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HUMAN POWER

Official IHPVA Newsletter ISSUE No. ~~6~~ 7 Fall, 1981

The entire "Poppy Flyer" II entourage posed for Yiorgos Naoum, our official photographer at the L.A. County Fairgounds.

SPEED CHAMPIONSHIPS; BRITISH VIEW

Now that a week has passed, can I put down some thoughts about the Association, and the event. As I see it, you are really going to have to go some way in our direction if you are going to continue to attract entries from overseas, or even from the East Coast. It is not so much the prize money that counts as the money to do good organization, and planning. As an example, it was very disconcerting for riders and entrants to have a second road race sprung on them on the Saturday morning, when nobody had said anything about it before. I do think also that a press officer really is vital. You cannot do everything, and it is press liaison which produces publicity which produces television and press publicity and therefore gate money. I know that there were all the problems of the Los Angeles Fairgrounds as a site, but people stayed away in far larger crowds than they should have done. Everybody that all of the English competitors spoke to knew nothing of the event. I know that California suffers from media oversaturation, so that everything gets lost, but more could be done.

Equally, I do feel that the whole event was too much of an "in" event for the competitors, and not organized towards information being given to the uninitiated. Too much of the time people did not know what was going on, with the result that they went away unsatisfied.

At Brighton we reckoned the commentator was the most important man there. His was a whole time job, and it was our top priority to feed him information, so that the crowd was totally involved the whole time. Although you all worked very hard, you were doing different jobs with differing responsibilities, which meant that your mind could only be part of the time on the commentary, leading at times to large gaps in information.

On behalf of all of us, I would like to say how grateful we were for all the kindness and hospitality which we received when we were over. We all enjoyed ourselves very much indeed. Poppy Flier returned safely also. They were told that it would cost them 550 in freight charges. so they cut the machine in half and took it through for 20 in excess baggage. Before the Vector team get too enthusiastic, Poppy Flier has already been joined together again.

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MEMBER'S FORUM

If you have an opinion, comment, or rebuttal or just something you would like to share, please do. All will be printed. Please type and limit yourself to one 8-1/2 x 11 page double-spaced. Mail to:

Member's Forum, IHPVA c/o Dave Sivertsen, 216-76 CALTECH, Pasadena, CA 91125

ELECTRIC VEHICLES

I was pleased to see the Electric Vehicle idea included - not all of the people in this country are able (or willing-ED) to power their own vehicles.

Further, almost all the electric vehicles (available today) are merely converted gas-powered vehicles with the same inefficiencies in aerodynamic design.

If rules are made up for future use (competition) I would suggest that unlike the British competition we do not disallow two-wheeled vehicles - they are the most efficient at moving one person. Against that I do suggest we have a minimum rider weight, say 154 lbs., to equalize entries. I think batteries that are suitable are available - even one of the deep-discharge Sears (batteries) gives a very reasonable 300 watts for 2 hours - enough for me to go 20 miles to work and back.

Chris Pollard
Monument, Colorado

OPEN LETTER

As a participant in this year's IHPVA competition, and as a long-term member of the IHPVA, I have drawn these conclusions:

1. The ultimate human-powered vehicle has yet to be conceived.

2. Human-power vehicles are not yet on the verge of entering the market place as a practical means of supplanting the conventional bicycle.

3. Human-powered vehicle development is very worthwhile as a purely scientific endeavor. Its spin-offs such as conventional bicycle streamlining and future commuter vehicle design leadership are significant.

4. Funding and sponsorship for IHPVA events is likely to continue to be scarce.

If these conclusions are considered correct, then:

1. Continued competition through the IHPVA championship events is the best means currently of continuing HPV development.

2. The IHPVA has responsibility to see that this competition continues unchecked while maintaining the original premise that rules should be kept to a minimum.

3. Road racing should be highly stressed to encourage practicality. The more publicized top-speed events should be continually encouraged. It is important that future events be held on courses which can produce official records.

4. The current dominant vehicle design is an asset to the IHPVA and should be continually supported and encouraged toward further development. However, dominance of events by one vehicle design or type can discourage competition and vehicle development. This discouragement is even more apparent when several of the same dominant vehicle types capture all of the top places in any one event.

5. In order to continually encourage competition, the IHPVA should request such dominant vehicles to limit their entries in any one event to one vehicle.

6. So that the dominant vehicle type will not be penalized thereby, the IHPVA should offer special events for dominant vehicles only. Additionally, in the top-speed events, the IHPVA should allow different riders to participate in any one vehicle and recognize the top speed for the fastest rider.

7. The IHPVA should not be discouraged by temporary sponsorship problems, but should alter its cash expenditures. Rather than continually awarding critical funds for prizes, a rotating "silver cup" type of prize should be given to annual road race winners. Trophies rather than cash should be awarded for top-speed events.

8. If possible, a 100 KPH trophy (and/or prize) should be purchased and publicized as an award for the first single to reach that speed. A similar multiple-rider award should be considered.

9. The IHPVA should set an additional set of long-term goals. For example, the IHPVA might support a transcontinental HPV record.

These conclusions and suggestions are intended for your consideration.

Allan V. Abbott, M.D.
Idyllwild, CA

Human Powered Vehicle

SCIENTIFIC SYMPOSIUM

On SATURDAY, NOVEMBER 21, for the first time, all of the best scientific minds will assemble to discuss their designs, research, lessons learned, and progress made. You can hear first hand of their experiences with aerodynamics, rider position and performance physiology, construction techniques and materials, and vehicle configuration. Special sessions will discuss water and air vehicles, and exercise physiology.

SPEAKERS AND PANELISTS WILL INCLUDE:

PAUL MAC CREADY, designer of English Channel-crossing human powered airplane

CHESTER KYLE, IHPVA founder, Professor of Mechanical Engineering

JOE MASTROPAOLO, exercise physiologist, consultant for human powered airplane

PAUL VAN VALKENBURGH, racing engineer, designer of IHPVA record vehicles

AL VOIGT, chief Vector engineer, World's Fastest Human powered vehicles

BRIAN ALLEN, pilot of English Channel crossing airplane

STEVE BALL, engineer of linear-drive, hand and foot powered record vehicle

CHRIS DREIKE, engineer of first human - powered vehicle to exceed 55 MPH and many more, including formal scientific paper presentation

DR. DAVID GORDON WILSON, Professor of Mechanical Engineering, MIT and recumbent cyclist.

DR. PAUL SCHONDORFF, human power advocate will be coming from Germany to make a presentation.

Advanced registration $15.00, $25.00 after Nov. 14.

Information and Registration:
Allan Abbot
P. O. Box AA, Idyllwild, CA 92349

Make Check Payable to: IHPVA
Nov. 21, 1981, 9 am to 5 pm
Disneyland Hotel, Anaheim, California

HUMAN POWER Editorial Staff Expanded

As of this writing, two of our members, Dave Sivertsen and Tom Milkie, have joined *Human Power* as Editors along with Dick Hargrave (whose primary function is really artwork, i.e., layout and production). They will write, solicit articles and edit those coming in. This is really good news. What it means to you is that *Human Power* will be published more often (four times per year) as it always was meant to be. We are truly sorry about the lack of publications — it is simply too big a job for one person alone. Well, now we have 3 people — now about 5 more?

If you are interested, please write or call Dick:

7301 Lennox Ave., E-9
Van Nuys, CA 91405
(213) 994-4547 (eves)

Our next issue will be mailed mid-January.

New Officers Elected for 1982

On Wednesday, October 14, 1981, at our annual election meeting, Peter Boor presented the IHPVA presidency to Lynn Tobias. Lynn has been an IHPVA member since 1978 when he worked on Danny Pavish's "Land Shark", No. 88. Later he worked with Peter Chesney and Steve Huston on the No. 99 vehicle, last seen at Ontario in 1980. Professionally, he is an aeronautical engineer working for McDonnell - Douglas, Astronautics Division.

The prestigious Dr. Paul MacCready, designer of the Gossamer Condor, Albatross and Solar Challenger, will continue as International President (primarily a public relations office, a very important job. Our new Vice President Land is Alec Brooks, designer of HPV's "Bunburner," "Sun-burner", and "Pressodyne" I and II.

Peter Boor has taken an interest in Human Powered Boats and will serve this year as Vice President Water. He plans to get his feet wet organizing the 1st Human Powered Boat Championships (if you are working on a Human Powered Boat - the speed to beat is about 15 knots—17.25 mph—or are interested in helping Peter set this up, you can write him c/o Bud's Bike Shop, 8643 Baseline Rd., Rancho Cucamonga, CA 91701). The meeting itself was quite interesting, successful and encouraging.

First, after the meeting opened, we had a presentation by Jackie Lapin, public relations and market expert interested in representing the IHPVA to prospective sponsors. Her presentation included (amongst many other sports events) the recent Yoplait Bike Challenge (Oct. 2) in Playa Del Rey. Coincidentally, this writer attended that event, and thought it quite well handled.

Continued on Page 16

PRESIDENT'S MESSAGE...

Greetings! As the newly installed president of the IHPVA, I would like to give a synopsis of what I hope We can accomplish during the coming year. I emphasise WE because as a small organization whose directors' interests, experiences, and capabilities lie more in the direction of vehicle design and construction rather corporate law and public relations, we need the help of the membership and professionals. We are all volunteers with full time jobs and are thus limited in the time we can dedicate to the association. Therefore, I am appealing to you for whatever contributions you can make, be it articles for the newsletter, organizing a local chapter or event, legal, accounting, or public relations assistance or just a complaint or suggestion.

Our primary goals are: to find a site and financing for the 1982 Speed Championships; to publish an enlarged newsletter with more regularity; to make the Association financially secure; and to involve more active members with regional races and chapters. Within this framework, we all can better accomplish our personal goals for human-powered vehicles and have a greater impact on the world around us.

To achieve these goals, we plan to seek the help of professionals such as public relations agents where necessary but hopefully recruiting as much help from within the membership as possible.

Remember, YOU are an important part of the IHPVA and can make a significant contribution to its development.

Lynn Tobias

Editorial

IPSOB

What we see happening today in HPV competition has happened in vehicle racing many times before; someone makes a quantum leap in technology, and the others, with less exotic vehicles, are left in the past. (Remember Andy Granitelli's 'Special' turbine-powered Indy racer (1963)? The following year USAC restricted the size of the air intake, effectively reducing horsepower so as to eliminate the turbine-powered car.

