraveler	---	3425	3100	EIPPER MICROLIGHT	WEEDHOPPER			



HANG GLIDER EMPORIUM

LOCATION:
Santa Barbara, CA
OWNER:
Ken de Russy

Ken de Russy's Hang Glider Emporium, originally established in 1974 as Channel Islands Hang Glider Emporium, is located in Santa Barbara on the California coast, just 100 miles north of Los Angeles. Only three minutes off U.S. 101, the fully stocked retail store serves also as the flight school headquarters. The Hang Glider Emporium serves Santa Barbara and the surrounding communities of Montecito, Carpinteria, Goleta, Santa Ynez and Lompoc (Vandenberg Air Force Base) with a total population of over 250,000.

The 640 square foot retail store is efficiently laid out with the pilot in mind, and is packed with every type of hang gliding equipment a pilot could want. All merchandise is attractively displayed and there are continually 15-20 gliders in stock in the shop or warehouse. The Hang Glider Emporium sells all brands of hang gliding equipment, including Ultralite Products and Wills Wing and the Price Harness. A varied stock of replacement parts for all brands of gliders is on hand and repairs can be obtained quickly from the complete repair facility. Virtually all store activities are managed by Bonnie Nelson, Ken's wife and partner.

Training is conducted on one of the country's best Beginner/Novice hills, with launch levels up to 200 feet AGL. This fine site with its consistent onshore breezes is located on 100 acres just 300 yards from the Pacific. Inside the city limits, it is only 10 minutes from the shop. They offer highly personalized small group instruction, with class sizes averaging six students. With an impeccable safety record, the Hang Glider Emporium has

pioneered many teaching techniques now in use throughout the country. Ken de Russy has been teaching full time continuously since early 1974, and is quite possibly the most experienced hang gliding instructor in the sport. Ken personally conducts the instruction five days per week (usually Wednesday through Sunday) aided by other experienced instructors (presently Jeff Mailes and Matt Dettman) equally committed to safe, precise instruction. Custom instruction programs of up to 21 days take students from the Beginner and Novice levels through Intermediate/Advanced levels. Tandem and two-way radio instruction is also available.

The Santa Ynez mountains, an eastwest coastal range in the Los Padres National Forest, provides Santa Barbara with unlimited flying year round. Averaging 3800 feet with peaks of over 4000 feet, access is via Camino Cielo (Sky Highway), a crest road running for 25 miles, most of it paved. Numerous launch points are available facing north and south, the most popular launch point being La Cumbre Peak (3985 ft. ASL) and 35 minutes from downtown. Most sites require a USHGA Intermediate or Advanced rating and clearance to fly any Santa Barbara site can be obtained by contacting the Santa Barbara Hang Gliding Association or the Hang Glider Emporium.

The multitude of flying sites, year round warm weather, the resort appeal of beautiful smog-free Santa Barbara, and the convenience of the full service Hang Glider Emporium make Santa Barbara an ideal place to live or visit for the hang glider pilot.

**THIS PACKAGE CAN SAVE YOUR LIFE.
WILL YOU FLY WITHOUT IT?**



Life saving technology from Flight Designs is backed by Pioneer. What does it mean to you?

Pioneer is the builder of the very advanced and demanding recovery systems for the highly technical space exploration vehicle, Columbia. That same engineering expertise goes into every Flight Design Emergency Hang Gliding Parachute.

A tri-conical gore shape with bias construction gives the Flight Designs parachute the flattest profile (for high drag per square foot of fabric), circumference "give," and tremendous radial seam strength. The threads are interlocked and cannot "comb out." With the remarkable F-111 fabric and this strong support construction, it's no surprise that the parachute system has been real-tested

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by
Noel
Whittall

**THE
YORKSHIRE
AMERICAN CUP
June 12-20, 1982**

On - off - on - off - and at last, it is definitely on. June, 1982, the American Cup Competition crosses the Atlantic to be flown in the Yorkshire Dales.

When Derek Evans, British competition chief, first approached us locals about hosting the Cup in our country, I do not believe many of us thought it would really happen. But now we find ourselves preparing to meet teams from three continents and wondering what they will make of our home sites.

It is a land of villages rather than towns, small inns rather than hotels or motels, age-old rock fences rather than barbed wire and, above all, open rolling moorlands.

The main activities are sheep farming and breeding game birds, and although the area is designated a 'National Park,' all the land is privately owned. The Dales Hang Gliding Club has carefully built up good relationships with the local communities, and taken care to see that visiting fliers respect the rules of the area.

Naturally that old British pre-occupation, the weather, plays a big part in local flying conditions. It has been said that we do not actually have a climate here in the British isles, just samples. Certainly things are often rather unstable here in that department. Cloudbase is rarely more than a couple thousand feet above the hilltops, and sunshine in the morning is no guarantee against rain after lunch. Only one thing is really certain — when it rains it will be *cold*. Dales fliers keep their skin suits handy the year round, although with any luck they will not be needed in June and July.

For hang glider pilots, the harsh climate and thin soil provide a great advantage — there are virtually no trees. Take-off and landing areas are plentiful, and top-landing is normal; quite a change from Lookout Mountain.

We really do not have much money to spend on making a lavish show of the Cup competition, (about none if the truth is to be told!), but all the teams are assured of a warm Yorkshire welcome, good competitive flying, and a scene that will certainly be different, whether they are used to the U.S.A., Canada, Brazil, France, or Switzerland.



Hiway's Chris Johnson shows the company's new hawk-like 'Alien,' beautifully finished (about US\$2,300) /photo: Noel Whittall

BOOK REVIEW

HANG GLIDING & SOARING

Written by James Mrazek

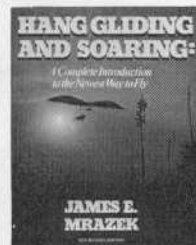


Photo by Chris Voith

Reviewed by Tom Phillips

Perhaps the only way a book on hang gliding can avoid immediate obsolescence is to always speak in the past tense. The experienced pilot, especially one who grew up with the sport, will find plenty to nit pick. However, the interested newcomer looking for the answers to basic questions and some reassurances will be pleased with the overall presentation. The old timers will find pleasure in the nostalgic value of seeing old friends again in the care-free days of "low and slow standards" and our turbulent, tragic adolescence.

Certainly Jim Mrazek has done his homework in flight history. It becomes evident that we have always been the mainstream of manned flight and this powered thing only a recent development. The "Followers of Icarus" is a very comprehensive gathering of the fathers of manned flight and they were all hang glider pilots. Makes you feel proud, eh?

Discussion of prices is surely the quickest way to become out-of-date, whether it is club dues or gliders, since with each successive point in glide angle achieved, we seem to be paying \$100 to \$200 per year more for gliders. Hopefully, L/D will one day surpass inflation.

Whenever you read that "such and so record is now..." you know it is wrong, you just do not know by how much or when. The same is true of hardware innovations or design specifications and performance claims.

The author's description of a 360 is scary. It takes me back to when the 360 was universally considered a radical maneuver and I think makes the fact that the author has never done one clear. Mr. Mrazek writes books for the rewards of writing books. Pilots of some experience could write more accurate books but do not. Here is an excellent maker of books with an intermediate pilot's technical knowledge, somewhat dated, and a beginner's flying skill level. This attractive book will be appreciated in proportion to the reader's flying background and its inaccuracies will hurt no one so long as they continue to pursue knowledge beyond this volume, as they should. The idea that some one might use this as a text on tow flying is terrifying. In that there is

very little alternative in print, the only safe way to learn this art is to go to the experts and let them teach you according to current methods. The author's last words on this subject should be underlined.

Visual presentations include dozens of "standards" and only one "Comet," and not really a good view of the wing at that. Photo revisions are badly needed. A curious selection of representative glider planforms is presented, when you reflect on the many well known models not used. Timewise, a glaring gap in the photo graphics exists. Most of the pictures and drawings are of "standards" with a few scattered shots of equipment current circa 1980-1981. This jump will give the student some confused ideas of glider evolution, especially when he finds that "standards" are extinct in 1982. This may be the inevitable result of a too hasty revision of a book which has spanned the most active segment of the life of this sport (1st edition, 1976; 2nd edition, 1981).

[Editor's Note: A newer revision of Mrazek's book is currently in the works at St. Mary's Press, and may well correct many of the above-mentioned flaws.]

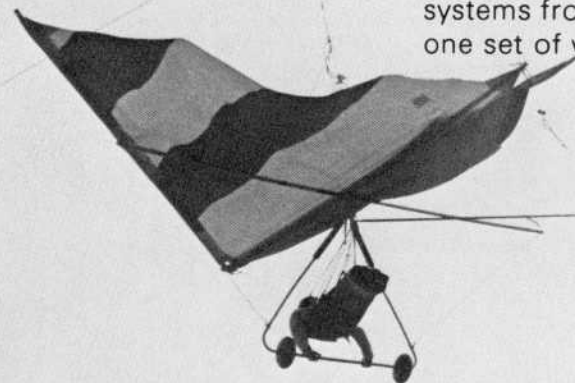
New material is presented on ultralight flying which is already showing its age, although it is for the most part correct. And chapters on the MacCready Gossamers and the use of reserve chutes do bring those subjects up to date.

The great number of incorrect, misleading, or just out-of-date information, along with the predominance of "antique" photos where more current state-of-the-art representations were available when the present edition was prepared, is annoying to this reviewer. Even though in one of the few up-dated shots I found my own likeness soaring some two years ago.

However, most of my critical observations will probably go unnoticed by the interested beginner or prospective pilot, and he or she will enjoy the book in spite of my picayunish evaluation. I do believe that the subject of soaring was rather lightly treated. As this is the real heart and soul of today's flying and half the title of the book, I am left with the feeling of "something's missing."

SERAPH*

SERAPH (ser'ef) n. 1. A celestial being of the highest order having more than one set of wings;
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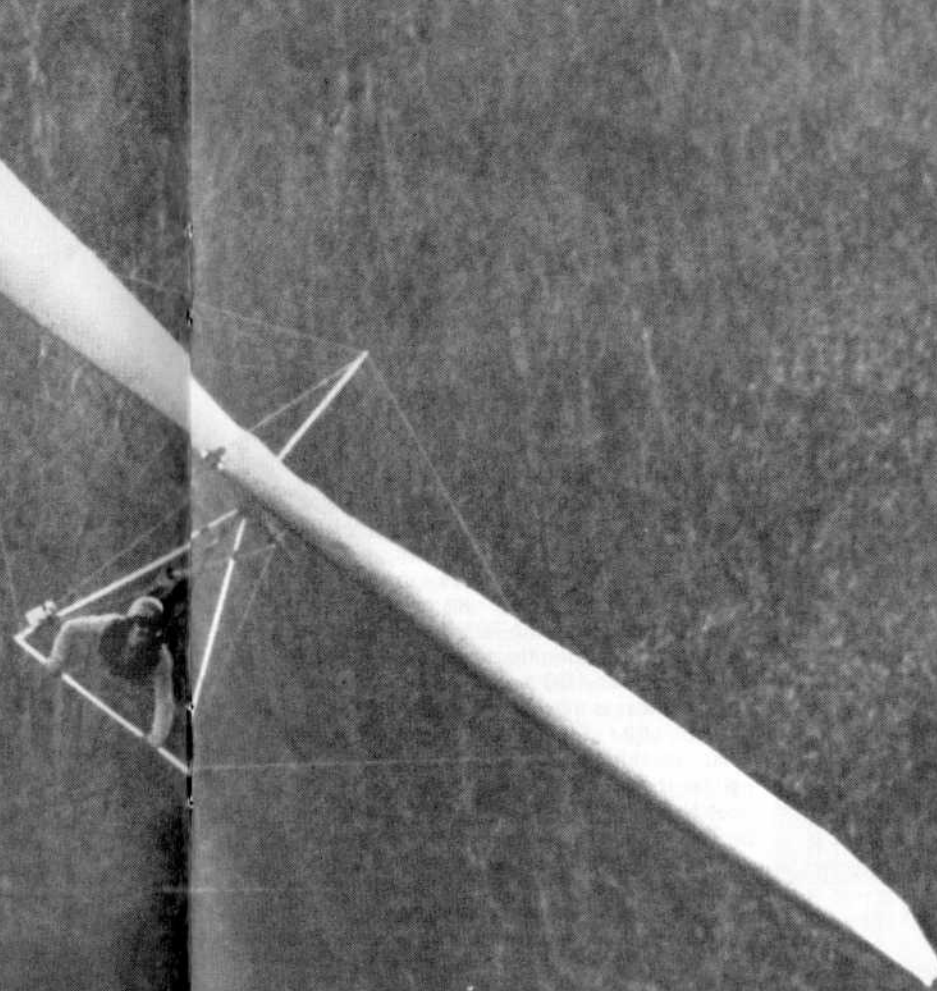
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FACE OFF

DUCK PROSTAR X

"Faster than a Comet... sinks better than a Comet... much easier handling than a Comet." One thing that all the new high performance gliders have in common is that they spend a lot of time getting compared to Comets. After all, there are more than 2000 of them flying; even if you have never flown one, you have got a pretty good idea of what they are like. And for going on two years now, Comets have set the performance standards.

In the pages that follow you will find out how three pilots felt about the Wills Wing Duck, the Progressive Aircraft ProStar, and the Delta Wing X Glider series. When making comparisons it helps to use a reference glider, as many questions about glider performance eventually reduce to, "Will it beat a Comet?" In this endeavor, the Comet 185 was used as that reference glider.





Prior two pages: The Wills Wing Duck against a backdrop of budding trees, a fitting beginning to the spring FACE OFF

Bennett's new X Glider shows excellent sailwork in a contemporary new design

SET-UP/CONSTRUCTION

If you have been waiting for a really new high performance wing, a totally different approach, you are going to have to wait some more. A quick look at the photos and specification chart will convince you that the Duck, ProStar, and X-Series are definitely Comet generation double surface wings. There is some variation in nose angles and aspect ratios, but no aerodynamic controls, no in-flight adjustable sail tensioners, no 100% double surface. These are weight shift controlled gliders, 60-70% double surface gliders with hidden floating crossspars. The Duck spreads 180 square feet of sail, our test X glider is also a 180, and the ProStar is a 162. On first inspection, the distinguishing characteristic of each glider is how much it "clunks." The X-180 has about half as much slack in the wires as a Comet; the Duck's wires are snug but not tight; and the ProStar's are good and tight.

