F.V.E.A.A. NEWSLETTER

May 1992

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NEXT MEETING

May 15th @ 7:30
College of Dupage
Student Resource Center
Room 1046
Use Lambert Rd. Entrance, Lot 7 at the Southeast corner of 22nd & Lambert
Nonmembers are always welcome!

MEETING TOPIC

Member Carl Chapman will present video and slides of the Solar and Electric 500 race that took place Phoenix on April 24th, 25th, and 26th. Carl attended all three days of the race and obtained video tape footage of the accident panic that occured on the last day of racing. We'd like to thank Lawrence Hudson, Ph.D. of the N.Y. state Energy Research and Development Authority for the use of his video tape footage.

FOX VALLEY 17:00 05/13/92 #2

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Fox Valley Electric Auto Association
336 McKee Street
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First Class

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PREZSEZ

This past month has proven to be the most interesting four weeks I have ever experienced in covering the electric vehicle industry. The Phoenix 500 has started off the racing season with a literal bang. Unfortunately the events that occurred are overshadowing the real strides that were made.

In this months newsletter I have included an article that I wrote for Joe Stevenson's Solar Mind publication. I was asked to cover the race for Solar Mind, but did not predict what ended up happening. I didn't see the accident that I write about in this article, but had a series of interesting and educational conversations following the event.

After hearing of the accident I had lengthy conversations with Joe Stevenson, member Carl Chapman, Ernie Holden (the organizer of the event), James Worden of Solectria, Anita Rajan of Solectria, Phillip Idler of Johnson Controls, respiratory specialists Dr. Ivan Shipiro and Marc Debow, as well as a number of people who were there at the time.

What turned out to be allot of bad press with headlines like **15 stricken at electric-car race**, should have been good press with headlines like **The Battle of the Battery Technologies**, or **Milestones in Battery Technology Demonstrated.** One good side effect of the accident is the greater attention to safety that will inevitably take place. This is not to implied that safety was lax, just that safety is never a bad thing.

I have also included the article that appeared in the Arizona Republic the following day, compliments of member Carl Chapman. This will give you an idea of the hysteria that occurred on rumor and the deceiving effect of Bromine gas. Also you will find the spec sheet supplied by Johnson Controls on their batteries.

Phillip Eidler of Johnson Controls has agreed to drive down from Milwaukee to speak to us about this new prospect for EVs at some future meeting.

I will be helping with the testing of the vehicles for the American Tour de Sol in Albany on the weekend of our next meeting. I will see you in June.

Enjoy,

Douglas F. Marsh
President

Minutes of April 17th FVEAA Meeting

The meeting at Marsh Products, 336 McKee Street in Batavia was called to order by President Marsh at 7:42 PM. There were 18 members and 5 guests attending. Meeting location was changed due to holiday closure by the College of Dupage.

President Marsh noted he will be attending the Phoenix 500 the last week in April. he also asked if any members could volunteer to work at the American Tour de Sol May 17-23. He circulated a newsletter on 3-wheel vehicles published by Paul Esterle, Box 3213 Bristol, TN 37625. He also asked for an OK to procure a FVEAA Banner which has been previously authorized by the membership.

Tom Spicer from the Electric Engineering and Computer Science School at the University of Illinois-Chicago gave a presentation on the solar vehicle project by students at the institution. Construction of this car has been underway since 1989 and it competed in last year's Tour de Sol.

The project has received about $10,000 in corporate support but more is needed to make improvements. The car weighs 800 pounds, has a 37 lb Clark series-wound motor, an array output of 96 volts, 5 amps, and 4 Die-Hard 12-volt batteries. A few improvements are planned before it competes in this year's event. An Australian-made "power point tracker" will be added, weight reduced, and they hope to add regenerative braking. Members offered suggestions on modifications. Information may be FAXED to Tom at (312) 413-0024. he particularly needs info concerning regenerative braking and fiberglass body construction.

Member Dick Marsh continued the discussion about design requirements for an electric car conversion package. He pointed out that 840 rpm is required of a 24" diameter wheel at 60 mph. The general problem is how an electric motor can best deliver the required torque over the speed range. He suggested use of servo-motor design principles in reaching a solution rather than the controversies of DC vs AC, series or shunt wound motors, system voltages and other parameters which are usually considered. He pointed out advantages of the MOSFET, particularly in an H-Bridge depending on voltage requirements. Discussion concluded with consideration of the need for differentials, gearing and other elements found in a conventional car power train.