Anything done to discourage advancement in technology or any attempts to control the outcome of events is contrary to our very existence. We promised to minimize our rules and to keep them simple and, in keeping with that, I think alternate solutions to the problems implied above are available. For example, one solution may lie in distinguishing "production" vehicles where two or more exist, from "prototypes" where said vehicle is the sole example. Prizes and trophies could be distributed within each class as opposed to overall.

The Abbott Prize, financed personally by Dr. Abbott, gave a tremendous shot in the arm to this organization. Morale was boosted and technology advanced according (in this writer's opinion) to the goal set. It seems convincing that people very often succeed in doing just about any damn thing they set out to do (especially if it's impossible). When we establish another major prize, it will eventually be won. Perhaps it would be wise to place that goal higher than what we think is possible today. 100 Kph (61.2 mph) is not far away for some of today's single-rider vehicles.

If we cease to establish challenging goals, and if we place conditions on either the number of one-design vehicles entered, or the amount of prizes awarded to a given vehicle design, then we will cease to provide a fertile and unrestricted proving ground for new or ingenious human-powered vehicle technology, and become, instead, an Institution for the Preservation of Streamlined, Obsolete Bicycles.

- Dick Hargrave

The opinions expressed here are those of the writer(s) and do not necessarily represent official IHPVA policy.

Composite Construction and
ADVANCED MATERIALS

By JIM MOYNIHAN...(Part 1): Beginning of a series of articles on composite construction, and the description of modern, advanced materials and adhesives that can be used in the process of model building [and HPV's too].

This article was published in the November 1981 Issue of Model Builder *Magazine, an excellent publication devoted to all phases of Radio Control and Free Flight modelling. The proper use of composite materials in Human Powered Vehicles by saving weight and increasing strength, will allow us to go alot faster, alot more safely. Reprinted by permission.*

Ever since your editor asked us to write a series of articles on composite construction, we have wondered where to start. Probably the best way would be to define composite construction. For our purposes we would define it as the construction of [a]. . . frame utilizing an admixture, or a blend, or a compound of distinct parts or elements of various available materials to produce a resulting structure with the highest possible strength-to-weight ratio at acceptable cost. . . .

We live in a world of advanced plastics, carbon fiber, kevlar, foam products, honeycomb products, and advanced adhesive systems, just to name a few. And we will be explaining them to you and stripping away the mystery and old wives tales we've heard about them. The existence of these new materials has made possible the flights of the Gossamer Albatross, the Condor, and the Solar Challenger. While proper utilization of the materials to make these flights possible was due to the superb engineering of Dr. Paul MacCready, he couldn't have done it either, without this material availability. We will give you a good idea of what can be done with the materials, their properties as well as the engineering and the practical know-how to work with them. This article will not explore specific . . . [vehicle] construction but will rather stick to the material side of things until we fully understand what we really have to work with. We are going to steer clear of complex formulas (I hate that word formula. Mathematical relationship of one thing to another is really a better way to say it. Formulas sound so pat.) Anyway, we want to stay as practical as possible. Like it or not, some presentation of numbers has to take place but we'll keep it as simple as possible. We are assuming that most of the readers are non-engineers. The articles will be geared as closely as possible to that assumption, and if you happen to be an engineer, forgive the simplification and please don't think that the definitions we are coming forth with are normal engineering practice.

Something else should be said at this point. Nothing you will read here is some pie-in-the-sky idea. All of what you will read here has been done, much by the author, tested, weighed, measured, and used by those standards with which we are familiar in the model airplane business.* You will see the results and techniques. . . Now, how do we relate to these new materials? It occurred to us the best way is like the old joke, 'How's your wife?' . . .*'Compared to what?'* In this case, compared to something we can all relate to: wood. And even that has to be clarified.

Dry wood is made up chiefly of the following substances, listed in decreasing order of amounts present: cellulose, lignin, hemicelluloses, extractives, and ash forming minerals. Cellulose, the major constituant, comprises approximately 50 percent of wood substance by weight. It is a high molecularal weight linear polymer. During growth of a tree, the linear cellulose molecules are arranged into highly ordered strands called fibrils, which in turn are organized into the larger structural elements comprising the cell wall of wood fibers. The intimate physical, and perhaps partially chemical, association of cellulose with lignin and the hemicelluloses imparts to wood its useful physical properties. Lignin comprises 23% to 33% of soft woods but only 15% to 25% of hard woods. It occurs in the wood largely as an intercellular material and like cellulose, it has a macromolecular chemical structure, but its three dimensional network is far more complex and not yet completely worked out. As a chemical, lignin is an intractable, insoluble material, probably bonded at least loosely to the cellulose. It is the plastasizing of the lignin by ammonia that allows us to bend wood pretty much to our liking and have it retain that bent shape after drying.

Okay, so now we know more about wood, and in fact, we know quite a bit, but we also have to know its mechanical properties such as tensile strength, elasticity and bending strength. Fortunately, others have done this for us, and we have a table of sorts to start with. Included in the table are other materials [of considerable interest to HPV designers] for which we have definite data and they are inserted to give us a comparison of strength. We are referring

MATERIAL	ULTIMATE STRENGTH IN PSI	COMPRESSIVE MAXIMUM CRUSH STRENGTH PSI	MODULUS OF ELASTICITY IN MILLION PSI	WEIGHT PER CUBIC FOOT
Ash	590	3510	1.13	34
Balsa	100	1700	.55	9
Bass	350	4730	1.46	23
Birch	620	5200	1.60	44
Pine	470	3510	1.12	32
Maple	500	5220	1.83	43
Spruce	345	6150	1.55	28
Aluminum	30000	10000	8.0	165
Aluminum Alloy 7075-T6	55000	13000	10.0	175
4130 Steel	95000	28000	30.0	489
Titanium 6A1-4V	133000	120000	16.5	277
Stainless Steel	250000	30000	28.0	489
E-Glass	500000	62000	10.5	162
S-2 Glass	665000	65700	12.6	156
S-Glass	665000	65700	12.6	156
Kevlar 49	525000	40000	19.0	86.4
Pan Carbon Fiber	400000	Over 40000	32.00	107
Pitch Carbon Fiber	300000	Over 40000	55.0	107

(Composites, con't)
to aluminum steel, stainless steel, and the various fiberglasses, Kevlar and carbon . . . The purpose of this entire article and the use of our table will be to give us some comparative data so we can shave a little off here and a little off there and do it with a reasonable degree of confidence

Before examining the data table on the materials, it would be wise for us to clarify a few definitions. Don't let words like modulus scare you. The *modulus of elasticity*, known sometimes as Youngs modulus or also, Hooks law, is simply a measure of how rigid a given material is under load. The higher the number, the more resistance to bending under load the material will have. If you glance at the table and compare spruce to balsa for example, and using data from this table, we take the modulus for spruce which is 1.55 and divide it by the modulus for balsa which is .55 and we come up with a number 2.82. This tells us that spruce is about 2-3/4 to 3 times stiffer than balsa with the same load. Or, to put it another way, spruce will bend almost three times less than balsa under the same load. All of this occurs with the same physical size piece of material. So we have to relate to the weight as well. From the weight column in the table we see that spruce weighs about three times more than balsa. We are now faced with an option, which will depend a great deal upon what we are looking for, of either using a heavier piece and getting a great deal more rigidity, or shaving the size of the piece of spruce to the same weight and coming up with the same strength.

Now let's define *ultimate tensile strength*. This is the load applied to a rope in a tug-of-war when the rope *breaks*. Simple as that. What isn't so simple is how a spar or leading edge acts in tension under load. But that, and spar testing, will be fully explored in the next article. This time we're establishing a base to work from.

Compressive stress in loading is very difficult to pin down for many materials. The load applied to a nut in a nutcracker when the nut breaks is the *ultimate compressive load* a nut can take. Again, simple. But a nut is brittle and the stuff we work with isn't, so we are interested in how much it can take in compression before it fails. And how much deformation of the part takes place at, or before failure. Again, the next article will get into this in depth. And now that you have a rudimentary explanation of what the table is all about, take a good look at it and use the facts and figures shown as reference values to compare one thing to another, not forgetting to put the emphasis on weight as well.

We should also make an important point at this time. It is our design philosophy that good design for high-strength-to-weight-ratio means that the airplane will break if it is abused. We are not of the school that believes in building very heavy unbreakable airplanes in an attempt to make impervious to the tilt of the earth. So bear that in mind. [Some parts related to HPV's may very well have to be practically fail-proof, such as cranks, axles, chain rings, load-bearing frame members, etc. - but that doesn't make this article one iota less valuable] While we won't go into all the extreme details at this time, by utilizing information in the table, we can come up with a piece of steel, a piece of carbon fiber, and piece of balsa wood which are all the same weight or the same strength. A piece of carbon fiber approximately 1/4 of an inch in diameter has the same strength as a piece of 1/8 inch diameter steel, and you will be able to bend the steel in your fingers. You will not be able to break the piece of carbon fiber rod with your bare hands and I don't care how big you are!. . . We'll get into a lot more of that in the next article. . . Now a look at the new materials.

Fiberglass is a registered trademark of Owens-Corning Fiberglass Corporation and has really come to be the generic term for all fiberglass products... ...The actual production of glass reinforcement began in the early 1940s. This was, and is still, a product known as E-glass. This was named E-glass because of certain electrical properties it possessed. Later on, C-glass was produced and so named for its chemical resistance properties. Later still, a product called D-glass was produced and it was so named because of its particular dielectric properties. As the space program evolved, and an obvious demand for better materials came about, the company developed what is known as S-glass in the early 1960s to meet the needs of the military and aerospace industry. A glance at the table as you read this will show you the dramatic improvements between E and S-glass. In the period between 1966 and 1968, S-2 glass was developed, because S-glass is extremely expensive and is a very extreme, premium product and yet there were commercial applications demanding almost the properties of S-glass but at a much lower cost. Owens-Corning began a program to upgrade E-glass to S-2 glass to fill this requirement. They were extremely successful and the S-2 glass has nearly the properties of S-glass, both of which are immensely superior to E-glass, and yet the cost is nowhere in proportion to its proximity to S-glass characteristics....

Fiberglass is made by using aluminaborosilicate glass marbles as a raw material. The S and S-2 grades use a low alkamagnesiauminasilicate glass composition as a raw material. The filaments, sometimes called fibers, are made by melting the specific raw material in a very high temperature furnace and drawing the molten glass through pure platinum dies. It is then cooled slightly and a sizing is immediately applied. As a matter of interest, Owens-Corning owns more platinum than anyone else in the world, except the U.S. Government.