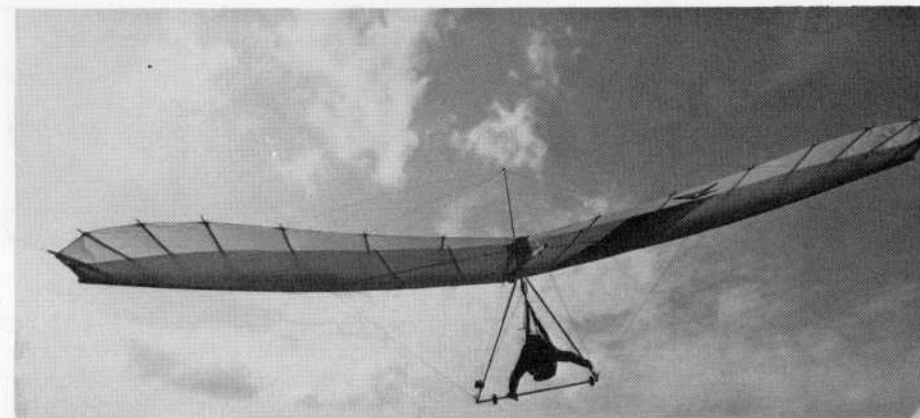
The overall finish and hardware of the ProStar are excellent. Leading edges break down to twelve feet by pulling a clevis pin on each side. The control bar is also fastened with clevis pins and rings. The crossspar is tensioned at the tail. The inner ribs are stout half-inch aluminum with Lexan tails. Outer ribs are 3/8" aluminum with fiberglass tailshafts. The impression the ProStar gives sitting on the ground is of high quality.

The sailwork on the X-180 is excellent. The sail is wrinkle-free (5.3 ounce cloth may have something to do with it), and there is webbing sewn in at all possible chafe points. Ribs are similar to the ProStar's, with Lexan shafts. The hardware is standard Delta Wing.

The Duck we tested was an early production model, and while the ProStar and X-180 were supplied expressly for the *Whole Air* flight test, our Duck was from dealer stock. The sailwork was not as clean as the other two gliders; there was quite a bit of pucker in the bottom surface which did not smooth out in flight. Hardware on our test glider was not the final version — washer stacks were doing duty for spacers.

HANDLING

Our first flight on the ProStar was a bit scary. Taber got spit out of a thermal and wound up headed back over the ridge with 100 feet of clearance. The glider was agonizingly slow to come around. After



The ProStar is up and away mirroring the up and coming image of the builder, Progressive Aircraft

that, local ProStar dealer, Denny Haldeman, loosened the tension on the tip ribs considerably. In later flights, Short and Engelhardt picked the ProStar as their handling favorite, describing pitch and roll pressures as light and quick, but positive enough to give good feedback. Score one for tight wires.

The ProStar excelled in punchy air, perhaps as a function of its smaller area and span as well as its quick handling. It seemed to roll into lift easier than a Comet; once cranked into a 360 it stayed nice and neutral, requiring very little high-siding to maintain its bank angle.

In spite of the fact that it was flown at a higher wing loading than the other gliders, the ProStar proved easiest to launch and land. The tight wires and excellent static balance inspired confidence on launch, while the quick handling and tight wires allowed easy last second maneuvers on approach.

On balance, the ProStar is oriented toward the handling/performance trade-off. At comparable wing loading, though, it could be quite competitive in any conditions.

In the Duck, Wills Wing has another easy handler. Light pitch and roll pressures make it less tiring to fly than a stiffer glider (like a Comet). The overall feel was described as much like a Harrier but a bit stiffer and with a little more lag time — the price one pays for double surface performance. Turns coordinated effortlessly. The Duck had the greatest tendency of the three gliders tested to drop its nose on landing, perhaps a product of its also having the widest nose angle. The snug wires made launches a no problem proposition.

The X had the loosest wires of the gliders tested and, perhaps as a consequence, the most "Comet-like" handling characteristics. In general, though, it requires less pressure in pitch and roll than a Comet, though more than the Duck or the ProStar. It flat turned on a par with the Duck, which is to say very well, and actually was a bit more forgiving to land, making less of an effort to drop its nose and humble its pilot.

PILOT'S QUANTITATIVE EVALUATION TABLE

[When scoring, the pilots used a 1 (one) through 5 (five) scale system... with 1 (one) being "no, less, or worse (less favorable)," and 5 (five) being "yes, more, or better (more favorable)." The Duck rating will be preceded by a "D," the ProStar by a "P," and the X Glider by an "X." Thus a D5-P5-X5 rating would be most favorable for all models.]

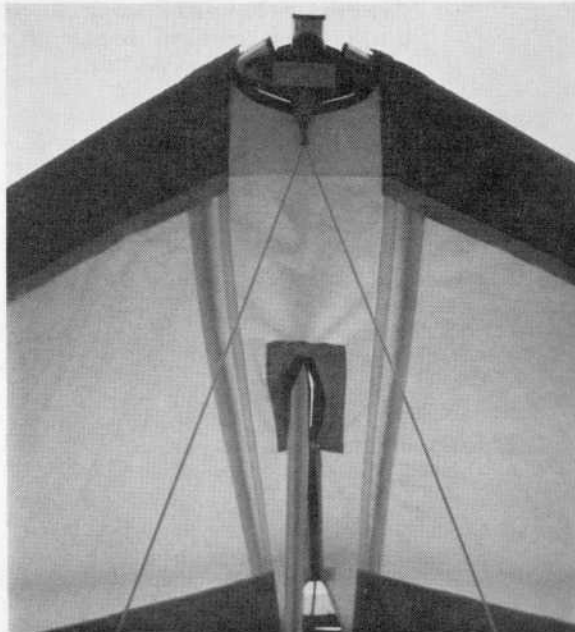
CATEGORY	Gary Engelhardt	Bruce Short	Matt Taber
LAUNCH			
Static balance (tail/nose heaviness)	D5-P5-X5	D5-P5-X3	N/A
Launch Run			
Planes off quickly?	D4-P4-X4	D2-P1-X3	D5-P3
Does the nose pop up?	D2-P2-X2	D5-P5-X2	D1-P3
Launch Stability			
Pitch - Does it drop its nose?	D2-P2-X2	D5-P5-X2	D1-P3
Roll - Does it drop a tip easily?	D2-P2-X2	D5-P5-X3	D1-P3
Launch Speed			
Does it take a lot of speed?	D3-P3-X3	D5-P3-X4	D3-P3
Does it launch real slow?	D3-P3-X3	D2-P5-X3	D3-P3
LANDING			
Predictable stall	D4-P5-X3	D2-P1-X2	D5-P3
Good flare (Nose drops through?)	D3-P2-X2	D3-P5-X1	D2-P3
Does it parachute well?	D3-P3-X4	D3-P5-X4	D7-P2
Landing speed	D4-P3-X3	D3-P2-X3	D4-P3
(Slow speed handling becomes important as well as mush characteristics.)			
(1) Does glider turn while it is mushing?	D4-P3-X3	D2-P3-X4	D5-P2
(2) Does it drop a tip easily?	D2-P2-X2	D5-P4-X2	D1-P5
(3) Does it parachute well?	D3-P3-X3	D3-P4-X4	D7-P1
(4) Does the nose drop through easily?	D3-P2-X1	D5-P4-X2	D4-P1
(5) Does it have a predictable stall?	D3-P3-X3	D1-P1-X3	D5-P5
FLIGHT			
Handling			
Trim condition	D5-P5-X5	D2-P1-X3	D4-P4
Launch characteristics	D5-P5-X5	D2-P2-X4	D4-P4
Sensitivity or feedback	D5-P5-X4	D2-P1-X3	D4-P3
Roll pressure (initial, continued)	D5-P4-X4	D2-P1-X3	D4-P2
Stall characteristics	D4-P4-X4	D2-P2-X3	D4-P3
Tip stalls (spiral)	D2-P2-X2	D2-P5-X3	D3-P3
Yaw stability (flat turn)	D5-P5-X5	D2-P2-X3	D2-P1
Spiral stability	D4-P5-X4	D2-P2-X3	D4-P3
Ease of turn coordination	D5-P5-X5	D2-P2-X4	D4-P2
Launch	D5-P5-X5	D2-P1-X4	D4-P?
Flight	D5-P5-X5	D2-P2-X4	D4-P?
Landing	D5-P5-X5	D3-P1-X4	D2-P?
PERFORMANCE			
Sink rate	D4-P4-X4	D2-P2-X3	D4-P3
Usable speed range	D5-P4-X5	D2-P1-X3	D4-P3
Thermalling ability	D5-P5-X5	D2-P2-X3	D4-P3
L/D (glide angle)	D4-P4-X4	D2-P2-X3	D4-P3

FACE OFF DUCK PROSTAR X

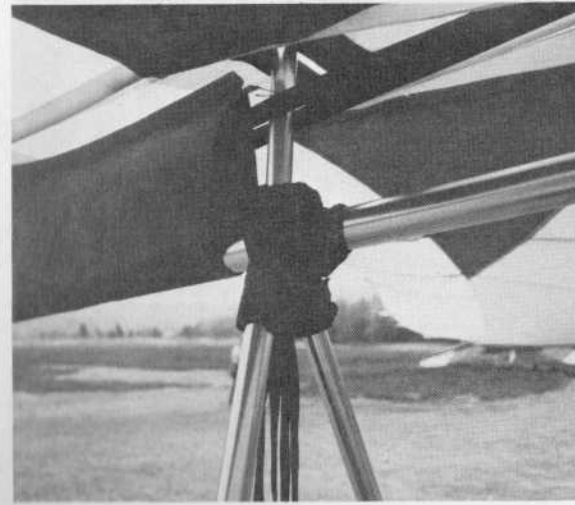
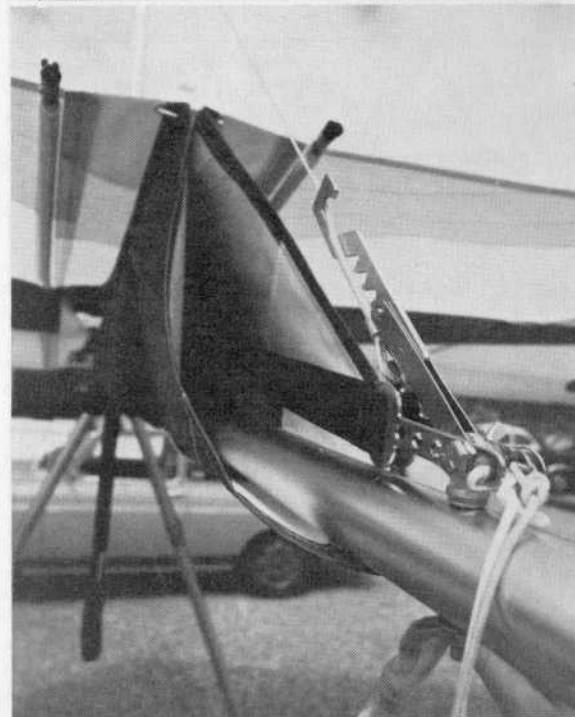
FACE OFF... an Evaluation/
compiled by Wade Leftwich;
flying by Gary Engelhardt,
Bruce Short, and Matt Taber;
photography by Doug
Barnette, Chris Voith, and BJ
Schulte; logistics by the
Whole Air staff

Our pilots for this test all fly Comet 185s. Of course, there is a certain level of brand loyalty at work, so while their comments will be candid, they will not necessarily be unbiased. (In case you are on the lookout for conflict of interest, one pilot is a dealer for UP, and another works for a Wills Wing dealer.) Just keep in mind that the test pilots are wired into their Comets. They know how to get the best performance out of them.

A note on the test procedures is in order. Each pilot was to fly each glider three hours. Each glider was to be flown with the other two, as well as with Comets. While deadline pressure and a spell of contrary weather kept us from getting all the hours we wanted, the gliders did get plenty of time put on them, in conditions ranging from light thermals to 25 mph ridge lift. The pilots all filled out multiple choice evaluation forms, to create an aura of statistical respectability; the overall results are presented in the table opposite, and their comments can be seen on successive pages along with hardware detail photographs. And now to the business at hand.



Hardware details of the Bennett Delta Wing X-180



GARY ENGELHARDT — Gary is senior flight instructor at Crystal Flight Resort, Chattanooga. He is Hang IV rated, and is highly experienced in soaring flight. He flies a Comet 185 yet has broad experience in many other brands and models.

(Duck 180) The most impressive characteristic of the Duck is the handling. Light pitch and roll pressures make it easier to fly as well as less tiring. Compared to a Harrier the Duck's handling is a little stiffer with a bit more lag time. Landing a Duck is about like most double surfaced gliders; you need to use up the landing speed and hold your hands high on the downtubes. Set-up is trick without any tensioners. The breakdown is easy but the sail bunches up between the mylar surfaces. The Duck is a fun glider to fly.

(Progressive Aircraft ProStar 160) The 160 ProStar has light handling with a minimum of high siding needed in a tight bank. The 160 handled my weight (210 pounds hook-in) well and optimized in stronger air. My landings were all good considering the high wing loading and landing speed. The short span can punch into lift and turn a fairly tight, controlled 360. Feedback tells you about the air you're flying through. The enclosed defined tips are the hardest thing to assemble in the set-up. It takes some muscle to double the plug/cord bungie. Tight wires improve launching, ground handling, and turn authority compared to a loosed rigged glider. Clean hardware rounds out a nice soaring machine. I like this glider the best, probably because I had my most fun flights on it.

(Bennett Delta Wing X-180) I enjoyed flying the X-180 very much. The conditions for the flights were varied. The X thermals nicely and likes to stay in the lift. It seems to be quite fast. Handling is very pleasant for a double surfaced glider with pitch pressures being light compared to a Comet 185. Roll pressure is also lighter than a Comet 185 with quicker response and less "yaw-out" of turn. Nose wire could use a more secure method than a wing nut holding the thimble wire. The double surface is quite thick and looks better than any I've seen. Its underside nose ribs hold the surface blunt in the center. Also the sail work and overall appearance are very nice. Uncle Bill's got a nice one here!