The meeting was adjourned at 10:45 and followed by a tour of Marsh Products facility.

Submitted by,

William H. Shafer
Secretary

The Phoenix 500:
A Touch of Panic in the battle of the batteries

By
Douglas F. Marsh

This years Solar & Electric 500 in Phoenix Arizona should have been marked as "The Battle of the batteries", when instead it ended in unnecessary panic. Understandable panic, but unnecessary. The vehicle entry from Solectria leaked fluid which overwelmed the driver and caused panic amoungst spectators.

Last year's Solar & Electric 500 race was highlighted by DEMI's Zinc/Air battery powered Honda that far out performed every entry. The second place finisher was Solectria's "Force", a Geo Metro conversion of James Worden's engineering powered by NiCads. Back this year, with a serious challenge, Solectria powered "the Force" with an experimental battery pack by Johnson Controls, using Zinc/Bromine. However, this promising technology brought to light a different focus. One of concern about safety and not one of excitement over a possible solution to EVs biggest down falls, the power source.

During the final day of racing, Solectria's Zinc/Bromine vehicle had lapped all other vehicles by 5, averaging 86 mph. On the 91st lap the panic occurred when a recirculating tube came loose leaking bromine solution onto track and into the vehicle. Due to the 102 degree heat of the day the vehicle and track temperature was great enough to cause the bromine fluid to flash into a gas vapor. Bromine, in its gas form appears as a thick brown cloud and has a noxious odor. This caused a great deal of panic as a few spectators announced the vehicle would explode. Rumors quickly circulated that James Worden, the driver, was in critical condition and that large holes were burned in the track from the bromine solution. It appeared as though rumors were going to affect sponsorship and possible bring an end to the annual EV race.

When the rumor cloud dissipated and panic subsided, the reality surfaced. James Worden was partially incapacitated by the vapors but was able to maneuver the car to a stop off the track. He was flown to the near by hospital for observation and was released a few days later. Solectria President, Anita Rajan said that Jim is fine and is back to work. Fourteen others who were exposed and fearing the unknown, arrived at the hospital to be checked. They were all treated and released the same day.

As for the track, no permanent damage was caused and the Bromine was easily cleaned up using baking soda and water. Bromine gas is similar to Chlorine when inhaled in that it restricts the bronchial tubes of the lungs and can be fatal in large enough quantities, but usually only causes temporary asthma and a bronchial cough in the worst cases, resulting in no long term effects. According to Solectria, James Worden is not experiencing any of these symptoms. The only long term affect that has occurred is the greater attention toward safety that will inevitably take place. However, it is not likely that any race official would have been able to anticipate the problem that Solectria experienced.

This was not the kind of attention that Solectria, Johnson Controls, the Solar & Electric Racing Association, or even the EV industry had intended for this event. Johnson Controls, the largest manufacturer of automotive batteries in North America, feels that zinc/bromine batteries are the next step beyond Lead Acid. According to Phillip Eidler, of JC's Advanced Battery Group, Zinc/Bromine has 2 to 3 times the energy capacity (70-80 Wh/kg) of lead acid, will cost about the same when produced in quantity, and is one of the most environmentally safe battery technologies available. Anita Rajan points out that even after 91 laps on 1 1/4 mile track, averaging 86 mph, the battery still had 2/3rds of its potential energy remaining.

In addition to its high energy to weight ratio zinc/bromine batteries offer a number of other major advantages. It can be manufactured to any voltage and can be placed and distributed anywhere within a vehicle. The battery casing itself is made of a High Density Polyethylene which is easily separated from the zinc and both materials are readily recycled. The Bromine electrolyte is reusable. When the battery reaches the end of its life the electrolyte can be pumped into the new battery casing, eliminating the need for disposal of the electrolyte. All elements of the battery are inexpensive and easily attainable.