At this point we had better get a few more definitions out because we will be talking about other filaments and fibers and there is a different language to describe and understand the properties of these materials.

Definitions

Denier — Weight in grams of 9000 meters of yarn.
Fiber – An individual rod of material of sufficiently small diameter to be flexible, having a known or approximate limit of strength.
Fiber Diameter— The measurement (usually expressed in hundred-thousandths of an inch) of the diameter of an individual filament.
Filament— A single thread or thread-like object. Many of these are put together to form a yarn. Usually the higher the filament count, the lower the price of the yarn.
Fill— The 90^{o} yarns in a fabric, also called the woof or weft.
Finish— A surface treatment given to fibers or filaments after they are fabricated into strands, yarn or woven fabrics.
Grams— 1 oz. = 28.349 grams.
Hts– A size applied to the glass fiber surface during forming of the fibers to give high performance compatibility with resin and resistance to mechanical damage to the individual filament, strands, or ends. (Trademark OCF)
Hybrid— Two or more different reinforcing fibers combined into a single resin matrix is a hybrid composite.
Matrix— A combination of resins and reinforcing materials of any type.
Meter— 1 meter = 3.281 feet.
Micron— 1 micron = .001 MM = .00003937 in.
Mil— .001 in.
Modulus of Elasticity- The ratio of unit stress to unit strain within the proportional or elastic range of a material. Also known as "Young's Modulus".

Continued on Page 8

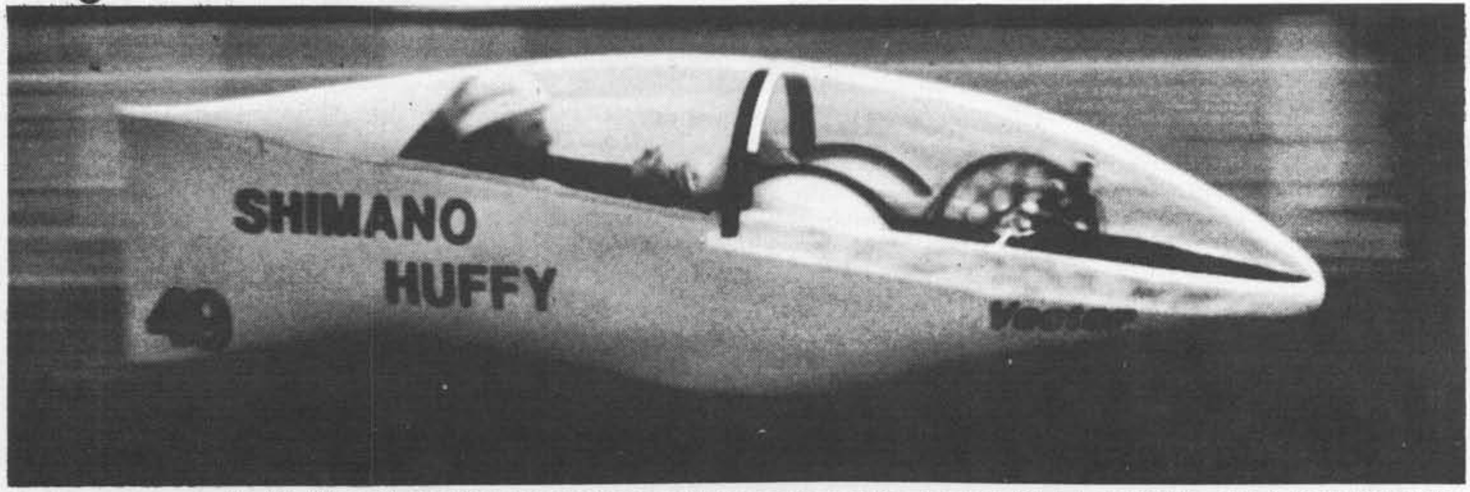
Saturday & Sunday, May 2 & 3, 1981, **7th International** Los Angeles County Fairgrounds

Human Powered Speed Championships: Photo Finishers.

Although the results have long since been mailed, we thought it appropriate and of interest to present the competitors photographically in order of finish in the 200-meter Time Trials. Included in the captions are the other accomplishments of that vehicle. Saturday and Sunday both started with the 200-meter T/T followed by two Road Races each day! The first Road Race of the day was the traditional LeMans start (R/R No. 1, Sat. & R/R No. 3, Sun.) - where, at the gun, riders run across the track, mount their vehicle(s) and race. The fastest vehicles do not necessarily get off first.

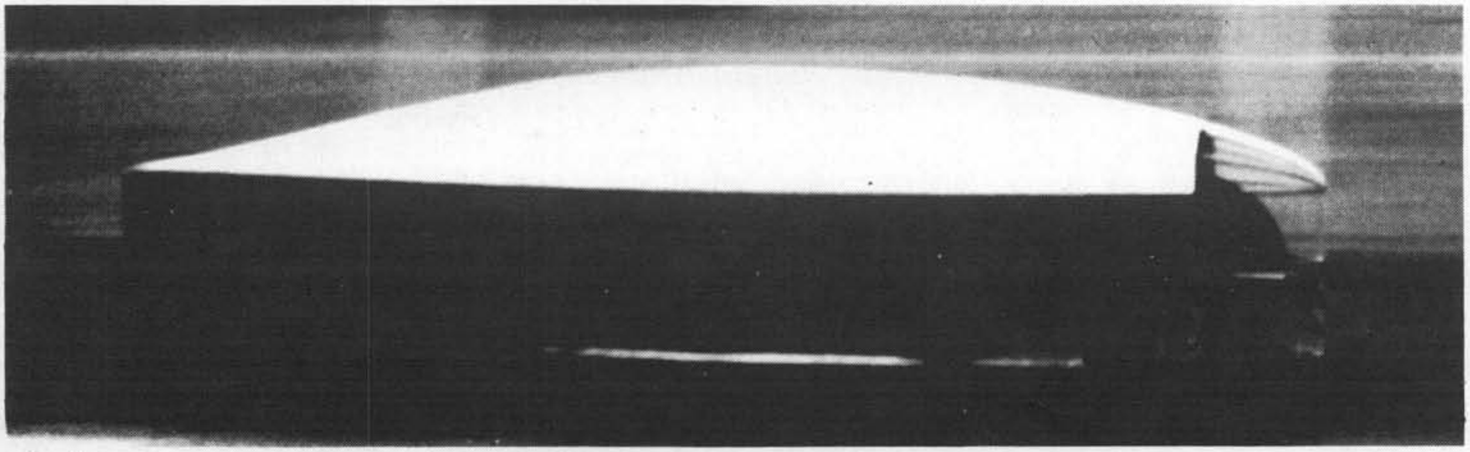
The second Road Race was a rolling start, riders already strapped in, etc. (R/R No. 2, Sat., R/R No. 4, Sun.). Other awards are the Phase-One (2 places): given to the fastest run by an owner/builder-ridden solo vehicle; the Static Performance Award (8 places); primarily a concours trophy, it is awarded to those vehicles displaying smooth contours, attractive finish, and good craftsmanship in general.

Single-Rider Vehicles



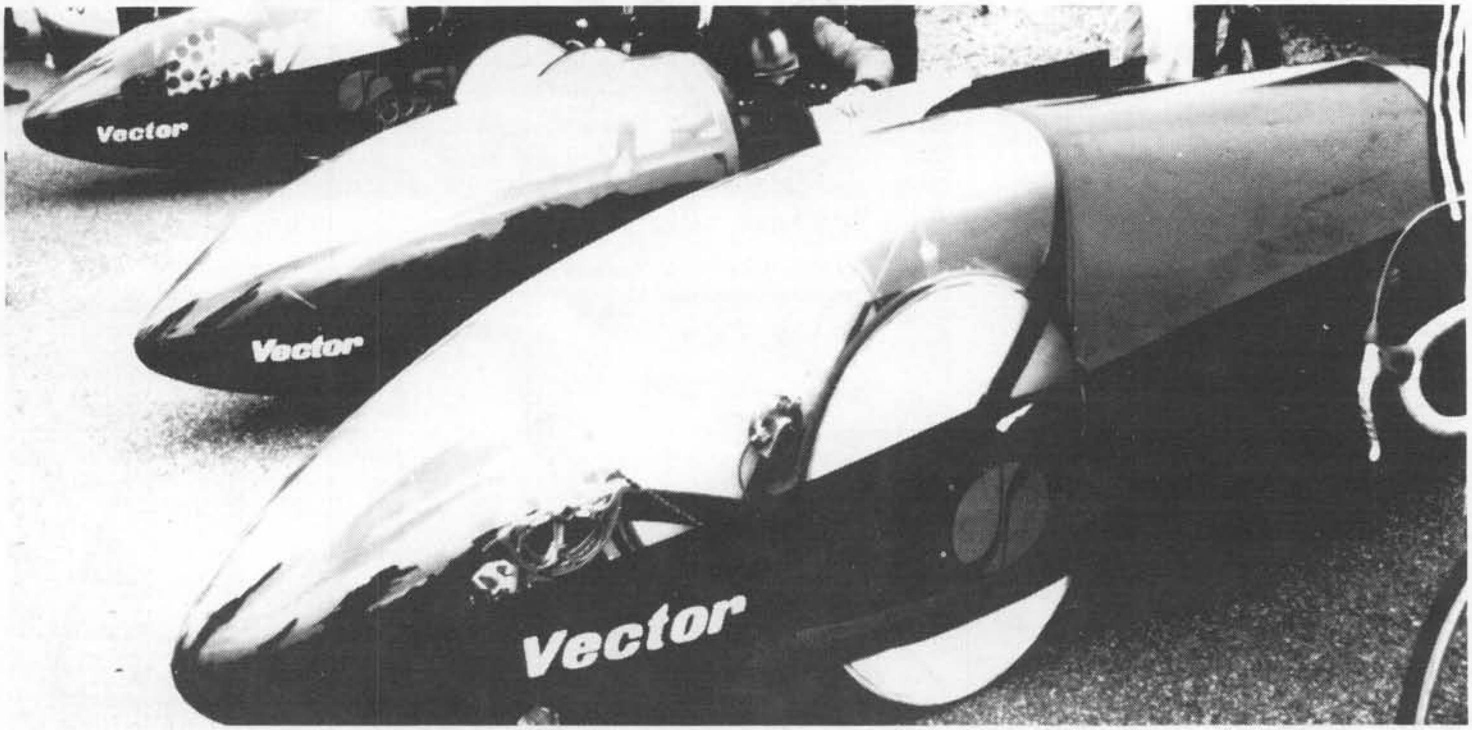
1st 55.63 mph No. 49 - "Vector" rider: Steve McIntosh owner: Versatron Research Co., Anaheim, CA Lemans R/R No. 1: 4th Rolling Start R/R No. 2 1st, 32.14 mph rider: Kevin Lutz LeMans R/R No. 3: 2nd, rider: Kevin Lutz Rolling Start R/R No. 4: 1st, 31.56 mph rider: Steve McIntosh Static Performance Award: 6th