Hardware details of the Progressive Aircraft ProStar 160

BRUCE SHORT — Bruce is the non-industry pilot of the three. Bruce is employed as a chef, a job which allows Bruce a liberal amount of time to pursue flying. He is Hang IV rated, and a very successful competition pilot, whose distinguishments take him right to the Masters Competition. He flies a Comet 185, but has experience in almost all major brands and models.

(Wills Duck 180) The Duck handles pretty good being lighter in bar pressure (both pitch and roll but especially pitch) than the Comet 185. Thought the top sail is tight and aerodynamically clean, the bottom surface is downright baggy and is subject to excessive pucker and undulation while in flight. I have been told that the bottom surface could be cleaned up considerably by adjusting the leading edge and/or crossbar tension but only at the expense of handling.

In conclusion, the Duck is a safe, well-performing, and easy handling glider that suffers mainly from a lack of refinement that can only be remedied by time.

(Progressive Aircraft ProStar 160) I was quite impressed with this glider in several areas. First, I felt that the weight and static balance made for the easiest ground-handling of any hiddencrossbar glider I've flown to date. Second, pitch and roll pressures were both light and quick but still positive enough to inspire confidence. Third, even though I felt this glider was a size too small for me, it still performed admirably in terms of slow-speed sink rate.

On the negative side, the trailing edge breaks up considerably at the upper speed ranges. The bag lacks sufficient padding or a handle, and the control bar junction bolt uses only a safety pin instead of a nut.

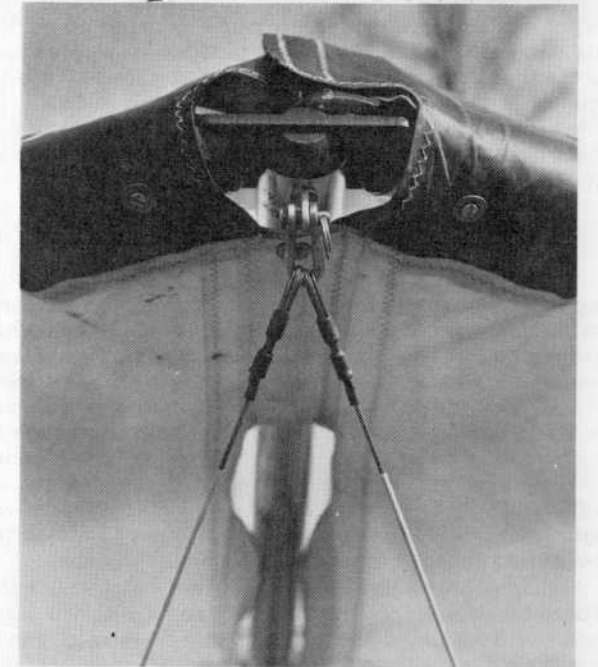
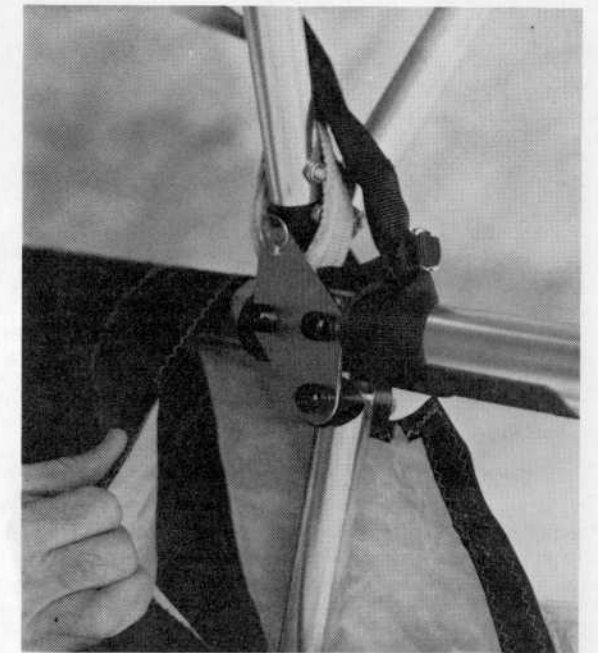
(Bennett Delta Wing X-180) Basically, I was not impressed with this glider too much at all. First, I felt that much of the hardware was overly plain, such as the tubular plastic for the flexible part of the ribs, and fold-over (as opposed to clamp-type) tensioners, and what appeared to be a non-aircraft quality bolt that was used to anchor the crossbar to the top-rear of the keel. The sailwork, however, looked to be just excellent, with a multiplicity of webbing used in many stress areas. It is only too bad the hardware could not match up to these same standards of excellence.

Handling-wise, the X exhibited moderate bar pressures in pitch and roll, but my major dislike was for the amount of push-out required in the back-side of a 360 to keep the nose from dropping.

[In fairness to Pro Air and Bennett, the following new item should not appear in the pages of this evaluation. But the happening is so significant an achievement that it was decided to go ahead regardless. These pages were the last completed, and thus, this position was the *only* slot available.]

FLASH! Bruce Case, an instructor for Northern Sun, and one of the country's top competition pilots, broke the stranglehold on 100 mile plus flights occurring west of the Rockies.

Bruce launched from Frontenac, a site on the Mississippi River bluffs, southeast of St. Paul, Minnesota. Climbing his Duck 180 to 6,000 feet, he flew over virtually flat terrain for some 5½ hours to Waterloo, Iowa. The Sunday flight (April 25th, 1982) has not yet been measured accurately, but the distance was estimated at 135-140 miles by reporter, Boris Popov. Applause is in order for Bruce Case for an exceptional bit of late winter flying, *not* in the Owens!





Hardware detail features of the Wills Wing Duck 180

MATT TABER — Matt is the proprietor of Lookout Mountain Flight Park. He instructs in addition to running the business. He is a Hang IV rated pilot, with wide experience in most brands and models. Matt was only able to get a single "sled run" on the X glider, so he declined to write a report that was based on so little direct information.

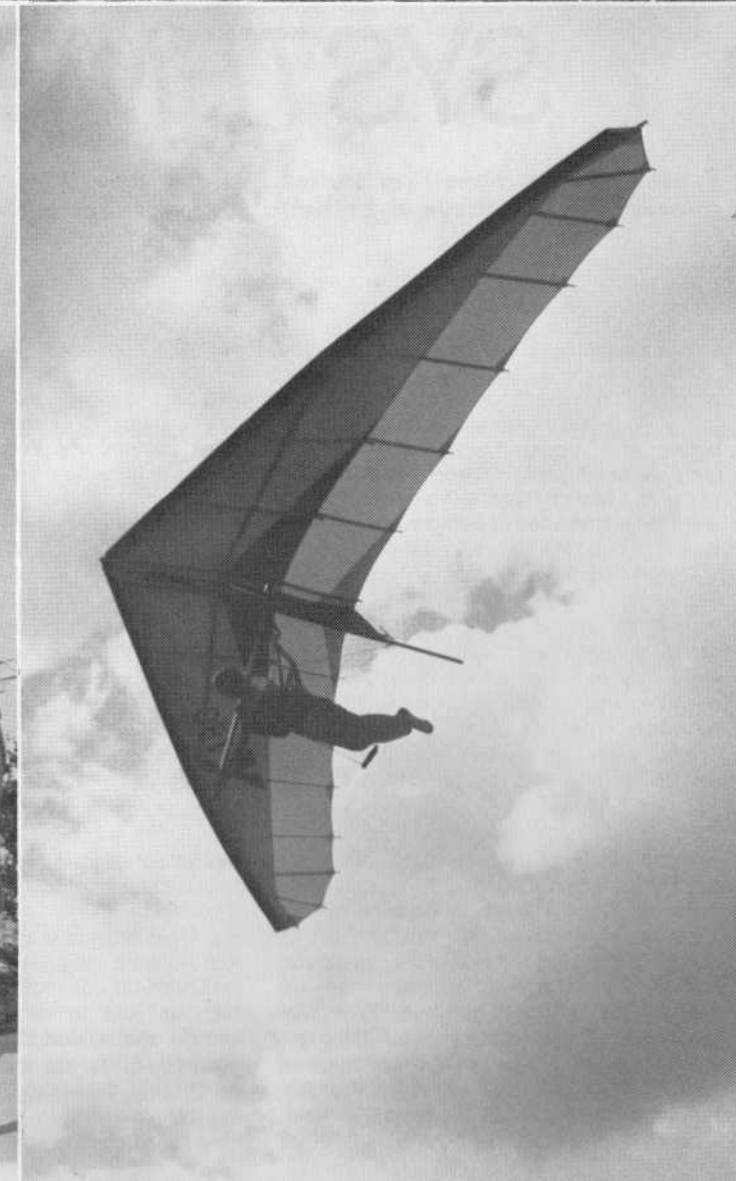
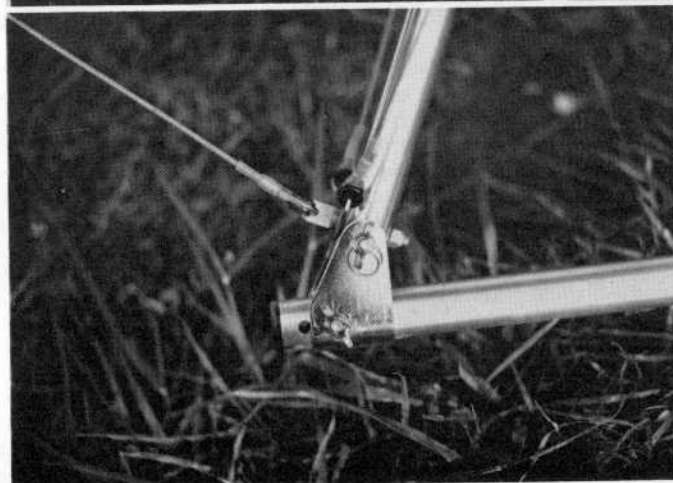
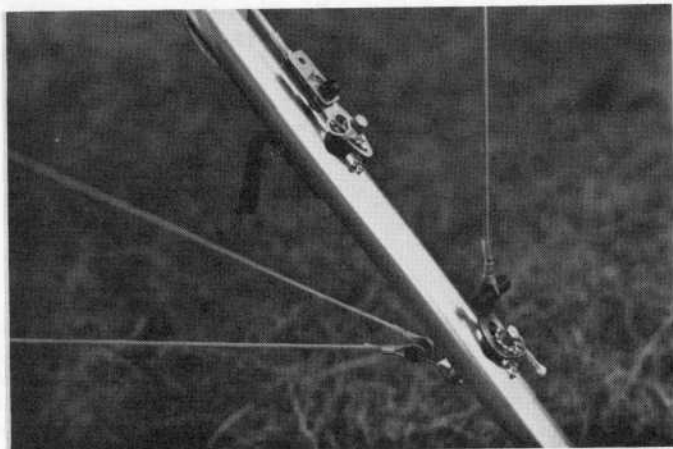
(Wills Wing Duck 180) The Wills Wing Duck is a good performing glider. I felt the Duck was my favorite in this evaluation, although I prefer flying the Comet 185. The Duck, although close, does not compare to the Comet 185. The Comet also seems to turn tighter, although with more bar pressure. The pitch pressure on the Duck is real nice, positive to inspire confidence and lighter than a Comet. I thought the set-up was real nice and simple. The glider has a clean appearance, although the sail work is not on par with the Delta Wing X-180. The Duck's top surface has wrinkles much the way the first Comets did, and the lower surface is loose like the Demon.

In summarization, I think the Wills Wing's answer to the double surface question is a fun to fly glider that handles well and performs well, although it is not that innovative.

(Progressive Aircraft ProStar 160) The way the ProStar came from the factory, it was very difficult to handle. It has a different coordination than I am used to and I did not get comfortable with it. I did not get to fly it again after adjustments were made in loosening the tips, but the other pilots did mention the difference in coordination. They expressed pleasure in both pitch and roll — in fact they thought that it handled better than the other gliders.

I did not get the opportunity to race or do an accurate sink rate comparison with any one of the other gliders, although with my weight (200 pounds hook-in), the ProStar did not seem to have the eye-watering speed I have experienced in other ships.

Although it has a good looking sail and a nice simple look, the sail does break up at speed. Th bag has no padding or chafe pads, or handles, and the control bar is held together with a clevis and safety pin. It is hard in my mind to justify the cost.



BASIC COMPARATIVE SPECIFICATIONS

	DUCK	PROSTAR	X-180	COMET 185
AREA	180ft ²	162ft ²	180ft ²	185ft ²
SPAN	35 Ft	31.4 Ft	32.7 Ft	34.8 Ft
NOSE ANGLE	130°	124°	130°	120°
ASPECT RATIO	6.8	6.1	6.0	6.6
WEIGHT	68 Lbs	64 Lbs	72 Lbs	78 Lbs
PILOT WEIGHT	160-240 Lbs	150-210 Lbs	160-220 Lbs	150-250 Lbs
PRICE	\$1995	\$1995	\$1960	\$2045

BALLISTIC RECOVERY SYSTEMS

Faster than a speeding bullet... that's how fast your parachute deploys, IF you have a ballistic system, that is/by Dan Johnson

Ballistic. Pyrotechnic. "Slug, mortar, line stretch, cartridge, projectile. Armed." The jargon of ballistic recovery systems is here today. And you, as an informed pilot, had better "arm" yourself with the newest hi-tech life saving information available.

In the March/April *Whole Air*, the BRS was first introduced as being commercially available on the world market. With a reported decrease from 7.48 seconds (full deployment time from initial pilot action, including "fumble time") to 1.50 seconds, ballistics represent 1982 State-of-the-Art in parachute life preserving systems.