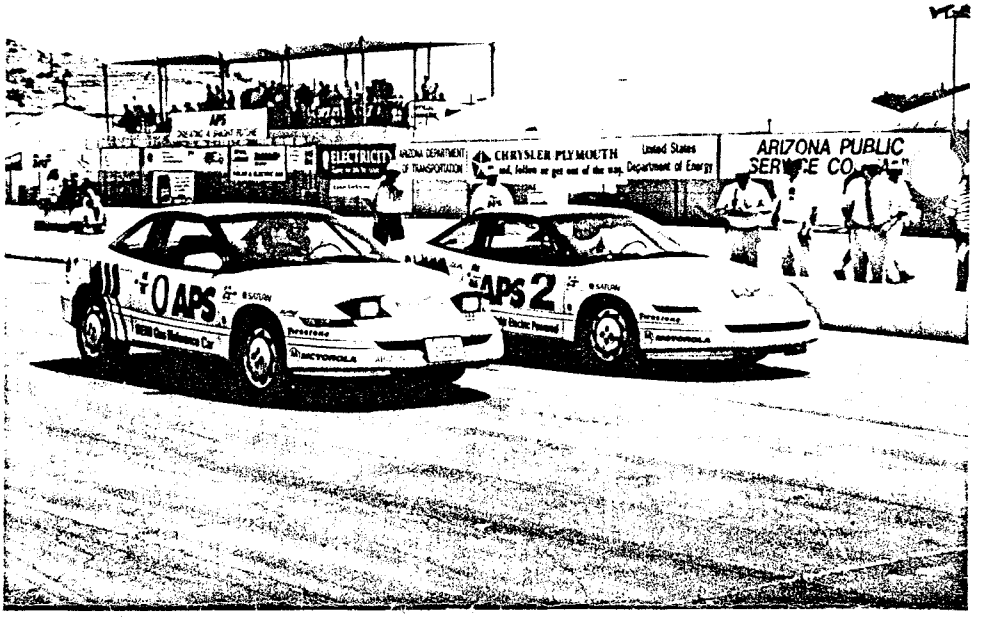
Despite the incident in Phoenix, Johnson Controls is moving forward with development. They feel they can eliminate the potential for such accidents, by developing containment that is safer then gasoline storage. However, they have withdrawn from racing until the problems are resolved. This includes their entry in the American Tour de Sol this May.

Solectria finished 1st, 3rd and 4th, with their Zinc/Bromine, NiCad and Lead Acid entries respectively. Demi with their Zinc Air batteries finished 8th and 9th.

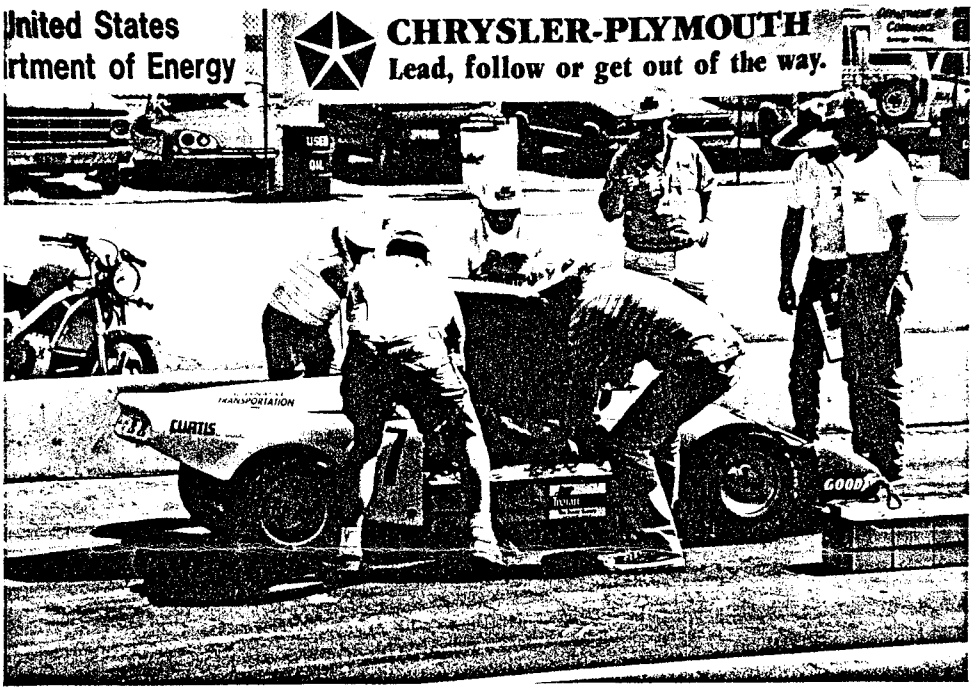
Perhaps the most exciting aspect of the race is not the actual racing itself but the creative solutions used to get the advantage. Unlike other automotive races, no two vehicles are alike. This is where electric vehicle engineers become artists.