2nd 54.91 mph No. 7 - "Poppy Flyer II" rider: David March owners: Jaymic Engineering, Southrepps, Norfolk England Static Performance Award: 2nd

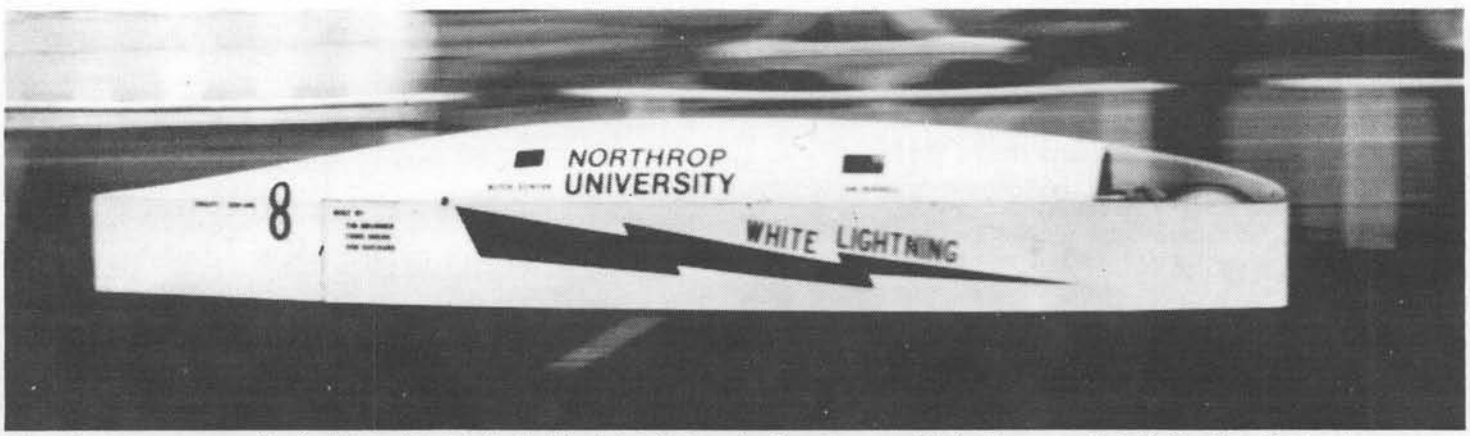


3rd 53.97 mph No. 74 - "Dragon Fly II" rider: Richard Bryne owner: Steve Ball, San Diego, CA Static Performance Award: 4th

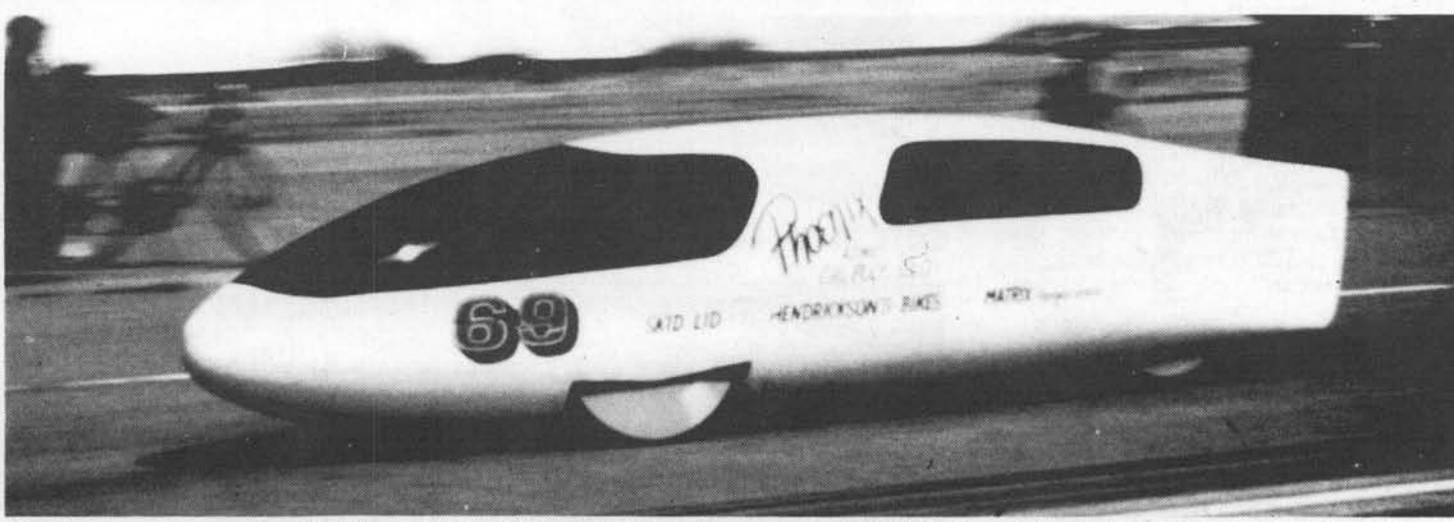
Multipile-Rider Vehicles



1st 58.47 mph No. 25 - "Vector" rider(s): Bruce Donaghy, Hugh Walton owner: Versatron Research Co., Anaheim, CA



2nd 57.25 mph No. 8 - "White Lightning" rider(s): Butch Stinton, Jan Russell, owner(s) Tim Brummer, Chris Drieke, Don Guichard
Static Performance Award: 8th



3rd 53.40 mph No. 69 - "Phoenix" rider(s): Jim Adamski, Jim Stone owner: Calif. Poly. State Univ., San Luis Obispo ASME LeMans R/R No. 1: 5th Rolling Start R/R No. 2: 2nd Static Performance Award: 1st

(Composites, con't)

Prepreg— Used to describe fibers or fabrics which have been impregnated with resin and partially cured to the B-stage. Prepreg at this state is drapable, tacky, and can be easily handled.

Roving— A number of ends or strands of material gathered together into a ribbon without twist.

Strands— A primary assembly of continuous filaments combined in a single compact unit with twist.

Yarn— A generic term for an assemblage of twisted fibers or strands, either natural or manufactured, to form a continuous yarn suitable for use in weaving or otherwise interweaving into textile materials.

Wetout Rate— The speed with which a given sizing or treatment on the material surface will allow the material strand to be completely saturated with resin. This rate is usually determined visually and measured in elapsed time.

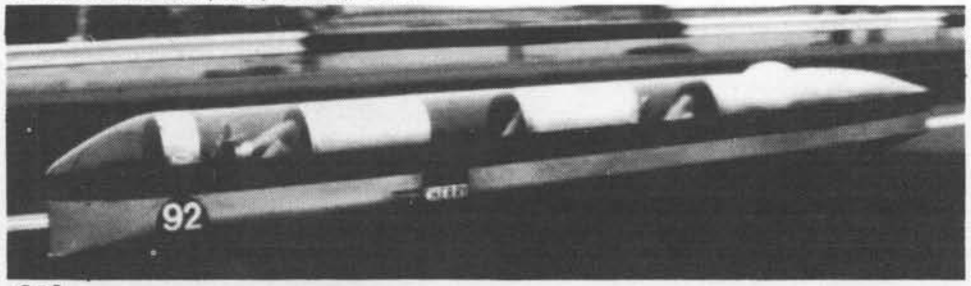
Warp— Yarns extended along the length of the fabric (in the 0^{0} direction)., and being crossed by the fill yarns.

Woof— See Fill.

The sizing we mentioned is a material usually organic in nature, that is applied to the filament to enable them to be handled more readily without breakage. Sometimes the sizing enhances the compatibility of the filaments to different types of resins, but this is normally done when the company knows exactly what resin system the customer is going to use with that particular batch of filaments. The filaments are produced in various diameters, depending on their end use, from .00006 to 00095 inches in diameter. As some comparison, the paper that this is printed on is 2 thousandth of an inch thick or .002. The filaments are then gathered into what are called strands and then sold to either prepreggers, or weavers. The weavers make cloth out of it. The prepeggers impregnate the fibers or cloth with a resin and partially cure it to what is called the B-stage. At this point, the cloth or filament bundle is tacky and drapeable and can be laid in a mold to be heat cured, usually at about 400 degrees farenheit, and under pressure. We don't use it this way, but it is important to understand what 'prepreg' is because, as we stray from the normal hobby market, a great many fibers are available only as prepreg material and this not the way to use them. This is particularly true of Kevlar, carbon fiber and cloth.

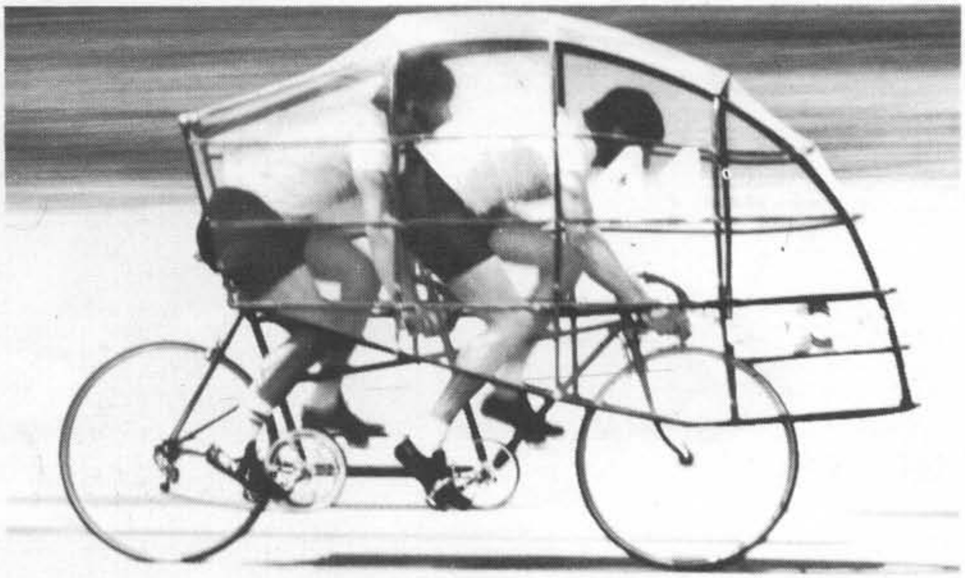
The E-glass coth we use in the hobby is the fabric made by various weaving mills in many different weights. One

200 meter Time Trial (Multiple Rider) - Cont.