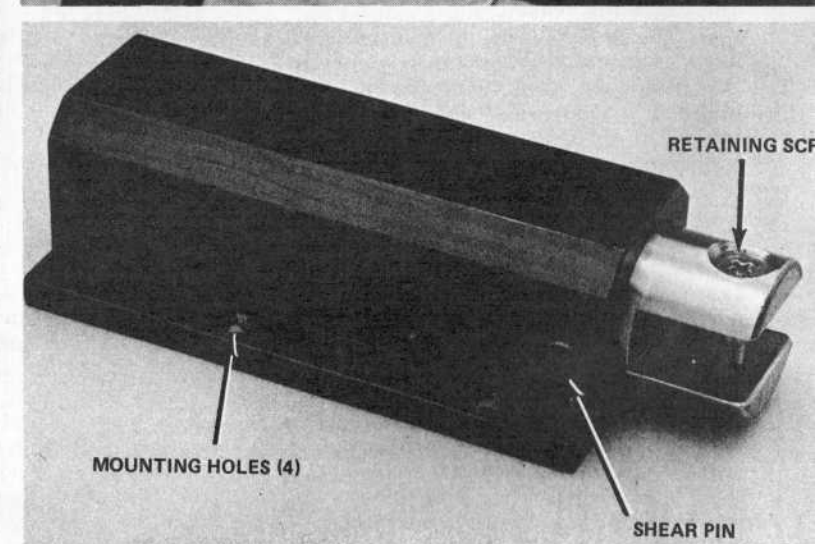
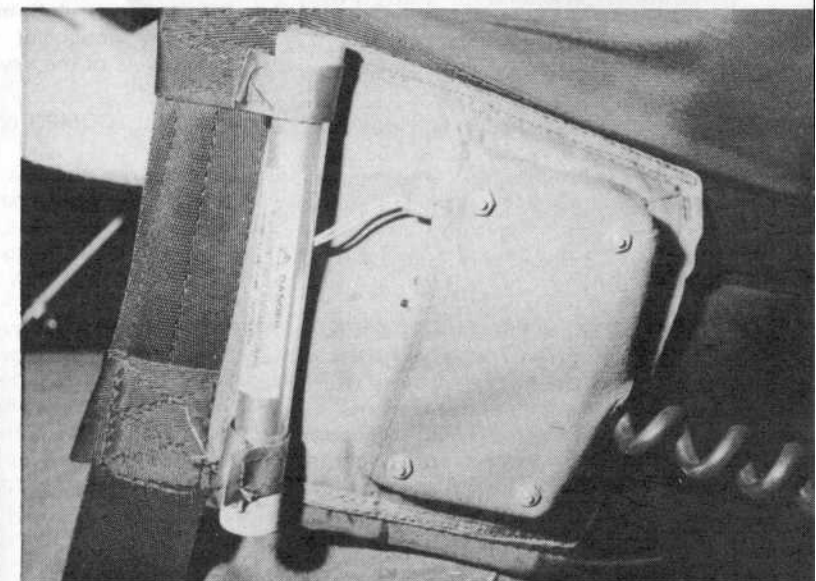
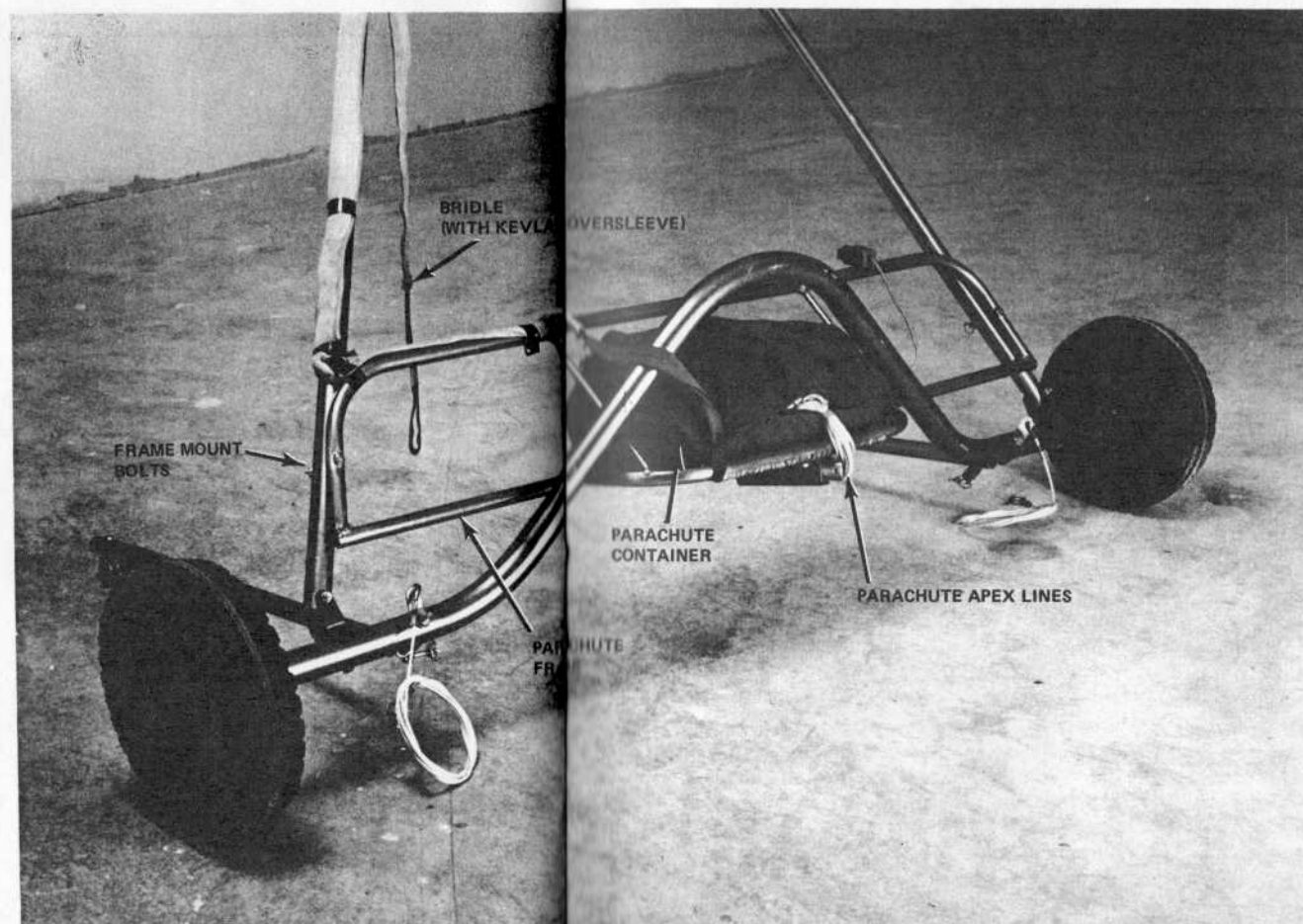
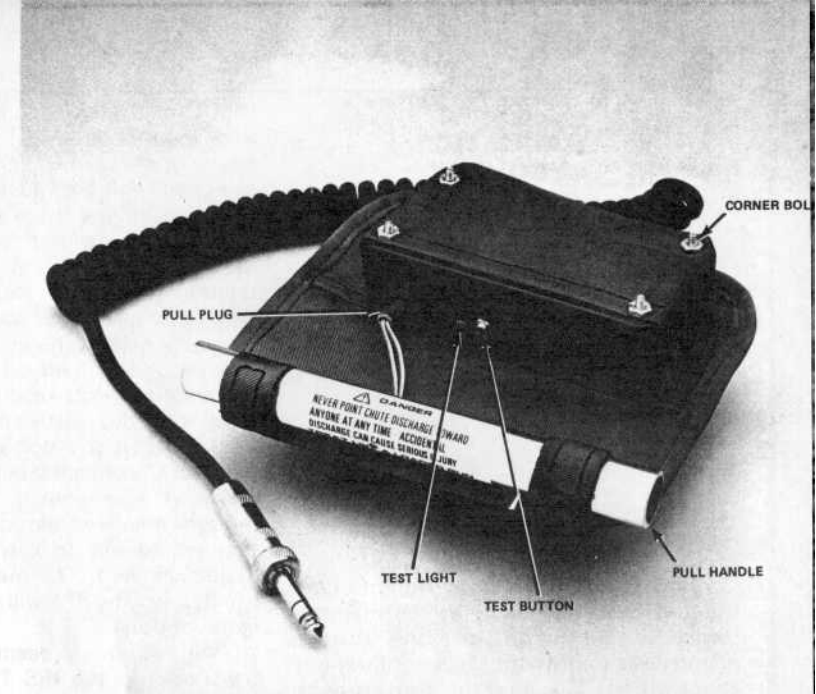
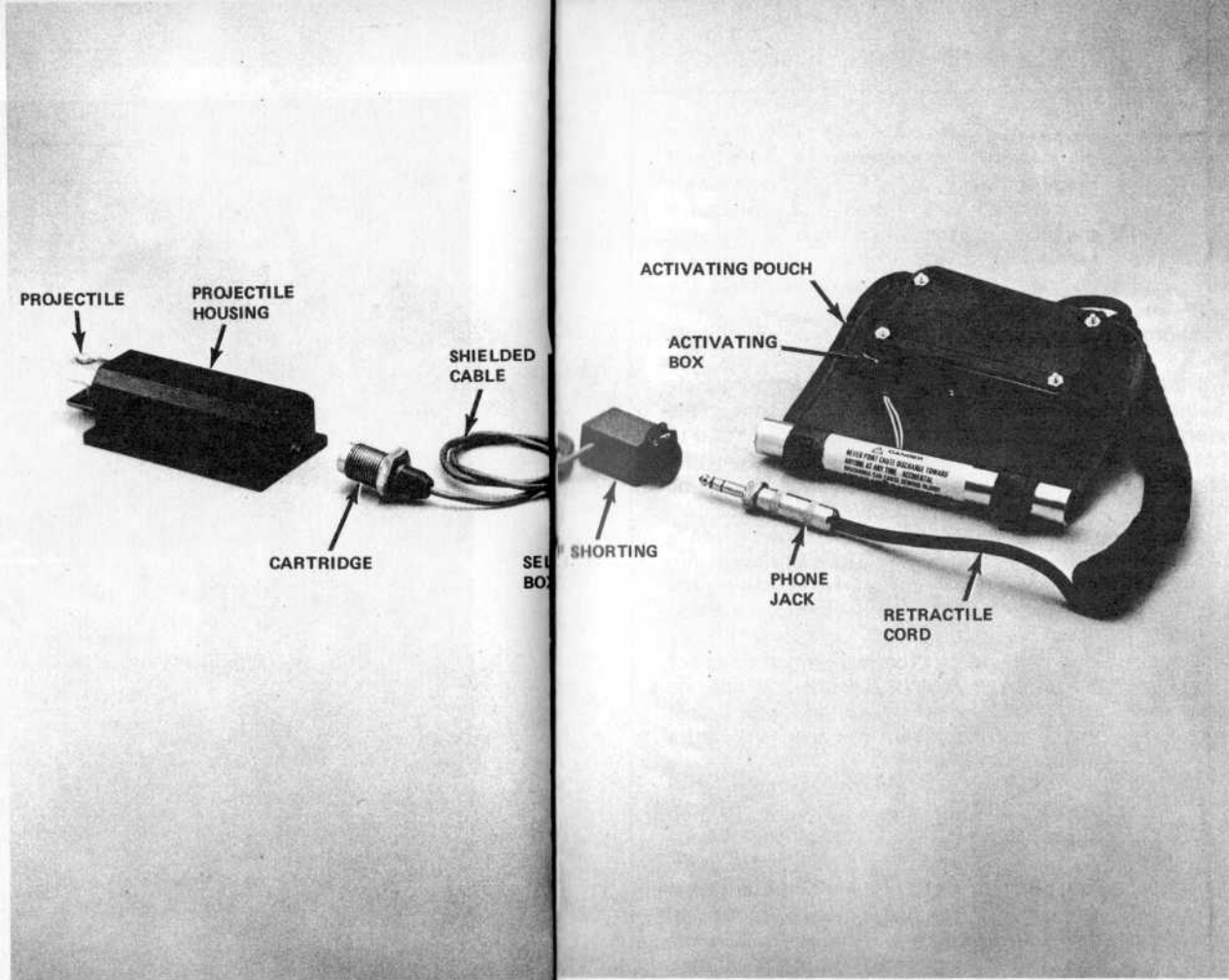
Whole Air first began surveys aimed at defining the growth in parachute acceptance in November/December 1978. Then, 35½% had realized the value of a back up system. The first commercial offering was from Bill Bennett, and many so-called recreational pilots shunned the need to wear a chute. Or at least they resisted the cost of an "accessory" which most thought they had no intention of using. More of them, 39% to be exact, preferred a variometer to help them up over a \$350 device to get them down. Not so unusual, for at least they could use the vario. The chute was never even seen, at least till the very-recent real deployment seminars began. But times have changed. Whether peer pressure, common

sense, a survival instinct, or the insistence of loved ones were the reasons, the fact remains that later estimates illustrate that chute sales penetrated over 70% of the pilot community. Perhaps coincidentally, perhaps not, the 1981 fatalities reached a new low.

Now the picture develops further, however. Ballistics have arrived. The first such system available for purchase is presented by Ballistic Recovery Systems, Inc., of St. Paul, Minnesota.

At \$690, some will defer to continued use of their hand deployed system. And for many, this is adequate. But on ultralights, or those recognizing the newly available ultra-fast deployment, ballistics are heaven-sent, thanks to BRS, Inc. Here's another important consideration. If you are one of the many now using a hand deployed device, you can move up to ballistics at sharply reduced cost, \$490. Is it worth it?

Next time you are scratching low...or just above a ridge in crowded soaring...or test piloting...or motoring about at 2-300 feet...or just in case, God forbid, you should ever need that chute *under* the claimed 200 foot minimum deployment height (hand deploy), think about less than five hundred bucks to get the most rapid life saving deployment.



Clockwise from top left: (Figure 3) Complete control/projectile assembly; (Figure 1) Activating unit; (Figure 2) Installed activating unit; (Figure 5) Ballistic device body and projectile; (Figure 6) Parachute and support frame, ready for use.

TYPICAL INSTALLATION ON QUICKSILVER LANDING GEAR

BALLISTIC RECOVERY SYSTEMS

the foremost
in 1982 parachute
technology

HISTORY

BRS, Inc is directed by Boris Popov. Boris is known to many as the majority owner of Northern Sun, one of the country's leading hang gliding/ultralight shops. He has also marketed zero porosity fabrics for Easy Riser builders (and other doped wing aircraft), and more recently, he debuted a landing gear snow ski line (for ultralights) called Snow Skys®.

All the while these enterprises have begun and flourished, Boris has been actively developing the first ballistic recovery system to be marketed to the sport aviation community. It has been an elusive goal absorbing the energies of Popov and many advisors or assistants for the past seven years.