This year, for the first time, battery exchange was allowed in the open competition. This clearly proved to be effective for Michael Hackelman's team which performed exchanges in the pit in less than 15 seconds. The modified Formula 440 vehicle, driven by Ely Schless, finished 2 laps ahead of the electric Midget car driven by Billy Roe. Both vehicles driven by competeing lead-acid battery manufacturers, Trojan and Exide respectively. Even though electric vehicle racing appears to be new and ground breaking, the drivers of the vehicles are not necessarily new to the track. Gene Cosmano, better known as Mr. X, is a former dragster driver, Eloy Grand Prix champion, and driver in NASCAR stocks. Bill Cheesbourg, veteran of 6 Indy 500's, was the driver of an '81 VW Dasher entry in the Electric Stock 200, and 5 year Indy 500 driver Jeff MacPherson drove the gas-powered 1992 Saturn that was challenged daily by a DEMI Zinc/Air powered Saturn. The electric Saturn was unable to beat the gas challenger but was a serious contender, finishing only a cars length behind on the final two days.

Despite the impressive entry list for the electric stocks there was a weak turn out for solar vehicles. Cal-Poly, Arizona State and Larry Mauro were the only entries. M.I.T. returned this year, but with an open class vehicle instead. The poor turn out of solar vehicles is largely due to the more established Tour de Sol race in New England that occurs only a few weeks later. This Albany to Boston race has proven to be the testing grounds for the larger U.S. Sunrayce and the Australian World Solar Challenge. Both races are for Solar vehicles only.



Gasoline vs. Electric. DEMI's Zinc/Air battery powered Saturn #2 challenged a stock gasoline powered Saturn #0 daily. The electric version never beat the gas version, but proved its force averaging 84.31 mph. The gasoline reference vehicle was driven by former Indy driver Jeff MacPherson and challenged by Chris Smith.



Hackleman and Schless performing their battery exchange in under 15 seconds. The Formula 440 vehicle with driver Ely Schless clocked laps of 80 mph and finished 2 laps ahead of Billy Roe in the electric midget car.

Tom Story/The Arizona Republic

A pit crew changes batteries in Ely Schless' car at the Solar & Electric 500. Schless eked out a win in the main event Sunday.

15 stricken at electric-car race

Battery leak causes poisonous fumes, driver in serious condition

By Steve Yozwiak
The Arizona Republic

A driver and 14 other people were hospitalized Sunday after inhaling fumes from a leaking battery in an electric car competing at Phoenix International Raceway.

A stock-car competition in Arizona Public Service Co.'s Solar & Electric 500 was stopped shortly before 5 p.m. Sunday after a malfunction caused a battery to leak in the car driven by James Worden, 25, of Arlington, Mass., and sponsored by Solectria.

Zinc bromide then spread across the track, creating poisonous fumes that sent Worden to Good Samaritan Regional Medical Center and melting portions of the blacktop.

Although Worden was in serious condition Sunday night, he was "awake and alert, and following commands," hospital spokesman Dan Richards said.

Fourteen track officials and race-team members also were taken to the hospital for treatment of gas inhalation. Twelve had been released by 9:30 p.m., Richards said.

The symptoms of bromide inhalation are tightness in the chest and shortness of breath, he said.

None of the nearly 200 spectators in the stands was injured.

Despite the accident, Worden, who had been leading the race through 91 laps, was declared the winner. The cause of the battery leak was unknown Sunday night.

The accident was preceded by one Saturday in which a car sponsored by Arizona State University blew a tire and hit a wall on the front straightaway. The car was going less than 10 mph and received only slight damage.

The accidents were the only ones in the three-day event that was marked mainly by an

Jeff Topping/Special for The Arizona Republic

James Worden is evacuated from Phoenix International Raceway after a battery leak in the electric car he was driving created poisonous fumes. Worden was hospitalized in serious condition Sunday.

But quieter engines did not lessen the action. An open competition Sunday between Chandler's Billy Roe and Ely Schless of North Hollywood, Calif., was the fiercest.

"We've been in very tight competition all our lives," said Rick Godber, a spokesman for Trojan Battery Co., whose batteries powered Schless' car. Exide batteries powered Roe's. The companies were co-sponsors of the vehicles.