4th **48.99 mph** No. 92 - owner: Tom Rightmyer, Fullerton, CA

5th **47.96 mph** No. 2 - "Wild Turkey" rider(s): Chester Kyle, Jack Cameron



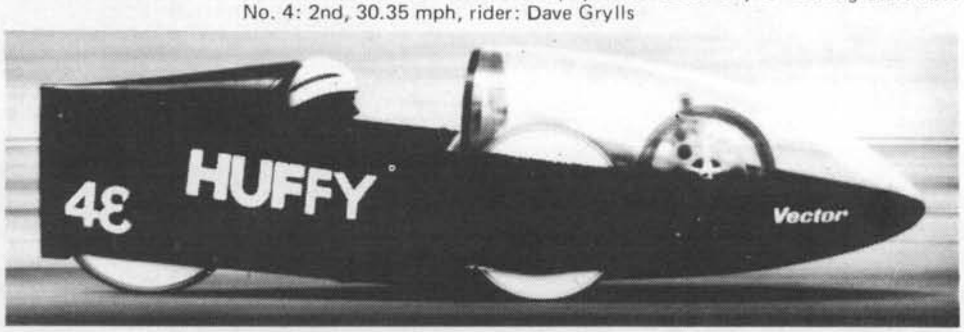
6th **47.22 mph** No. 44 rider(s): Tony Webb, Dave Hughes owner(s): Tony Webb, Dave Hughes, Bromsgrove, Worchestershire, England LeMans R/R No. 1: 3rd Rolling Start R/R No. 2: 6th Rolling Start R/R No. 4: 4th

7th **43.43 mph** No. 37 - owner(s): Ken Suter, Kirk Stokes, Jim Chavez, Las Cruces, New Mexico

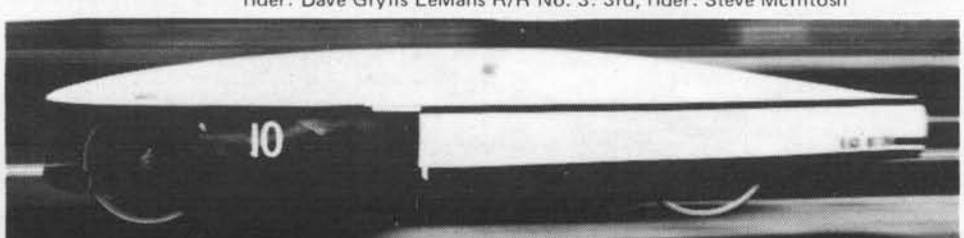
8th **39.27 mph** No. 59 - owner: Richard Hoekwater, Upland, CA LeMans R/R No. 1: 8th LeMans R/R No. 3: 4th

200 meter Time Trial (Single Rider) - Con't.

4th **53.03 mph** No. 24 - "Vector" owner: Versatron Research Co., Anaheim, CA, LeMans R/R No. 1: 2nd Rolling Start R/R No. 2: 5th, rider: Bruce Donaghy LeMans R/R No. 3: 1st 31.76 mph, rider: Dave Grylls Rolling Start R/R No. 4: 2nd, 30.35 mph, rider: Dave Grylls



5th **52.75 mph** No. 48 - "Vector" owner: Versatron Research Co., Anaheim, CA LeMans R/R No. 1: 1st, 30.00 mph, rider: Dave Grylls Rolling Start R/R No. 2: 3rd, rider: Dave Grylls LeMans R/R No. 3: 3rd, rider: Steve McIntosh



6th **51.87 mph** No. 10 - "Black Bottom" owner: Allan Abbott rider: Allan Abbott, Idyllwild, CA, Phase One Award: 1st more thing can be done to greatly improve resin wetability and wet-out and that is called finish. An Amino silane finish on the fabric greatly improves its wet-out characteristics, and its end strength with either epoxy or polyester resin systems. As a matter of interest, all Aerolite Products, glass, cloth, etc., are so finished.

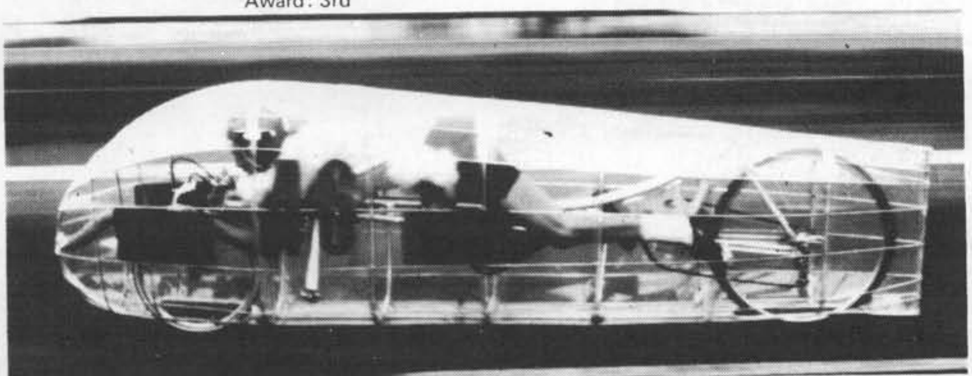
We don't believe it's important here to tell you how to use glass cloth as I'm sure you have all dont it. Later on, however, the use of yarn and strands, and roving will be explored.

...Now, let's look at Kevlar. Kevlar is a registered trademakr of the DuPont Company. Fiber B, as it was originally called, was discovered in 1965 following a concentrated effort by a research group aimed at specifically coming up with a polymer exhibiting new high levels of physical properties. DuPont knew that if a polymer molecule could be made from a symmetrical molecule having para-type orientation, a super rigid molecular chain could be made. All precursor chemicals had to be made from scratch to form the polymer. The polymer also had to be dissolved in solvent because it would not melt, before it could be extruded as a fiber. After many spinning attempts, fibers were successfully spun and initial property tests showed that the years of intense research were about to pay off. The modulus of the fiber tested at a high value, which meant that it was even stiffer than glass. Later the modulus was raised making the fiber two and one half times as stiff as fiberglass on a weight basis. Much more work, in fact 8 years of it, took place before fiber B now identified by the trademark Kevlar, would reach the market place. In early 1970 there was a significant break through. An ingenious spinning process which is highly proprietary, was developed which quadrupled the spinning speed and provided an unbelievable bonus: the fibers turned out to be almost twice as strong as those made with the first process. And that is how it came about. Three forms of Kavlar are made; Kevlar, Kevlar 29, and Kevlar 49. All are pale yellow color and all feel somewhat similar to fiberglass until you try to cut them. The DuPont Company makes only the fibers, filaments, and rovings. Once again, the weavers and prepreggers get into the act. We've already gone over that end and it doesn't change with Kevlar. From a hobby viewpoint, since we don't use high temperature and pressure to cure resins, prepregging again isn't desirable. Kevlar has the unique property of absorbing resin and wetting out very well all by itself. Therefore

Continued on Page 13

7th 51.08 mph No. 3 - "Red Shift" rider: Danny Van Haute owner: Tom Milkie, Gary Hoisington, Steve Fujikawa, Irvine, CA LeMans R/R No. 1: 7th Rolling Start R/R No. 4: 3rd, 28.5l mph, rider: Danny Van Haute Static Performance Award: 7th

8th 50.98 mph No. 60 - "Jim Gentes Speed Bike" rider: Fred Markham Rolling Start R/R No. 1: 5th 26.16 mph, rider: Fred Markham Static Performance Award: 3rd



9th 50.24 mph No. 46 - " Quantum Cruiser" - rider: Greg Johnson owner: Greg Johnson, San Diego, CA LeMans R/R No. 1: 6th, rider: Greg Johnson Phase-One Award: 2nd

10th 48.75 mph No. 6 - rider: Eric Heiden, Olympic Gold Medalist owner: David Wiener

11th 49.67 mph No. 14 - Greg Johnson

TECHNICAL COLUMN

We are planning to start a question/answer sharing Technical Column for each issue starting in January. We are hoping to be able to answer all *specific* questions regarding design and construction of human powered vehicles and fairings. The questions will be answered by the editor (or somebody else if need be) most qualified in the subject. Obviously we will need more than one technical editor, so if you are willing to write a few answers, please contact:

Tom Milkie
5645 Ave. Vinedos
Anaheim, CA 92807

***P.S.** Those of you who have specific questions regarding certain design materials or construction techniques please write a note to Tom. We will try to publish all answers. Please send S.A.S.E. if you wish to get a reply by mail.*

British Speed Record Attempt

by Kevin Desmond

On the weekend of August lst/2nd, a series of attempts took place at the Berkshire airfield to break the Land Speed Record for non-paced, streamlined human-powered vehicles. The record under attack was the Flying 200 Metres of 58.85 mph, created in the Autumn of 1980 by a single-seater Vector machine from Anaheim, California. Although this was not broken, a British National Record of 49.16 mph was achieved by 26 year old Steve Poulter (Anglia Sport Huret Cycling Club, Essex) in the 14 ft 6 in Poppy Flyer II-½. A number of tactical lessons were learnt about record attempts in such conditions and with such unique vehicles.

This was the first two-day record attempt to be officially sanctioned by the International Human Powered Vehicle Association (IHPVA) and held in England at a top security airbase closed to the General Public.

RAF Greenham Common, formerly one of the main wartime glider bases for the D-Day Invasion of Europe, is situated on the Berkshire Downs. It is jointly operated by the RAF and the USAF-EUROPE, and kept on constant standby. Every June, an

200 meter Time Trial (Single Rider) - Con't.