Boris had a structural failure way back when a few current designers were so young they could hardly spell the words "structural integrity" or "deployment."

But the 1975 accident did not involve a deployment, as no back up parachutes existed to deploy. The water impact which probably spared his life was so rude that it knocked fillings right out of his teeth. Ever wonder why certain people are motivated? This was Boris' reason.

From ground zero to a marketed, patented contraption now simply known as "the BRS" claimed many months spent in planning, prototype building, testing, failure, re-designing, re-checking, re-testing, new failure, more work, checking, testing, and marginal success. All efforts ploddingly approached the goal of today's finalized system. The culmination of these tests brought Popov to consult with and subsequently retain Rob Kells, well known pilot, president of Wills Wing.

Rob made two deployments from a flex wing hang glider, both very successful and another from a Quicksilver MX. That deployment was proficient enough to really impress Eipper Vice President, John Lasko, who had loaned the MX. However, a failed release system held Kells and MX to the chute unwillingly and the pilot and craft were dumped into Lake Elsinore. Fortunately, no injury to Kells and the MX was recovered with no damages whatsoever. Many other tests from the ground have truly verified the reliability of the system.

One extremely important point needs

to be mentioned here. The frame supports for mounting the chute have been designed, wherever possible, to permit the pilot to reach the chute apex (by which it is drawn out via the projectile till full deployment occurs). Why? So that in the unlikely event the electronic actuation fails, the pilot may reach behind and manually deploy the chute. It is a mighty nice secondary back-up.

A lot of pilots reading the BRS ad or discussing the relative merits of ballistics agree that it is so much faster a system that the extra sophistication and cost still makes it a reasonable trade-out. Many though, have expressed the opinion that they would like to carry a hand deploy system as well. The manual deployment capability of the BRS will save these pilots a fistful of dollars.

All this would seem to invite further description of the BRS. The following is no substitute for carefully examining the BRS Owner's Manual, but will present the fundamentals of the new device.

COMPONENTS

Of course, the heart of the BRS is a parachute. As yet no parachute has been designed solely for use with this ballistic device. While a specialized one seems inevitable, now you may choose a 24 or 26 foot model. Kevlar bridle sleeving is available at optional expense, and is stated to be mandatory for powered use, to help prevent damage from the engine/prop on an ultralight. After the chute and bridle, five components make up the BRS.

An Activating Unit consists of a fabric pouch, activating box, pull handle, coiled retractile cord, and male jack connector (see figure 1). A battery will further be needed.

On harness type aircraft, the pouch is sewn on the side of the harness, using only a machine which will sew securely enough to withstand a hard jerk (see figure 2). If the craft is a fixed seat ultralight, it is attached in a suitable position which may be reached by the pilot. In either case, the retractile cord should not be well-stretched.

The activating pouch has a test button with LED light to check the system. A five second push will discharge any residual voltage that may be present. This procedure should be done each time prior to connecting the activating unit to the self-shortening box.

When the entire system is connected, but before inserting the jack into the self-shortening box, you are again instructed to depress the test button which will illuminate the green LED light. This will accomplish three things. Firstly, it verifies battery charge. Secondly, it assures that all connections are in place. And thirdly, it assures that all circuitry (including the cartridge) has electrical continuity.

A push of this test button is done for another five seconds, while observing the

green light. If the light glows brightly, then dims slightly, the system is armed and ready. If the light does not glow or is barely visible, the battery needs to be replaced. If the problem persists, you must contact the factory for further advice.

Next among the components is the Cartridge Assembly (see figure 3). It consists of three parts, a cartridge or explosive charge, a six foot specially shielded cable, and a self-shortening female connector box. This represents the propulsion of the system. Once added to the ballistic device body (projectile) the device should be treated with the same respect accorded a loaded weapon.

The cartridge, which is not given a common "caliber" value, is screwed into the projectile housing after attaching the self-shortening box to the frame. This box must be attached by nylon ties or hose clamps or some other way which does not penetrate the box (see figure 6). Under no conditions would you tamper with any of the circuitry, as this may cause premature firing.

After the cartridge, chute, and activating unit, you are ready to add another component, the Ballistic Device Body (see figure 5). This part has four units, the body or housing, the projectile, the shear pin, and the bolts plus neoprene pad needed to attach it. The projectile is the work horse which will leap out like a bullet, yanking the chute's apex, then trailing the chute, shroud lines, and bridle behind it, till line stretch occurs.

The last component is the mounting frame for the parachute. This is merely a light weight support to hold the chute in a position from which it may be correctly fired. Different frames are available for different ultralights and gliders. If on an ultralight, the mounting place must assure the projectile does not fire through the propeller.

Once bolted on, the bridle should be routed, secured at intervals by tape or velcro in a way that will permit at least marginal control of the (possibly damaged) aircraft, and in a way that has the landing gear (ultralight) or control bar (hang glider) striking the ground first. Of course, do not have the bridle lying on the hot exhaust or running across sharp objects. Whatever routing method, it is imperative that the pilot be directly connected to the chute.

Again, it should be emphasized that the Owner's Manual must be followed meticulously, and great care be exercised with what could also become a lethal instrument. Surely a life saving system should not endanger anyone.

Really it is a simple enough system. Some may think, as always seems to be the case, that they could have done it themselves. But Boris and his help did do it, and that is all the difference that must be stated. In the mature and thoughtful pursuit of your sport of flying, you are strongly encouraged by this writer to obtain information on the BRS ... today!

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SUN 'N' FUN

More than just a pretty face, the EAA's Eighth Annual Lakeland Fly-in displayed a lot of hard work since Oshkosh 81/by Dan Johnson/photos by Doug Barnette

At major fly-ins, especially where new equipment makes its debut, it is always fun to try to select which model will afterwards be considered the "darling of the show." A major challenge at EAA's 1982 Sun 'N Fun Fly-in was deciding whether the "darling" model would be aircraft or human.

The girls of Sun 'N Fun could easily have been a focal point in 1982, as several manufacturers (Mirage, Rotec, Weedhopper, Eipper, Flight Designs, among others) made sure their literature was well distributed by employing very attractive models (the flesh and bones type) to talk about their other models (the dacron and aluminum type). As this writer observes fly-ins, the method was a First for ultralight air shows, and surely made touring all the hardware more pleasant, considering such eye-catching "software" existed.

But while listening to the pilots buzz all week long, it seems the most salient impressions were made by the Cub-like CGS Hawk, the nicely finished Ultralight Flight Phantom, Eipper's Amphibious Quicksilver MX (retractable), the newly released Swallow, the rakish Flight Designs 440ST, the American Aerolights Simulator Eagle, and the appearance of a fleet of trikes (Bennett X Gliders and Flight Designs Jet Wings).

This leaves out a lot of hard work by several other companies, like McCornack's clipped wing, composite-podded Ptiger, the improved Vector 610, American Aerolight's smooth Falcon (which flew briefly), Gemini's almost enclosed Hummingbird, the superbly finished Kondor, Starflight's debut of two models, the introduction of Robertson Aircraft's B1-RD, a veritable gaggle of Goldwings, plus two-seaters from Eipper, Rotec, and Wizard.

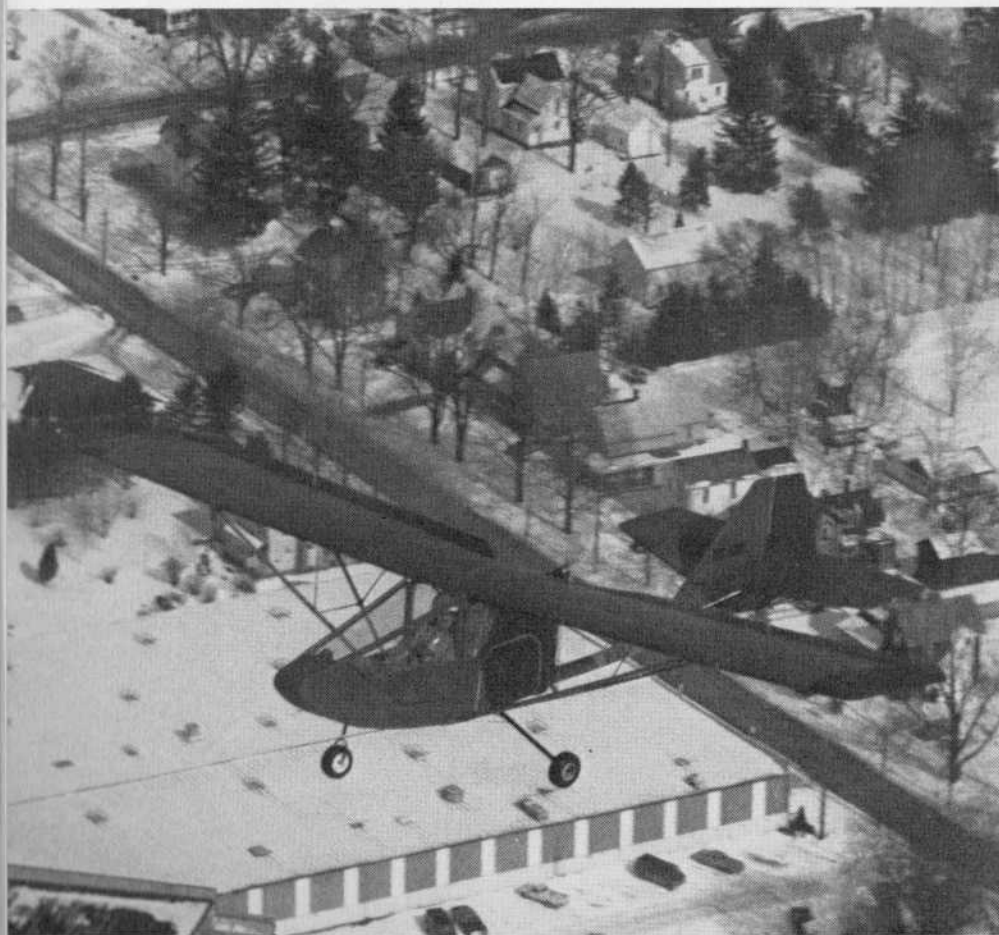
In the aftermarket area, the Ultralight Accessories Sky Stobes could be seen everywhere, and several of their high quality FM radio sets were in regular use. Floats were everywhere, too; representing mostly the same names as in the past, but with further refinements. Also, one could find props for water use ("metalized" leading edge tips), wheel pants, training booklets/programs, wing covers, several engine-only suppliers, and on, ad infinitum.





Above: Flight Designs gave first showing to their three axis ultralight, the 440ST, with ballistic parachute.

Below: Chuck Slusarczyk's "little airplane," the Hawk drew crowds all week long. Its price tag? Only \$4895.



One of the most significant aftermarket (or OEM) items to be shown at Sun 'N Fun was the ballistic parachute system offered by Pioneer Parachutes. This world leader in sport and military recovery systems debuted their mortar propelled pyrotechnic device via their subsidiary, Flight Designs.

The cannon-like ejector was concealed by a fairing on Flight Design's new 440ST, and almost instantly deploys a 29 foot diameter parachute capable of recovering craft and pilot even assuming zero drag from the aircraft. The canopy is packed into a cylindrical shape some 15 inches long and six inches in diameter. This is achieved with a machine packing system using 15 tons of pressure, then heat (200°F for 12 hours) after which more pressure can be used to load the cylinder to 20 tons! The packed container is as hard as a chunk of wood, yet has a "shelf life" of 5 years before a general re-pack is required. No firm price was quoted, but company officials *did* indicate that it will be made available to other manufacturers as well.

Air show announcer, Roscoe Turner, with whom this writer had the opportunity to co-announce daily, told the relatively small public turnout that "over 500 ultralights were registered by Friday (the 19th)..." This compares with under 200 at Oshkosh '81, and 104 at Sun 'N Fun '81. The awesome enlargement of the ultralight sector caused some long-time EAA'ers to bemoan the "overtaking" of the airshow, while ultralight enthusiasts speculated on the presence of 1,000 plus units at Oshkosh 1982! Most attendees doubted the official estimates, though, and many felt 300-400 was tops. Even so, the invasion was certainly evident, and one observer allegedly counted 144 craft all airborne in the too-small, too-low, too-wide-a-speed-differential pattern which most flew.

Excursions were made all over the neighboring countryside though, as pilots were allowed to depart the pattern, an escape most felt was more sane and a lot less dangerous than hanging around the pattern. One restaurant, Raffles, got inundated around lunch-time, due to the presence of a briar-ridden but otherwise acceptable field adjacent to the dining spot. Certainly passers-by were given an unusual sight as Raffles' parking lot got filled with colorful ultralights which taxied in from the nearby landing field.

The daily two hour long airshow had six slots of ultralight demonstrations, though they could not be put through any spectacular flights as rules were imposed in the interest of safety. The EAA still knows little about ultralight capability, and wishes to show only the fun side of this form of aviation, at least until ultralights further prove their aerobatic or formation flying activities. Participants were limited to 60° of bank, 30° of pitch, and had to remain separated one from another by 500 feet in all directions. Restricting the time slot for

each model to five minutes was actually a beneficial decision as the nonaerobatic (or otherwise conventional) routines only held general interest for short periods.

Trikes, as they are generically called, made their first appearance in a major EAA air show, demonstrating with some of aviation's best known performers. The three Flight Designs Jet Wings, flown by Steve Brockman, Jean Michel Bernasconi, and Doug Barnette, did a very enlightening routine not only proving the substantial climb and maneuvering capabilities of the machine, but more importantly (to *Whole Air* readers) illustrating the engine-off soaring potential of this type of ultralight. On one flight, pilot Doug Barnette, whose engine was fully stopped, had difficulty getting down within the five minute slot as runway-generated thermals tried to buoy him up in spite of steep turns and a low angle of attack attitude. Another attitude, this one human, was also evident as several manufacturers were dismayed by the entrance of the likes of Chuck Slusarczyk's new Hawk, which is most assuredly not foot-launchable. It has so complete an enclosure that the pilot cannot touch the ground.

However, the public's reaction was a kind of "love at first sight" proposition, it appeared, and the little blue airplane had a crowd around it almost all the time. In flight, it slipped through the sky 10-30 miles an hour faster than nearly all others (Goldwings excepted) while exhibiting smooth control.