For most of the 90-minute main event, a

of size or design, is the world's fastest, Roe and Schless were neck and neck.

Roe's car, which looked like a midget racer, was faster, hitting speeds of 95 mph.

But, Schless' car, with a lightweight composite body sculpted to fit over its electrical components, was more efficient.

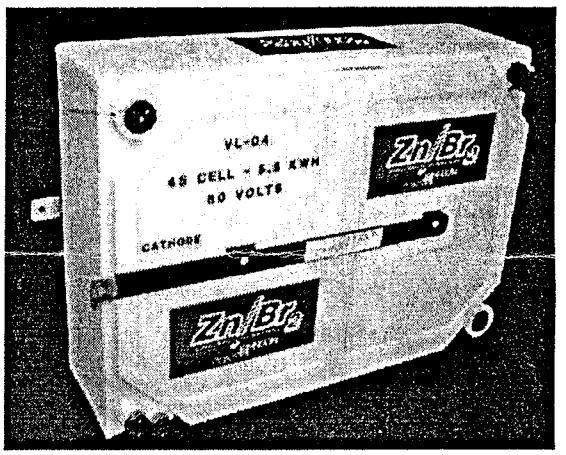
With just minutes to go, Roe's car lost a rack of four of its 10 batteries on the back straightaway, allowing Schless to win with 104

ZINC BROMINE BATTERY SPECIFICATIONS

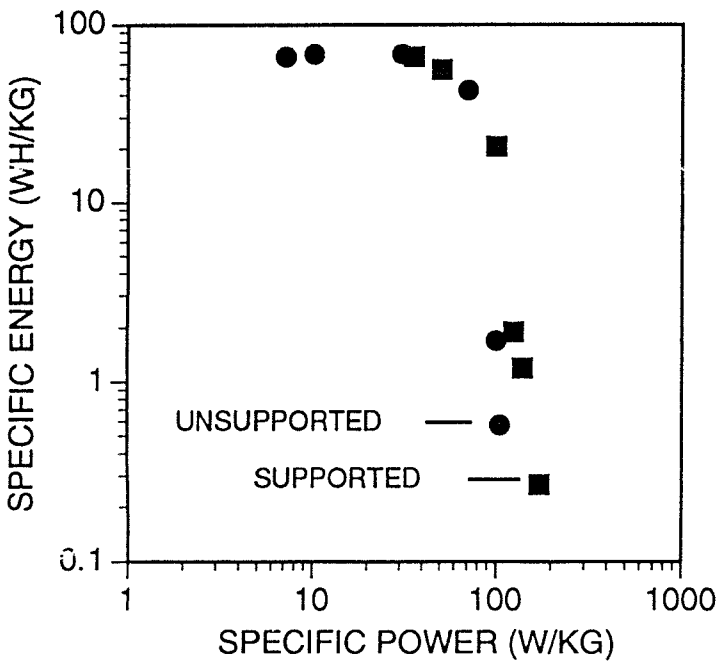
JOHNSON CONTROLS
Battery Group

INTRODUCTION

Johnson Controls Battery Group, Inc. is developing Zinc/Bromine battery technology for use in electric vehicles, and for electric utility load leveling. The new technology gives from 2-3 times the energy storage (70-80 Wh/kg) of existing lead/acid batteries, and is capable of power densities as high as 200 W/kg. The battery has deep discharge capabilities, rapid rechargeability, and a potentially long cycle life. The electrolyte (which is re-useable) is circulated to reduce self-discharge of the battery, and to simplify thermal management of the system. The battery operates at room temperature, consists of nearly all plastic parts, and uses conventional molding and joining processes for construction. This system's low cost, recyclability, and near term availability make it attractive for a variety of applications.



ZINC BROMINE BATTERY SUSTAINED POWER DISCHARGE



CHARACTERISTICS

APPLICATION	HIGH SPECIFIC POWER	HIGH SPECIFIC ENERGY	HIGH ENERGY EFFICIENCY
SYSTEM SIZE	30 kWh	30 kWh	30 kWh
ELECTROLYTE UTILIZATION	90%	90%	80%
PEAK POWER* (100% SOC)	171 W/kg	126 W/kg	94 W/kg
PEAK POWER* (80% DOD)	85 W/kg	64 W/kg	48 W/kg
SPECIFIC ENERGY	81 Wh/kg	83 Wh/kg	62 Wh/kg
ENERGY EFFICIENCY	71%	72%	78%

* POWER SUSTAINED FOR 20 SECONDS TO 1.07 VOLTS/CELL CUT-OFF

Tidbits

Some interesting facts about some of our entrants...