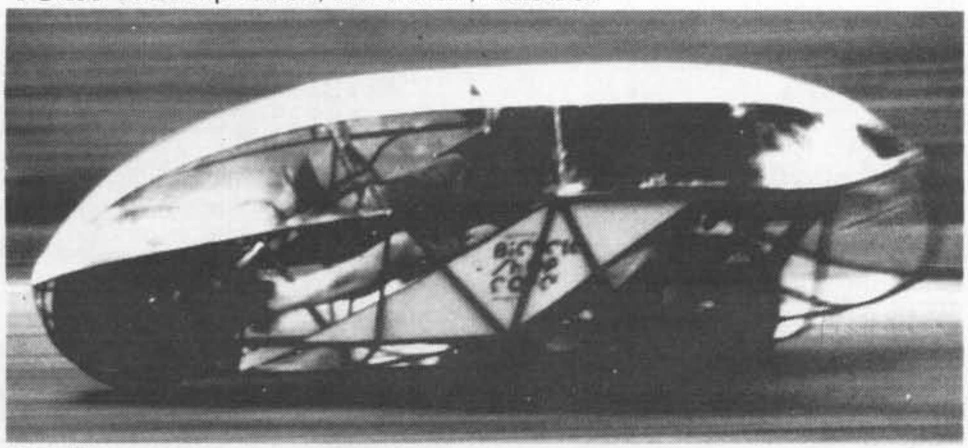
12th 48.75 mph No. 54 - rider: Kurt Zickerman owner: Kurt Zickerman Pleasant Hill, CA

13th 47.57 mph No. 85 - owner: Dan Egger, San Diego, CA

14th 46.12 mph No. 15 - rider: Bill Watson owner: Bill Watson, Van Nuys, CA Rolling Start R/R No. 2: 4th Rider: Bill Watson

15th 44.56 mph No. 97 - "Freestream I" owner: Scott Strom, Los Alamitos, CA

16th 44.25 mph No. 13 - "Bun Burner II" rider: Alec Brooks owner(s): Will Snyder, Alec Brooks, Dave Sivertson, Pasadena CA



17th 42.21 mph No. 27 - owner: Roc Fleishman, Los Angeles, CA

18th 42.02 mph No. 16 - "Linius", owner: Glen Cole, Phoenix, Arizona

19th 41.04 mph No. 5 - owner: David Weiner, Westport, Conn.

20th 40.27 mph No. 23 - "The Other Woman" owner: Kirk Newell, Ramona, CA

Air Tattoo is held, involving hundreds of historic aircraft and thousands of spectators.

The 2000-metres long backup runway was surveyed by West Byfleet Engineering Surveys and found to be level to 1 part in 512. Down its centre, a 4-inch yellow line. Timing was by Hird-Smith quartz crystal apparatus, checked by the RAC.

Although there was no major sponsorship for the event, some five streamlined tricycles arrived, four of which were solo.

The most serious contender for the Record was Poppy Flyer built by Jaymic Engineering (Mike Macartney, Mic Waudby & Alan Young) of Cromer, Norfolk. The first Poppy Flyer (named after a famous express train on the old Midland and Great Northern Railway Company) competed in September 1980 along the Madeira Drive, Brighton and had been timed at 40.63 mph. The second Poppy Flyer was built with modifications. These included a unique 24-inch 140-tooth chainwheel specially made for them by Royce Racing, Hampshire. Altogether some thirty companies helped out in the construction of this 14 ft 6 in tricycle with a maximum width of 18 inches and height of 30 inches. Its streamlined bodyshell was made of foam-reinforced glassfibre, with overhead, specially moulded Plexiglass canopies. There were two 24" alloy-rimmed wheels 12" apart and one 18" front wheel. A six-speed gearbox with Huret Juberlee changer was mounted upside down on the subframe. Total weight of the vehicle: 90 lbs.

Sponsored by Aspro Clear, Poppy Flyer II went out to the 7th International Human Powered Speed Championships at Pomona Speedway, California. Here rider, Dave Marsh was clocked at 54.89 mph, only to be beaten by the improved Vector machine with 55.65 mph. Both records were achieved on a slightly downhill gradient, which made it impossible for IHPVA ratification.

The runway at Greenham Common is almost perfectly level, even if infinitesimally uphill. As Dave Marsh was competing elsewhere, Steve Poulter, on the BCF National Squad for three years, more a long-distance "roadee" than a sprint "trackee" was brought in at only a day's notice. The first time he saw Poppy Flyer II was on the rainy Saturday morning in its transporter truck. Next to it was a second body shell, some 30 lbs lighter, to be fitted after initial runs. By the end of the first day, Mark II

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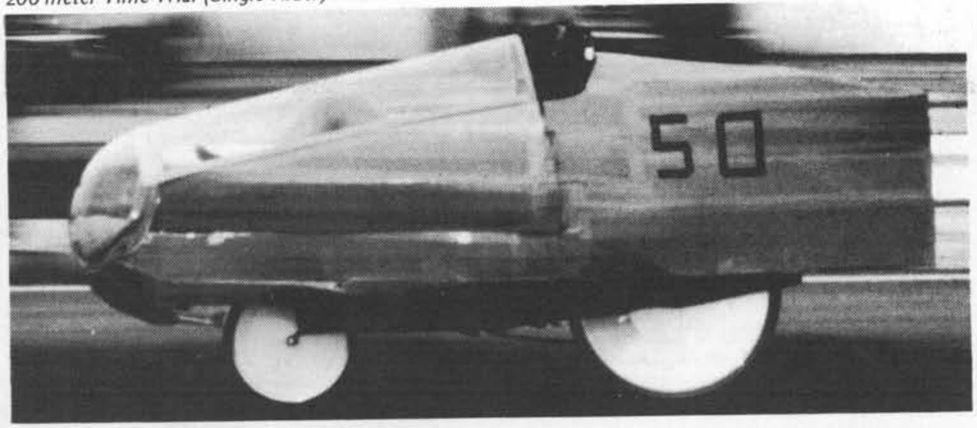
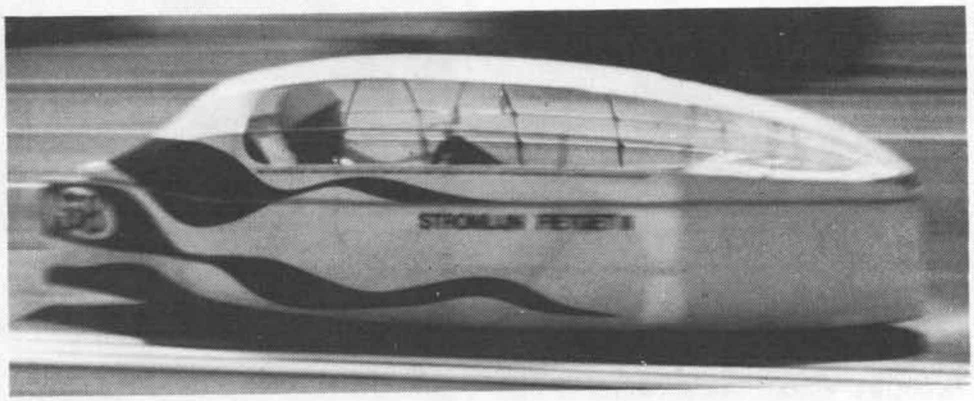
200 meter Time Trial (Single Rider) - Con't.



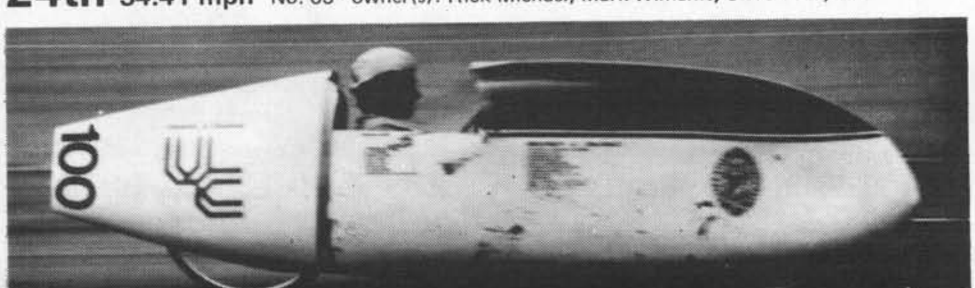
21st 38.61 mph No. 50 - owner: Ken Brant, Anaheim, CA



22nd 36.28 mph No. 58 - "Stromlin Feigiet" owner(s): David Blanding, Blaine Rawdon

23rd 35.48 mph No. 4 - "Sun Burner" owner: Alec Brooks, Pasadena, CA

24th 34.41 mph No. 63 - owner(s): Rick Michael, Mark Williams, Claremont, CA



25th 31.72 mph No. 100 - owner(s): Univ. of Cincinnati HPV Grp., Dept. of Mech. Engrg., Cincinnati, Ohio Static Performance Award: 5th

(British Speed Record, con't)

had been clocked at 43.31 mph and Steve was familiar with recumbent pedalling.

Before each run, before the Plexiglass canopy was sealed over his head, the rider had attempted deep-breathing exercises. But with a potential run-up of 1500 metres and another 300 metres slowing down after the Measured Distance, when the canopy was untaped at the other end of the runway both riders were suffering from oxygen shortage, and dizziness.

USAF Staff Sgt. Orville Ridgely and his assistant, Bob Valentine, agreed to become part of the team. They administered oxygen at the flow rate of 4 litres per minute, which either Poulter or Dixon inhaled for 20-25 seconds before each run. Poulter's speed went up to 48 mph, Dixons to 46 mph.

They also started paying with run-up tactics: Pedal at 30 mph for 350 metres before the run and then sprint into the Measured 200 Metres.

The Plexiglass canopies were also carefully rubbed down with a Jay cloth to see whether a smoother surface would give some decimal points of extra speed - until it was found that this made them static with the rider's hair standing on end!

From midday until 6 pm the weather was far too hot for further exertion; a mirage hung over the runway.

Attempts with oxygen began again at 6.40 pm. Poulter established the highest speed of the weekend of 49.16 mph, but although George Dixon again achieved 47 mph, neither of them succeeded in topping the 50 mph, due to a build-up of lactic acid in the blood stream.

Among the questions remaining and lessons learnt at Greenham Common: Sprint riders are perhaps better suited to this work, but what is the ideal run-up strategy? Are dawn and dusk the optimum times regarding the obligatory below 6 kph wind speed? Could course-marshalling be made stricter especially where timekeepers and their apparatus are concerned? Should preparatory runs use lower gears? How often should the track surface be checked?

After all said and done, Greenham Common airfield is ideal for such attempts and this will probably not be the last time it is used.