The FAA, however, finally required CGS to place N-numbers on the craft, correctly so, as the current law is still "foot-launchable." The General Aviation District Office (GADO) in Ohio, where CGS Aviation is based, had approved the Experimental classification, but held off issuing the numbers themselves as the proximity of the NPRM seems imminent. The Hawk *does* weigh in under the 220 pound limit which most expect to become the new definition of ultralight aircraft.

As if in final salute, Marty Alameda's Jet Wings flew all week long in the daily parade of ultralights.

As with the tragic loss of Weedhopper's John Chotia, Sun 'N Fun '82 missed another well-known name, Marty Alameda, also lost in a test piloting accident, as he prepared his company (Flight Designs) for its first real entrance to the world of ultralights.

Marty would have tremendously enjoyed the public's response to his Jet Wings and the piercingly thoughtful inspections given the firm's new three axis machine, the 440ST. His laudable hang gliding achievements brought Flight Designs from a humble beginning in June



1978 to international prominence by 1981.

This energy and success coupled to the recent merger with Pioneer Parachutes looks to catapult Alameda's company to a leader position in ultralights as well. It is indeed a shame that Marty will not have the opportunity to affect and witness this metamorphosis. But his personally chosen cadre are more determined than ever to fight the good battle in his spirit.

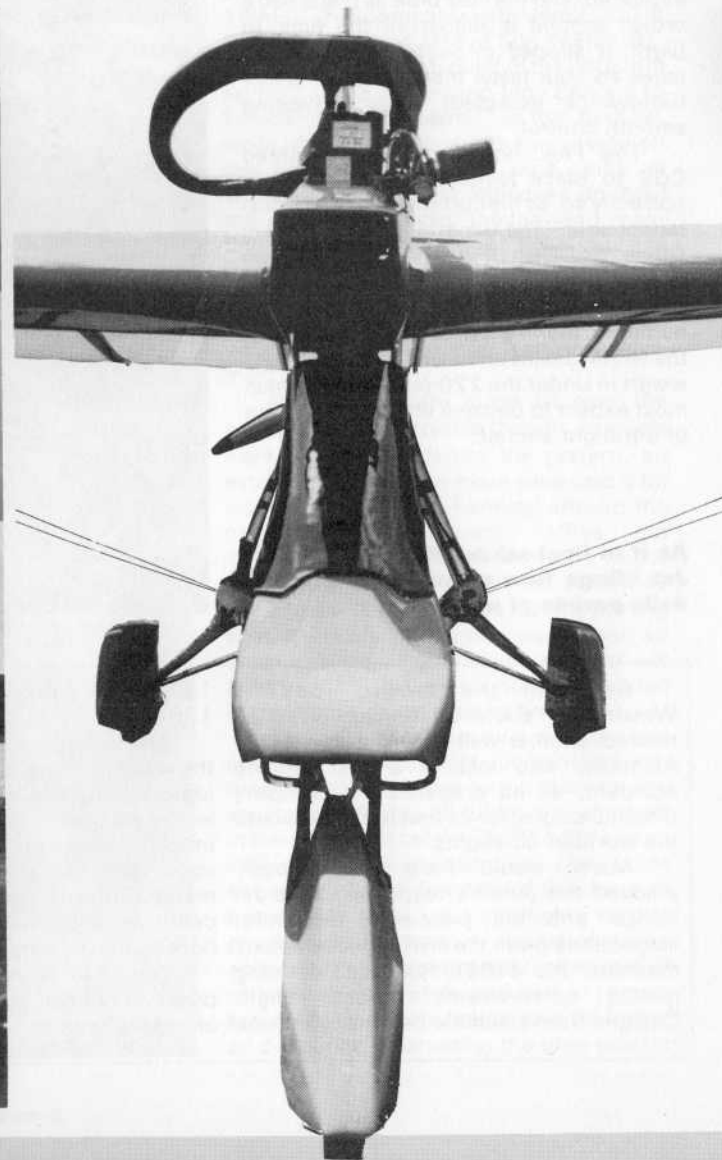
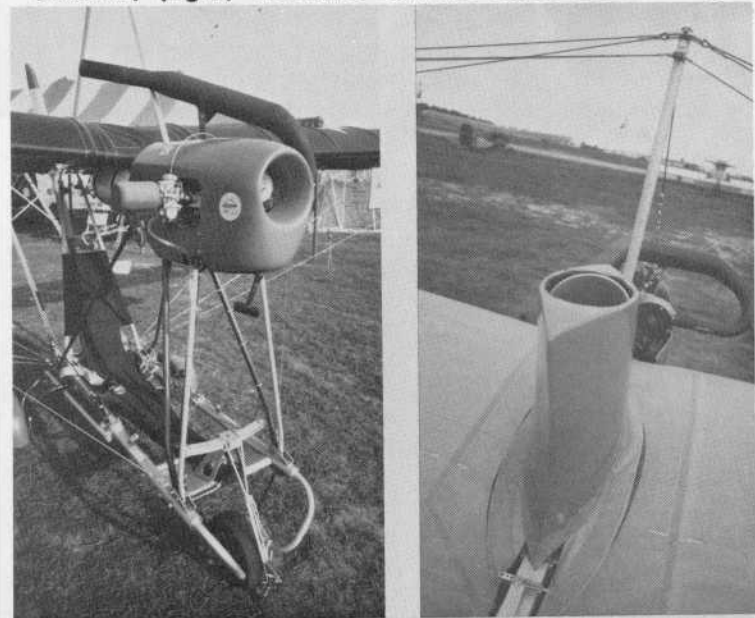
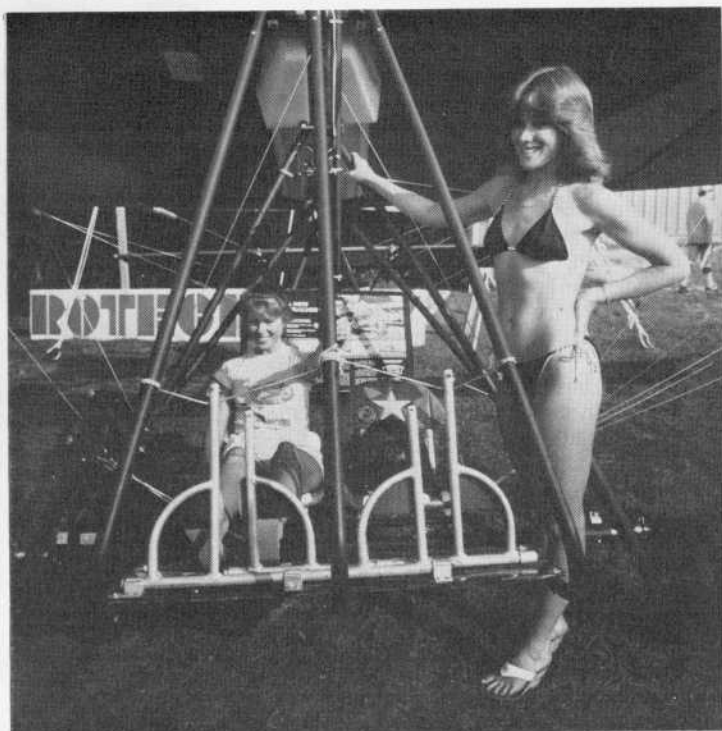
The Manchester-based design team privately dubbed the "ST" part of the new ultralight's name as, "Super... Terrific."

words often used by the optimistic Alameda. It is likely Marty would have chosen these words about Sun 'N Fun '82, as a great new season dawns on the youngest form of sport flying.

While all the hang glider community misses Marty's dynamic efforts and personal warmth, the thermals continue to form, uninterrupted by the events, victories, or tragedies of mankind. So goes ultralight flight in the '80's, powered or unpowered. Let us all make a firm resolution for safer flying, and enjoy the exciting months and years ahead.



Only the "fair" are not faired in this photo collage. Clockwise from above: the Robertson B1-RD; Rotec's 2-seater; Flight Designs' 440ST; McCornack's Ptiger; (left) the Swallow; (right) Pioneer's ballistic chute with fairing.



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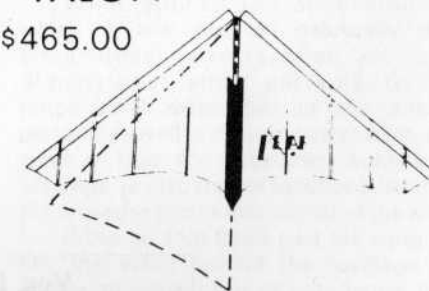
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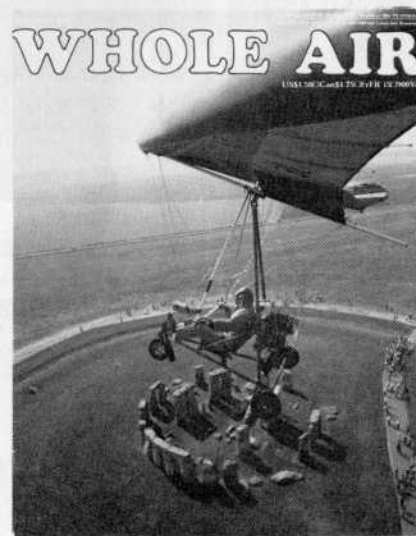
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WING TIP DISTURBANCES

Wing Tip Disturbances/Problems, Solutions, and Theories by
Richard Miller

[The first part of Miller's essay on wing tip disturbances appeared in the March/April 1982 *Whole Air*. This concludes the article.]

The Eagle aircraft, a high aspect ratio agricultural biplane manufactured by Bellanca, has negatively raked tips of a more extended form. Neither reference (*Flying* for September 1979, p. 38; *Aviation Week* for June 30, 1980, p. 80), however, provides performance results not design rationale.

The particular combination of physical characteristics that contribute to the flow around the extremity of a flying surface — the three-dimensional nature of lift and the attendant mathematical powers — seem almost deliberately contrived to discharge the maximum possible amount of energy into the atmosphere. The very same characteristics, however, provide a means for attacking the problems they create. The key to this process is linear division, and it can be expressed mathematically by stating that two square 2's equal half of one squared 4. In other words, if you break a linear dimension ruled by a square power, the reduction in total area enclosed by the squares will vary directly with the number of divisions: $4^2(X1)=16$; $2^2(X2)=8$; $1^2(X4)=4$.

Although the technique of linear division can be employed spanwise — in diffuser breaks and vortex gates — as well as chordwise, its most evident application is in the branched primaries of the land soaring birds such as the hawk and the eagle. Each branching, however, results in a notch between the two elements, and the losses due to the turbulence caused by these notches must be balanced against the gains derived from breaking up the chord dimension.

A further degree of diffusion is achieved by distributing the resultant discharge points (the tips of the feathers and the notches) three-dimensionally in a manner that tends to isolate each wake. The result is an optimum number of discharge points arranged, consonant with the other functions of the wing, in the most diffuse manner possible. In his work "On the Thermal Soaring of Birds," Clarence Cone relates how he probed behind a vulture's wing tip (it was mounted in a wind tunnel) with a fine wire and thread and was unable to find any marked vorticity. Manipulating the feathers caused areas of turbulence to appear in the wake of the wing.

Mr. John Spillman, senior lecturer in aerodynamics at Britain's Cranfield Institute of Technology, has successfully adapted the principle of the bird's braced primaries to full-scale aircraft. (See "Wingtip sails" by David Scott, *Popular Science*, April, 1979, p. 68. Also see *Popular Mechanics* for December, 1978, p. 69.) His initial experiment was with a single vane, or sail, with a span equal to about one-half that of the tip chord. This resulted in a 10% reduction in losses due to tip flow. Subsequent tests with three sails raised this figure to 29%. Tests on full-scale aircraft gave a 21% increase in overall L/D ratio. The Spillman sails are mounted radially on the tip, in a sense contrary to the tip flow, and in echelon. Radial spacing is 15 degrees. Sail span is about 25% of the chord dimension.

In its spanwise mode the process of linear division does not break down with the same geometric simplicity as it does in the case of the branched primaries of the hawk. Nonetheless, the root technique is the same and there is an identifiable primary unit, the diffuser panel, that corresponds to the tip feather. This panel, a segment of the outer wing with a reduced angle of attack, acts as a transition surface between the wing, with its full increment of lift, and the uncharged air outboard of the tip.

(The simplest way to form such a panel is by folding a portion of the wing extremity downward on a line with negative rake. A little snipping and folding with some paper or light card stock is perhaps the easiest way to get a grasp of the diffuser-tip configuration. Also, see *Soaring* for April, 1972, p. 30)

The diffuser fold, of course, makes waves, but with two discharge points instead of one, the panel provides a net gain. This is due, first, to the decrease in lift coefficient which, were it reduced to half its initial value in a given case, would cut the volume of tip flow by three-quarters, and in part to whatever reduction in chord, with its square power, results from angling the leading edge back at the junction of the wing and the tip. This increase in leading edge sweep, or rake, and of taper ratio is advantageous from a number of points of view, one of which we have already examined. Another is the advisability of making the diffuser panel as small as practical because it contributes less per unit area to the total lift of the wing — part of its notch, so to speak. The

standard objection to this sort of treatment, that excessive taper or sweep tends, effectively, to wash in the area near the tip, is offset by the actual washout.

The tangent of the rake angle times the tangent of the fold angle gives the tangent of the diffuser angle, or the difference in angle-of-attack between the wing and the diffuser panel. Thus a diffuser panel formed by a rake angle of 11 degrees and a fold angle of 15 degrees would have three degrees less angle-of-attack than the wing proper. Additional combinations: $13/17=4^\circ$; $15/18=5^\circ$; and $15/21=6^\circ$. These are not given as recommendations, simply as examples.

In 1950, Charles Holbrook tested a single-fold diffuser-tip model in the wind tunnel at Mississippi State University as part of a search for a suitable flying-wing design. Due to the small size of the model (span 31 inches) and the low aspect ratio (5.5:1) Holbrook anticipated a glide ratio of between 8 and 10:1 and a maximum lift coefficient of about 0.85. The actual L/D was 13.9 and the CL 1.04. Holbrook concluded that the unexpected gain in performance "... appears as reduced induced drag (and) was probable caused by some action of the diffuser tips."