□

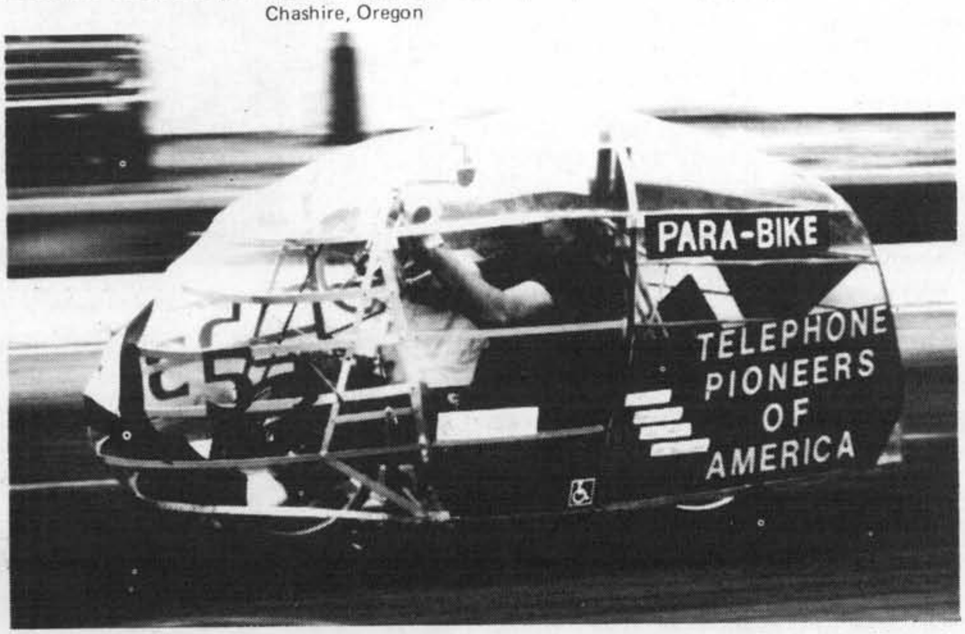
200 meter Time Trial (Single Rider) - Con't.

26th **30.44 mph** No. 40 - owner(s): Adam Cos, Oliver Cos, Fair Oaks, CA

27th **28.59 mph** No. 26 - owner(s): Peter Landon, Richard Smoke, San Diego, CA

28th **28.26 mph** No. 1 - owner: Chet Kyle Jr., Seal Beach, CA

29th **27.36 mph** No. 101 - owner(s): Aero Cycles, Irvin Housinger, Gary Hale, Chashire, Oregon



30th **25.09 mph** No. 53 - owner: Doug Schwandt, Rehabilitation Engineering Research Development Center, Palo Alto, CA we supply only scoured fabrics, and yarns with no pre-finish of any kind required.

Some of the real life uses of Kevlar boggle the mind. Five thicknesses of Kevlar cloth will stop a .38 caliber hand gun bullet at close range. It is used for lightweight bullet proof vests for police all over the country. One of the first uses was to replace steel in radial tire cords and the automotive industry is looking very hard at it in various parts of automobiles. The Sikorsky S76 helicopter used a fair amount of Kevlar in composite form to the degree that they could add one more passenger seat to the helicopter and extend the range 20% because of the weight savings. The new Boeing 757 and 767 will use a great deal of Kevlar composite material to the extent that they will save over 1000 pounds per airplane. The Lockheed 1011 has been flying with Kevlar parts since 1974 at a savings of 800 pounds per airplane. It's used to make lightweight canoes, and thousands of other things, and so we should be using it.

One more complaint we've heard about Kevlar relates to cutting it or more specifically trimming the excess around the edge of a layup. Remember this trick: Wait until the material is semicured, when it has that leathery feel, and cut it at that time. For some weird reasons, regular hobby knives or blades will cut it quite well as that one stage. How does it compare to fiberglass? We'll go over that later, but hold on now while we tell you about carbon fiber and then we will look at all three materials.

Carbon: Nobody has registered a trademark on this or graphite (which we will use interchangeably). So here goes. The processes used by various companies to produce carbon fibers are essentially similar but are all highly proprietary. The raw material is polyacrylonitril, which has a high carbon content and is a synthetic organic fiber. The polymer is spun into very thin filaments to make double knit clothes, and that is the reason it is so popular as a raw material because there are large available stocks plus it can be readily spun. This material is called Pan base. The other raw material is Pitch base using pitch which is by-product of oil refining operations. The majority of materials on the market are Pan based because they have a higher modulus and better Hybrid properties. We stock only Pan based materials.

After the spinning operation, the filaments pass into a very high temperature furnace; in the order of 1900 degrees centigrade. From that point to the gathering of the fibers into a tow after sizing, is the secret part of each company's process. What is not necessarily secret is the fact that the fibers are called carbon fibers up to about a 96% pure carbon composition and true graphitization takes place when the temperature is up much higher, in the order of 23 to 2500 degrees centigrade. The higher the temperature the higher the modulus, but that is accompanied by a decrease in tensile strength. However, the neat part of this is that by controlling certain parameters in the process, many combinations of strength and modulus can be obtained. Some of the materials are available with 450,000 PSI tensile strength and 80 million PSI modulus. These latter are extremely high priced, premium aerospace materials. The ones that we list on the table are the ones that are reasonably priced and available now. It is interesting to note that the Japanese are large producers of carbon fibers and are very, very expert in the production of that product. Some of the major companies in this country are only now committing to production to produce their own carbon fiber and have, in fact, been marketing under their own name, materials made by two different Japanese companies. However high priced they are at the moment, it is inevitable the price will come down as time goes by. The automotive industry is very interested in graphite component materials. The Ford Motor Company carried out a lightweight vehicle program (graphite/ component/weight/summary), and compared to steel they would save an average of 58% in weight for a small car. So, if the automobile people get into the act, as we suspect very strongly they will soon, the price will definitely come down. But back to the fibers themselves. The filaments, as drawn out of the furnace, are roughly 13 microns in diameter. A glance at our definitions will tell you how big a micron is, and 13 microns are about 1/4th the thickness of the paper this is printed on. So you can see that they are really small. The tow that we offer is about as thin as this paper and about an inch wide contains 40,000 filaments. Again, the yarn, strands, and roving are available and fabric is available, too. Once again there are separate weavers and prepreggers who get into the act and the same thing applies here as applied to Kevlar and glass. We are really not interested in prepreg. All carbon filaments are sized to keep them in some semblance of tow and tape form or we couldn't handle them.

As to hobby use, carbon fibers simply blow your mind! They impart such incredible strength and stiffness to a piece of punky soft balsa [as well as polyurethane or polystyrene foam, too] that it has to be seen to be believed. And at such a minimum weight!...Again, we'll show you all this in the next installment. But, check the table again and take a look at the strength values and the weight that accompanies it. This is super material and, in our opinion, the best by far of the composite materials available today. Its use in aircraft is also mind boggling. The wing skin of the McDonald-Douglas AV-88 Advance Harrier is the largest graphite epoxy composite ever built for an aircraft. It has 121 square feet of area and it's all laminated from .01 thick graphite epoxy composite. The speed brake on the F15 is also a graphite composite. A support truss for a satellite launched in 1974 was one of the early major composite structures launched into space. This truss was a large tubular frame 14-1/2 feet long connecting the earth viewing module to the parabolic antenna. It consisted of 8 graphite epoxy tubes that weigh less than 8 pounds each but can withstand compression loadings of 20,000 pounds. Using this material saved 50% over a comparable aluminum structure and the thermal expansion was less than .01 inches. Aluminum would have changed .75 inches! Boeing, McDonald-Douglas, Lockheed, Bell, and just about everybody is using it somewhere.

Probably the most dramatic use of it is the new Learfan aircraft with which I'm sure you're familiar. The entire airplane including the fuselage, the wings, the frame, the tail finds, and the controls surfaces are all made of carbon fiber composites. Even the seats are carbon fiber. This airplane can carry more fuel (1700 pounds), than the weight of the carbon fiber used to fabricate it. We carry this very same material in stock.

We've covered a lot of ground so far, and I hope you are still with us. This is the boring part, learning all about the materials. It is very important to realize that the only way we can utilize the high strength and light weight of these new materials is to use it with a suitable resin. Unless the resin will bond properly to the materials we build with, and unless the resin will bond equally well to the composite material, we will never realize the advantages they offer. Fortunately, we have spent a great deal of time developing proper sizing for the fiber products that require it, to make them compatible

Continued on Page 16

Datsun-Compton Grand Prix Results

The Datsun-Compton Grand Prix was held on 2 August 1981 with eight streamline vehicles competing. The race was videotaped for the YOU ASKED FOR IT show and should air sometime in November. The race was six laps around an industrial complex, about nine miles. Greg Johnson's winning time was 20 minutes and 8 seconds in temperatures approaching 100 degrees.

PLACE	VEHICLE/RIDER
1	Greg Johnson
2	Vector/Ron Skarin
3	Ken Grant
4	Greg Fleishman
5	Dan Egger

Did Not Finish:

Vector/Clark Roberts
Peter Landon
Red Shift/Jeff Kress

1982 Speed Champs Location

Almost a year ago we got the bad news: Ontario Motor Speedway, where we held the 3rd, 4th, 5th and 6th Speed Championships, was sold to Chevron. Goodbye Ontario, hello tract homes & shopping centers. As you all know, we held the 7th IHPSC at the L.A. County Fairgrounds. It looked perfect, a little short, but easy to get around, and with a super road race course, not to mention an incredibly cooperative and hard-working Marketing Staff. Sadly, a survey showed that the 200-meter course (the drag strip) was downhill over one percent — 2/3 of a percent [8 inches per 100 ft] is the max allowed, uphill or down — which made the course ineligible for World Records.

So, we're looking for a new location. We're putting out feelers here and there, but a few people can think of just so many places. Do you have a reasonable idea? Well, if you do, get out there and take a couple of snapshots with your polaroid, and send them to our new President, Lynn Tobias. This sounds like a contest, but it isn't. The IHPVA is *your* organization and the Speed Championships is *your* event. So, maybe you've had a place in mind we haven't thought of. If so, we sure would like to hear about it.

(British View, con't from Pg. 1)

We have three machines which would like to make an attempt on the world record, as all are convinced that they can exceed 60 mph. Could I be official observer for such an attempt? I have all the criteria, and we would have everything properly and correctly certified. Unfortunately Frank Whitt will not be able to be an observer, as during the time that we were away he had a rather bad stroke, and is now in hospital, almost completely paralysed, though I gather with his mental faculties unimpaired. It is very sad. I am sure that if Chester Kyle or any other of the people that he has been in touch with in America would be able to write to him, he would love to hear from them. Letters to his home will be taken on to him by his sister. Bettina and I are going to visit him tomorrow evening.