The closing of streamlines behind a low-drag body can be considered as marking a theoretical neutral point which divides the structure from its wake, or a point of tangency between ideal aerodynamics and the ideal of a freestream flow in which velocities and pressures have been restored to their normal values. It is, at best, a kind of deal which permits the smallest possible transmission of turbulence to the wake, and whose efficacy is dependent on the systematic reduction of the physical dimensions and functional forces at the aircraft extremities to their smallest practical values.

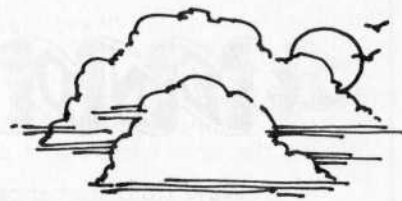
What applies two-dimensionally, which is the way we habitually view streamlines, also applies in three dimensions; what pertains to the longitudinal extremities of the aircraft pertains as well to its lateral extremities; and what is true for structures, such as a fuselage, is also true of functions, such as the pressure forces that surround the wing. If the air that flows past the wing tip, like the wake behind the fuselage, is, ideally, to remain free of turbulence, then there must be a corresponding neutral point marked by a similar closing of streamlines and restoration of velocities and pressures.

This is precisely the aim of the process of linear division. In the instance of the hawk's wing the initial stage in this process is the division of the tip into a number of miniature wings, the branched primaries. Each of these unloads, or washes out towards its extremity as a consequence of the pressure forces acting on it falling in a precise pattern to the rear of the flexural axis. The final contact

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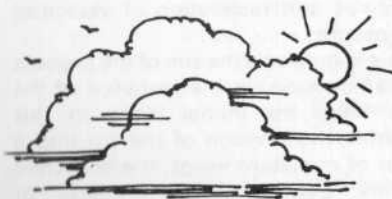
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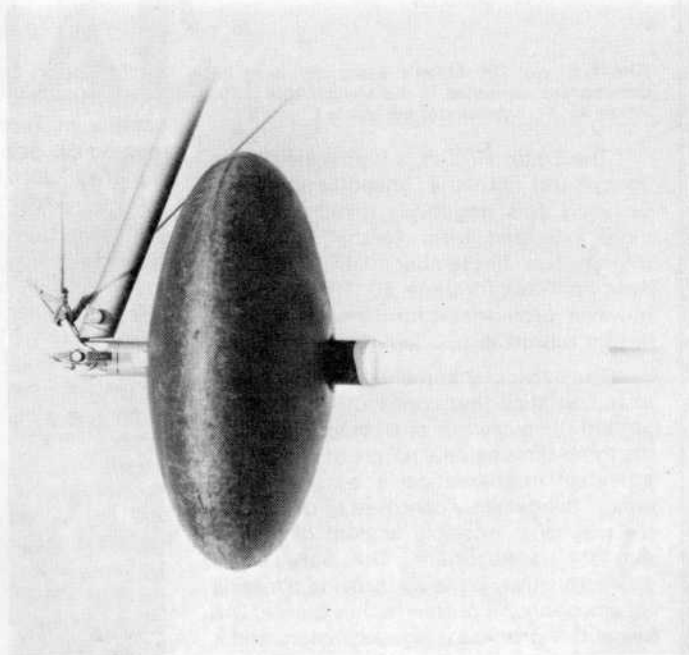
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between the wing and the passing flow are half a dozen points, scarcely more than a fluff, which yield freely, leaving inappreciable traces in the wind.

The continuously-variable diffuser tip reaches the same goal in, as it were, an inverse sense to that of the feather. Given the function of the single diffuser panel and the three angular relationships that regulate its form — those of rake, fold and sweep — the reader can begin multiplying elements in his mind's eye. Not many additions are necessary before the reduction of the angles begin to dissolve into infinitesimals and straight lines are replaced by curves. All the physical characteristics of the wing that contribute to lift, and the lift pressures themselves, diminish toward and finally disappear into the common point of zero size and force that ends the wing.

The several means we have examined whereby wing efficiency can be improved lend themselves with greater or lesser practicality to use in full-scale aircraft. The continuously-variable diffuser tip, our somewhat arbitrary choice as the ideal configuration, requires continuously variable structural elements and is not the sort of thing you can knock together in a weekend. Any sort of diffuser tip has the additional disadvantage, at least in the short term, of affecting such factors as new dihedral and mean angle-of-attack, so that to properly integrate it into a wing may well require starting not only with a clean sheet of paper, but with some fairly reliable information about specific aerodynamic properties.

Simply raking the tip is probably the modification that offers the most for the least. It is possible to approximate an elliptical form with a few straight lines and the construction (or retrofitting) problems involved are relatively simple. A Best Buy.

Wing-tip vanes lie in the middle ground between the special problems presented by diffuser tips and the easy gains possible with a rakes planform. The ease with which vanes can be fabricated from composites (foam and glass, for example) and patched onto existing wings, and the possibility of testing new configurations against a proven one using the tip-v-tip method, make them particularly attractive.

Finally we come, almost serendipitously, to a composite of all the elements we have so far examined: to a raked tip we add what may be viewed either as a radially mounted set of downward canted vanes or as a diffuser panel split into chordwise segments, each of which has a greater fold angle than the one ahead of it. How fortuitously they all come together!

There is first the advantage of raking the tip; then the lateral spreading of the notches between the vanes, which reduces mutual interference; next, the tendency of each vane to act as a kind of alula, concentrating the flow in the area behind it; and finally the wash-out effect resulting

from the progression, front to back, of the diffuser angles of the respective vanes.

As the confluence of three distinct pressure systems the wing tip is functionally unique. It is unique in another way as well, for no other part of the aircraft provides such an extraordinary potential for dissipating large amounts of energy into the atmosphere if proper attention is not given to its design. Nowhere else does a little carelessness yield such spectacular results. In spite of the very high aspect ratios and correspondingly small chord dimensions of contemporary sailplanes, as much as two-thirds of the total aircraft drag at low airspeeds may result from uncontrolled flow at the ends of the wings.

The wing tip has not received the care it deserves. Quite the contrary in fact; while areas inconsequential by comparison have been worked over time and time again, the end of the wing has simply been left, so to speak, hanging in the wind. Whether this is seen as another instance of that pervading perversity that makes toast fall jell side down, and dropped objects roll into inaccessible corners, or simply normal operating procedure — if not both — will depend on the refractive distortion in the perceptions of the beholder.

What is comforting, if one is disposed to view matters optimistically, is the knowledge of the power of imagination and perseverance, once they are brought to bear on a problem, to wear away at the incrustations of our ignorance and preconceptions until, from the mists, our ideal lies actualized before us.

The sailplane, which is the focal point of our common experience as soaring pilots, is testimony to these very processes, desire made tangible through vision and a tradition of unremitting work and patience, a kind of collective mistress conjured out of the longings we have to possess her and our willingness to pay whatever price is required. The result is something to marvel at, although we are perhaps too close at times, inured by our familiarity, to see what a beauty she has become. And that beauty is almost incidental to the qualities it expresses, the responsiveness and the tractability, and with these a certain high solitary splendor with which she matches our aspirations. And yet for all this, her grace, her lively turns, her fleet runs, all these enchantments it would be churlish to deny, one longs to see her dance without the army boots.

The archetypal aircraft, that abstract composite which is the product of a century of passion and vision, of ambition and industry, of ceaseless reworking and refinement, is incomplete. It leaks at the extremities of its flying surfaces.

Despite the labors of generations of men dedicated to the pursuit of perfection; despite theorizing, the measuring, the testing, the ever-closer approximation to ideals; despite the engineering methodologies, the research techniques, the revolutions in data acquisition and

processing; despite the high-tech SpaceAge razzle-dazzle and the prodigies of speed and size, or range and power that have been achieved, the archetypal aircraft remains incomplete. It leaks at the extremities of its flying surfaces.

Despite the fact that wing-tip vortices are symptomatic of precisely the sort of conditions the aerodynamicist is generally most at pains to try to eliminate, and despite the coincidence of these symptoms with those area of the glider known to make the greatest contribution to drag; despite the flagrantly flexible physics, the inconsistencies, the illogic and incongruity of the theory which is accepted as an explanation for the three-dimensional flow around the wing, and despite the variety of anomalous data points hinting at the inadequacy of that theory; and despite the patent examples of the wings of our avowed models, the soaring birds, there has persisted an inexplicable and obdurate resistance to the acknowledgement of the fact that the aircraft leaks at the extremities of its flying surfaces.

Very curious indeed.

(This article is) an abbreviation of a far greater and more detailed quantity of material on the subject of the wing tip and its function. In making the abridgement it has been necessary to sacrifice many of the usual examples, amplifications and specifics and the multitude of qualifications by means of which an author attempts to avoid inaccuracy and equivocation.

The reader is asked to make appropriate allowances; when in doubt, to make simplifying assumptions — that, for example, a wing is rectangular in planform unless there is reason to believe otherwise; to devise specifics when they are lacking; and to expend whatever extra effort is required to understand what is written if the meaning is not immediately clear.

I would prefer to be excused from being asked to make any specific recommendations for the application of any specific modifications to any specific airplane, or from being drawn into involved correspondence on theoretical issues. The first is a matter for the individual, his common sense, and the wing-root bending moment; the second is of very low priority. What matters is what works.

I would be happy to try to answer any reasonable question, however (please include a self-addressed, stamped envelope with your query), to serve as a contact person between individuals working along similar lines, to be informed of the existence of any corroborative material, or to listen to any serious criticism, providing that it is coherently stated.