As I was saying we would aim at a record attempt early in July at an Air Force Station near Newbury, and we would have full electronic timing. We would aim to be there for a whole week end so as to be able to take advantage of still conditions.

Particularly on the second day, the atmosphere was very good, and that is something that you should not lose, although I wonder whether a bit more control over the spectators might not be exercised in the interest of safety. I would never dare organize an event in which the public could stroll so freely over the course, and indeed I saw a couple of near accidents which might have been really dangerous. We have to exercise a great deal more control both because we have more people and because we are in trust for somebody else's money.

I hope that you can find somewhere better than the Los Angeles County Fairgrounds for next year. It is so uncompromisingly hostile as a site that nothing you do there will ever send crowds away happy. And I do hope that you succeed in finding a sponsor who will put up enough money to enable you to have a couple of paid staff working for six months or so before the event. It will make all the difference, and make your task at least possible.

Well that's our thoughts for now. I hope that they are a little constructive, and I look forward to seeing

Yours,
Peter Selby
Director,
Crown International
Productions Ltd.
London, England

By the time you read this, The IHPVA will have signed a contract with Jacki Lapin & Associates — a Public Relations and Marketing firm specializing in sports events — to represent us to potential sponsors. We feel this move is necessary to insure good, reliable relations with all future sponsors.

T-SHIRTS

3-color design

At least two of our members,

Dr. L. Daniel Metz
San Luis Obispo, CA

Phillip Ginolfi, Bolinas, CA

ordered and paid for t-shirts before last May's event. Expecting to be there, they paid no postage and I still have their shirts.

Please contact me, guys, so we can arrange for you to get what you paid for.

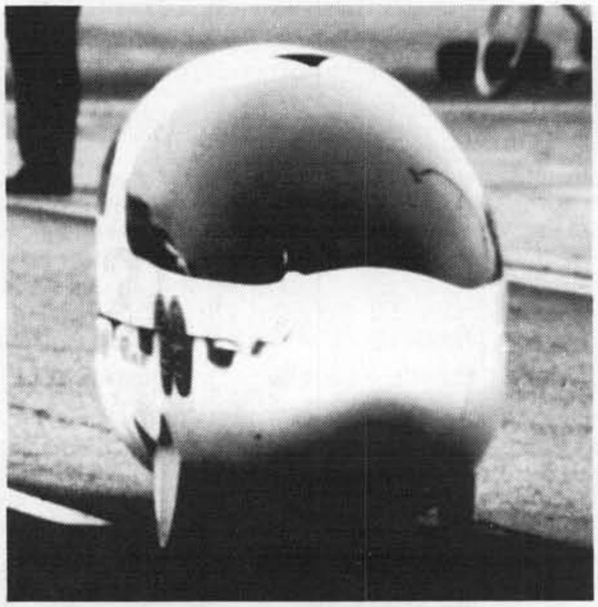
(PS. there are still some shirts available to those who are interested. They are 100% cotton "Russell Athletics", sizes M (38 - 40); LG (42-44); and XLG (44-46+). Sorry, no smalls. Yes, Virginia, they will shrink (over 5%) in hot water or hot dryer (about 1% in cold wash, drip-dry). Colors: black, grey (35/65 poly-cotton), light blue, royal blue, maroon and yellow.

IHPVA T-SHIRTS
c/o Dick Hargrave
7301 Lennox Ave., E-9
Van Nuys, CA 91405

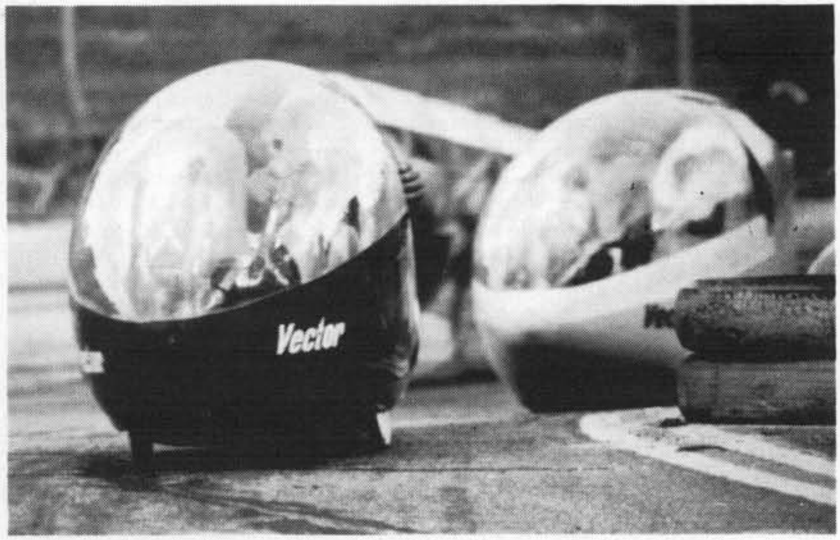
Price is $5.00 each + $1.50 postage and handling*, unless you want to pick them up personally and save the buck-and-a-half. Use address above).

**for more than one shirt on the same order/address, $1.00 for each additional shirt will be okay.*

MORE PHOTOS...

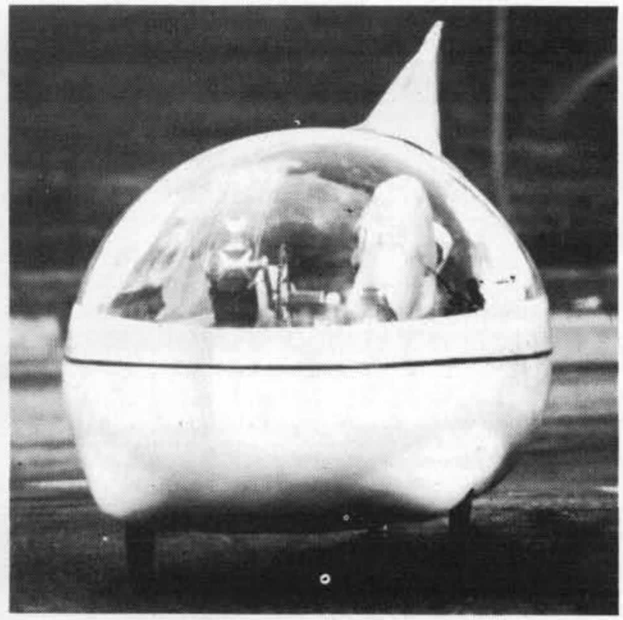


Static Performance Winner No. 69 "Phoenix" showing off nice lines and beautifully formed brown-tinted canopy.



That funny shape in between Vector No. 24 and Vector No. 49 is Greg Johnson (San Diego, CA) riding his own Vehicle, No. 46 (see pg. 9) during the Rolling Start Road Race No. 4. Even though Greg's fairing is much less sophisticated than Vector's and Greg is not a licensed bike racer, he stayed right on their tails until he damaged it in the 8th lap (of 10).

Eric "The Ice-Man" Heiden, Olympic Gold Medal(s) winner, poses with Vehicle No. 6, David Weiner's Carbon Fiber Composite (Frame) trike.



"Red Shift" No. 3 from the front.

Greg Johnson (L) and Vector (M) about to pass 53 (R), (the arms-only streamliner) during one of the weekend's road races.

John Howard, 1981 Triathalon winner, in Dave Weiner's other vehicle (No. 5). John did not run due to illness.

(Composites, con't)

with the resin systems used in the hobby industry. Since we have accomplished this sort of thing, we can start the type of construction which is called Hybrid. Hybrid techniques can yield terrific products. For example, the combination of carbon fiber and glass increases the fatigue strength of a laminate, the impact strength, and the overall stiffness. So, the inner combination of carbon fibers, Kevlar, and various types of glass in a resin system can make a very large difference in the end results. We'll cover that sort of thing in the next article as well as getting down to actual tests on spars and other parts. Before we get off the subject of advance composites, you may be wondering why we didn't involve titanium and boron in this article. The reason is simply that the costs of these materials are extremely high and while they are used on the F14, F15, and F16 aircraft to name just a few, they are 12 to 15 times as expensive as carbon fiber and carbon fiber is 20 times as expensive as glass. Titanium is a special metal which you can look up in any metals book. It is simply a super strong lightweight material generally regarded as having the strength of steel and the weight of aluminum.

Boron is another story. Filaments are made in continuous form by decomposing boron and trichloride and depositing the elemental boron on thin tungsten wire. High and uniform modulus and tensile strength are attainable with a tensile modulus of 555 to 58 million PSI as an average and a tensile strength of about 530,000 PSI average. They are available in 2, 4, 5.6, and 8 mil diameter filaments. Recently, a less expensive boron-on-carbon filament with lower tensile strength and modules has been developed, but these materials are simply way too expensive and virtually impossible to get as far as we're concerned. Well that's about it for now guys, and next time we'll get into the good stuff. Any questions, please write and include a SASE.

We would like to acknowledge: Owens-Corning Fiberglass Corporation, The Celanese Corporation, Hercules, DuPont, Fiberite, Narmco, Hexcell, Gentex, Merlin, Toray and Toho Beslon on of Japan.

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(New Officers, from Pg. 3)

We need quite a bit of professional assistance in this area and we certainly have nothing to lose by using this offered representation. Other topics discussed were Dr. Abbot's Human Power Symposium. This Newsletter, location of the next race (which must be decided well in advance of the Championships), and timing equipment. As most of our competitors know, our timing equipment has, on occasion, failed, negating someone's run. Very frustrating. It was proposed that (a) a private individual (not named) provide alledgedly reliable home-made equipment and (b) that a major time piece manufacturer be offered the opportunity to gain publicity by providing accurate, large read-out equipment. Also, it was brought up that the ASME may set up their own speed championships because (the rumor is) the IHPVA has snubbed the ASME. Let it be said here that if such feelings do in fact exist, it is the wish of all members to resolve any problems, forthwith. In closing, Dr. Kyle showed slides from the 2nd British Speed Challenge held in Brighton, England, Sept. 5 & 6, 1981. The next open meeting will be announced by mail. Any questions, inquiries, or corrections to these minutes should be addressed to: Lynn Tobias, President, IHPVA.

HUMAN POWER

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Except as noted, all photos courtesy of Yiorgos Naoum, P. O. Box 1220, Arcadia, CA 91006 (213) 447-1572

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