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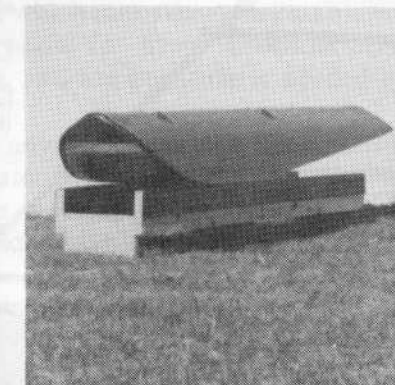
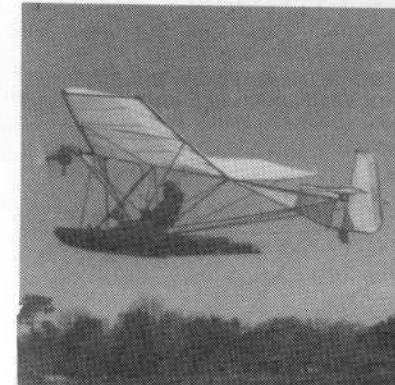
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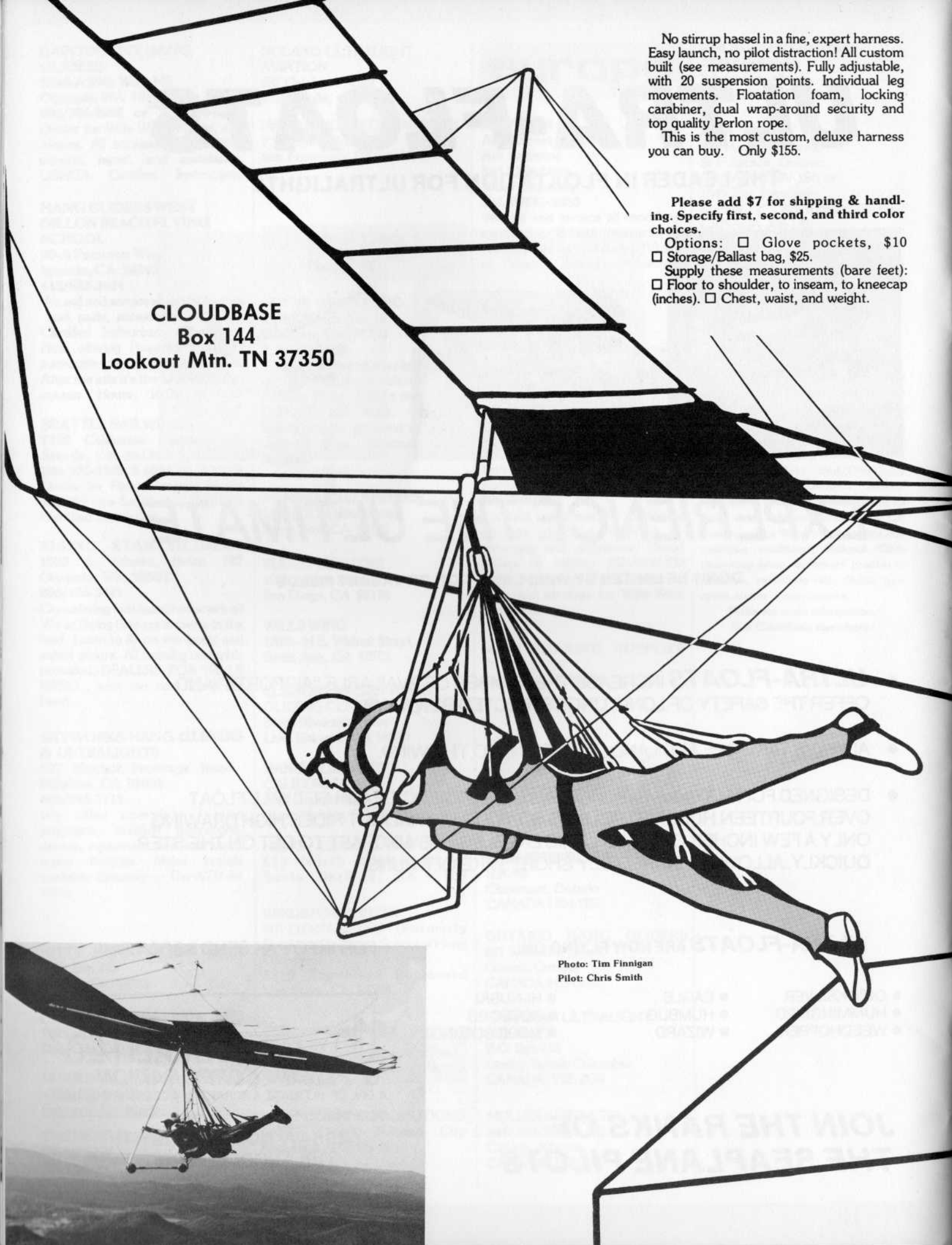
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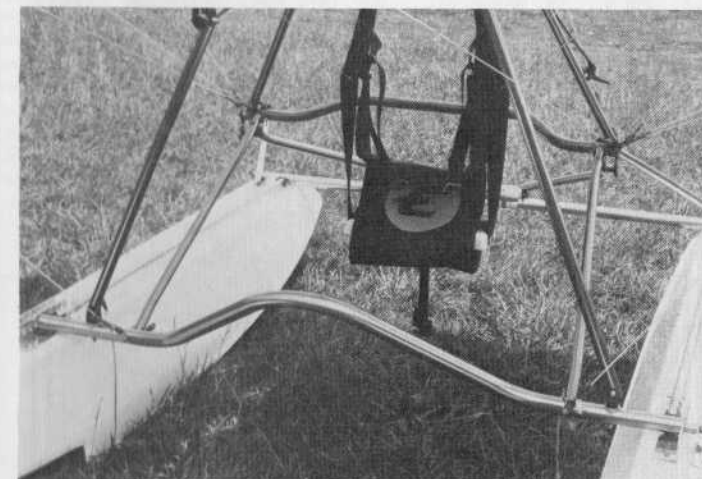
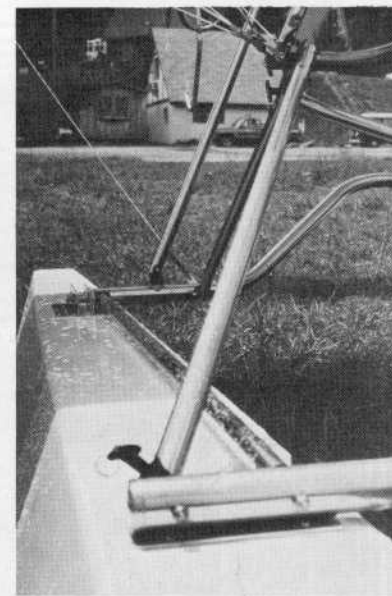
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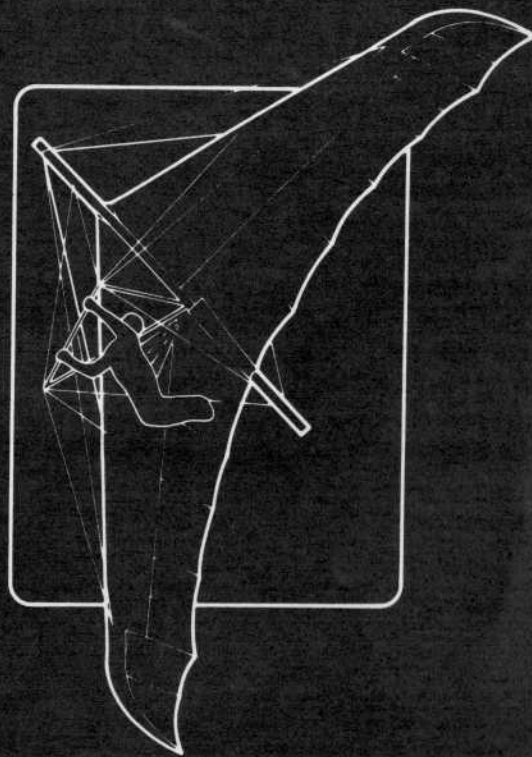
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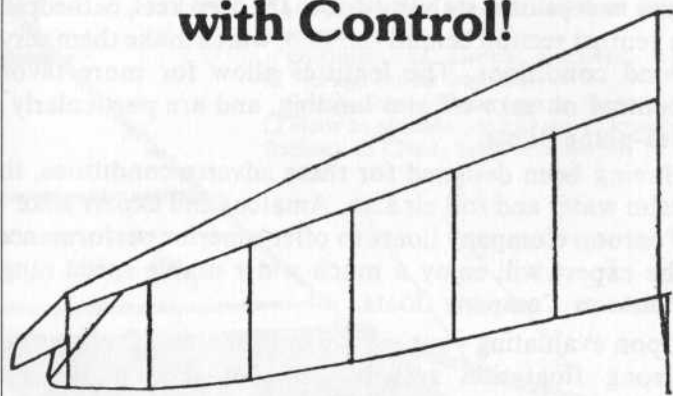
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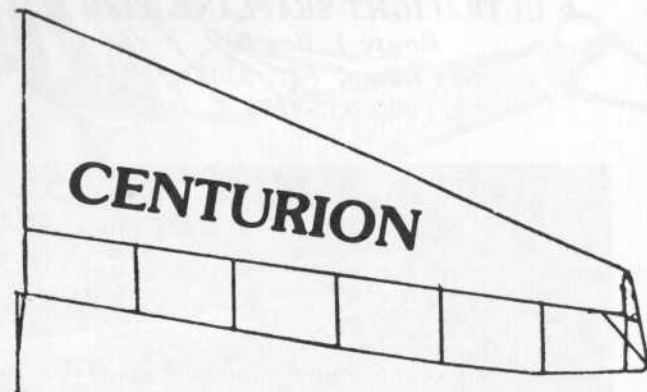
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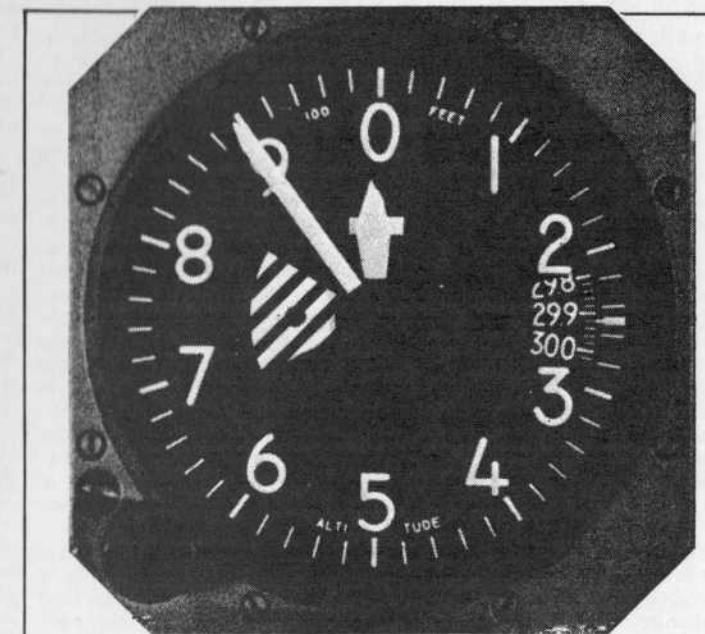
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PRODUCT LINES

CHATTANOOGA, TENN. — Tremors can be felt. The reverberations are emitted by noises of a new generation of gliders. Several manufacturers are putting out this new glider chatter. Bennett's crew is working hard; Flight Designs is actually due; as is UP (even with the success of the Comet). Names are being dropped here and there. The tremors can be felt. But the shockwave is generated by more than the advent of a new batch, or a new generation, of gliders. From our January visit to the coast and again more recently, the grapevine tells of a major new price hike. With at least one company, this is no rumor, yet perhaps others will indeed not follow. But it has been some time now since the over \$2000 (glider) door was approached and yet we never really broke that barrier. True, Seedwings is well above, at \$2195, but then the Sensor is a small-company, hand-crafted machine. And Moyes was at \$2195, but they were able and siezed the chance to roll back the price to just under Two Grand. (What think the early buyers of that...?) A year ago, Pete Brock had terrific momentum, and when the time came for his spring (1981) price hike, it was a mere dollar, thanks to a production flow that aided in keeping the lid on prices. Perhaps the fact that such a pivotal design like the Comet did not jump past \$2000 had great effect on others, who at first, had no performance capability like the Comet. Still, the Comet OVRs listed at \$2400 last year. The popular Comet 185 has been over \$2000 since its debut. The Fledge III sells at \$2500... and inflation grinds on. Possibly the day has come honestly for a general increase. After all, *Glider Rider* ads have tripled in price since fall of '81, *Hang Gliding* is up 36 percent, and *Whole Air* went through a 25% rate increase. The manufacturer must now pay considerably more to advertise, and that is just the tip of the rising cost iceberg. However, a gigantic wedge lies dormant, ready to wreak havoc with any such major price increase. It is the large, un-directed, un-organized market for USED GLIDERS. There are 2000 Comets out there and hundreds upon hundreds of Harriers, Demons, Megs, Sensors, and Vipers. And that is just 1981 models. Many 1980 and 1979 craft are still very worth buying in 1982. Used equipment receives no manufacturer advertising support; basically only classified advertising communicates the message nationally. That and the effort of dealers active in used sales. Just look at used car sales. Or better, look at used aircraft. In a time when a Cessna 152 (two-seater, trainer type plane) can sell at way over \$25,000, the market is brisk indeed for 10-year-old Cessna 150's (earlier model, very similar) at \$8-10,000. The analogy is simple enough. The total effect realized is a matter of speculation only, at this time. But wait. If that new, alleged increase comes... well? Turning to more hard news, we are saddened to report the loss of still another major figure in an ultralight accident. Marty Alameda died near the beginning of March, and now Steve McCarroll at the beginning of April. You may not instantly recognize that name, but on reflection, if you've been in the sport more than a year or so, you've surely seen some of his brilliant photographic work. His photos have also graced the covers of several *Psychology Today* issues and he has been published in *National Geographic* as well as several other high quality magazines. Steve was fatally injured while flying his Eipper DoubleQuick to a land sailer race which he was to photograph for *Windsport*. Details reported from a grief-stricken friend, Tom Peghiny, were very sketchy and we regret not being able to further unearth the obvious questions, but the issue went to print as information was becoming available. We've been saying what a tough year aviation in general has had in 1982. And so again we want to stress great care while flying! It can/does literally happen to the best among us. Please consider your limitations, the craft, weather, the site, and the many other variables involved before you commit aviation. Let us end these totally unnecessary losses. Always fly with a parachute, and be prepared (knowledgeable) to use it! Hang glider pilots have largely learned this lesson, the hard, tough way. Why does powered flight still lag so? Enough is enough, but do use caution. The Nationals is in trouble, too, sponsor-wise anyhow. Blue Stratos is out. Nope, it wasn't that they didn't feel good about hang gliding/ultralighting, but was simply the failure of the market place to accept the new fragrance line from the Old Spice folks. To get an idea about the money not being the problem, consider that the sum total of what Blue Stratos

spent on the Nat's was but one 30 second network TV spot in value. The effect of this tenth hour withdrawal is indecision about where to have the Nat's. Last year was west (Nevada), so this year should take it east. But the chosen eastern site is a place called Gunstock (New Hampshire). Though reported to be an excellent site, not much prior flying has been done. Two sites, wind direction alternates, it's said, are available. But due to the bucks shortage and experience shortage at the site, it is easier to agree with several west coast manufacturers, that Crestline should be used again (site of the 1979 Nat's). Seems these folks (including Bennett, Wills, UP, ProAir, and others no doubt) will help fund the thing, if at Crestline. And even though Gunstock took the majority vote at the USHGA Board of Directors meeting our only real choice could be to return to Crestline. Since we've got this whole column kinda upside-down anyway, let's mention a couple more calendar items, arriving too late to make page 10. First is Mike Robertson's "First Ten Years, Professional Development Seminar," at the time and place of Kitty Hawk Kites East's Instructor Certification Program, June 2-6, 1982. You are invited to contact Mark Airey of KHK-E for more information. Close by, starting Friday May 28, is the USHGA Region 9 Qualifier for the Nat's. To be flown at Hyner View, PA, you can get more poop by contacting Director, Les King, at Sport Flight (phone 301/840-9284). Rob Kells reports Wills is on top of demand for the new Harrier 2, as they've got 80 sails ready for final assembly. He also says they are right on time for quoted Duck delivery dates. Having lost the demand vs. production battle last year, Wills is going all out to assure no similar bottlenecks this year. Bennett's shop is humming along more than ever, with a backlog of orders for his new X-series. The team of West & England have gotten the ship flying very well (see Pilot Report, pgs. 28-35). Their trike has gone through some new developmental up-grading, too, and the one we flew at Lakeland performed great. That Fuji engine, so popular throughout the European trike scene, must climb 1200 fpm, easy. Speaking of trikes, Flight Designs' Jeff Skaggs, reports an active beginning to the '82 sales season for their Jet Wing, already approaching expectations for the entire year. The company is re-organizing itself following the stunning loss of leader, Marty Alameda, and while problems still exist (in filling Alameda's shoes), the engine of production rumbles along. ProAir is also busily trying to keep up with great demand for their line (now ProStars and Breezes added to the ProAir I). See the report on pg. 28 reviewing the ProStar. Dick Boone has also gotten a supply established for Handbury's "snap-opening" parachutes which are selling well. Bob Trampenau's Seedwings is also fighting to keep up. Sales remain "better than ever" for the long-time Santa Barbara manufacturer of the beautiful Sensor 510. They are still seeking useful employees, so if you've got a talent, give 'em a call. As we presented so much "news release" material on pages 12-19, we'll keep this column from being redundant by signing off for now. Some changes are due following this "editorial test." Probably, *Product Lines* will continue to cover the product news in brief, snappy, down-home style, with a few legitimate news items receiving more in-depth investigations. The plan will be to replace factory written news releases, which have been coming in so fast as to cover up *Whole Air*. We believe you readers will appreciate this method more. And anyway, news reporting never was our specialty (enough others are doing the same reporting), but "interpreting" what it all means, is indeed, you might say, our strength. Got news or opinions? Send 'em to Product Lines, Box 144, Lookout Mountain, TN 37350-0144.

Stop Press Flash! — Just as the mag was to leave for the printer, Bob Trampenau called to announce Seedwing's manufacture of a new Sensor 510, a special production of the Sensor Cross Country Racer, made especially for the 1982 flying season and for cross country flying and record setting. Yep, the Sensor XCRacer features (1st) a special run of mylar dacron sailcloth for lower drag and improved overall performance. Its (2nd) feature is adjustable performance and handling, which can be tuned to suit your desires and flying conditions. The XCRacer will be available with 3-4 week delivery. Some 25-50 units are planned for the next month or two only. Interested? Contact Seedwings directly by phone (see ad, just inside cover). No mention was made of the price of the XCRacer, nor was the adjustment explained. Just call 'n ask!

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