Louie Meyer is perhaps the greatest statesman of American auto racing. He was the first three-time Indy 500 winner, was part owner of the Meyer-Drake Offenhauser company, whose famed "OFFY" engines won dozens more Indy 500's.

Mary Ann Chapman (Open Competition) is a former SCCA road race driver.

Tom Brawner's electric midget is believed to be the world's first electric midget. Tom is a cousin of the late Clint Brawner, famed USAC and CART chief mechanic and worked on Clint's ing crew. Tom built the electric midget in the same Phoenix garage where Clint built Mario Andretti's 1969 Indy 500 winning race car.

Gene Cosmano is a former 270+ mph dragster driver, former Arizona Sprint Buggy Champion and Eloy Grand Prix winner.

Tim Considine, driver of the Michael Hackleman entry in the Chrysler-Plymouth Electric Stock 200, is former star of TV's "My Three Sons" and currently writes for Autoweek Magazine.

Bill Cheesbourg, who will drive the Burkhardt Turbine entry, is a veteran of six Indy 600's.

Solar Electric/Sol Solutions was the builder of the car featured in the movie, "Naked Gun 2 1/2."

All of **Gary Jackson**'s pit crew are PhD fusion physicists.

Nine-time Indy 500 driver **Emil Andres** will steer the Keith Vogelsang Open Competition entry.

Steve Pombo is from the il-known California Pombo racing family.

Larry Mauro, one of the Solar Division competitors, built the world's first solar-powered airplane.

Southern California Edison (SCE) and the South Coast Air Quality Management District (AQMD) have announced plans for the construction of a revolutionary solar-powered electric vehicle recharging station.

The facility will be located in Diamond Bar, Califomia, and will serve as a prototype for future solar powered installations in the parking lots of shopping malls and businesses throughout Southem Califomia. Land once limited to parking purposes can now be used to generate clean, solar electricity.

When fully operational next year, the recharging station will provide emission-free recharging of electric vehicles over the course of a typical work day, even during winter months. Solar electricity generated when vehicles are not plugged in will be fed back into the building's grid. In addition, carport shade will minimize cooling requirements for EV's during the summer months.

Top Russian Electric Vehicle Team Involved in APS '500'

In February, 1992, SERA officials Carol Holden, Perry Edwards and Ernie Holden met with three Russian government representatives who were in Scottsdale as guests of the World Affairs Council. SERA invited the Russians to visit the 1992 APS Solar and Electric 500 and to be involved, if they could. The Russian representatives carried a SERA's written invitation back to their home country. Soon, they wrote back, stating, in part; "We gratefully accept your invitation...we look forward with great interest to learning about your achievements in solar and electric vehicles, especially since conversion of our space industry makes this a most opportune time to begin to look seriously at these ideas...we will bring with us various concrete business propositions, and we hope to...collaborate with American companies".

Through March and early April, negotiations continued via fax and late night phone calls. (St. Petersburg is ten hours ahead of Phoenix, so an 11 P.M. Phoenix call reaches Russia at 9 A.M.) The following two top executives from the Russian electric vehicle industry were chosen. Vladimir Novikov, chairman of the board of the joint stock company, "Delosa", and a member of the editorial staff "St. Petersburg vedomosty", and Vladimir N. Leonov, director of the NPO "Instochnik", Accumulator (battery) Institute.

Arizona's Mt. View High School enthusiastically offered to let the 37 year old Novikov drive their entry and he accepted. A donation to the Solar and Electric Education Foundation provided plane fares for the pair, and their VISA's were approved April 8.

The Russian delegation has already offered to reciprocate and have begun discussions with SERA to organize a major event in Russia.

And, **Scott Cornell** reports that his wife, Anna, has not driven a gas powered car in over 5 years. She drives only her electric VW Rabbit.

DAF Electric Car Facts (DAFACTS)

By William Shafer

The following handout was prepared in connection with exhibiting my DAF in Oak Park on April 26, 1992, the 22nd anniversary of Earth Day.

The DAF was manufactured in Einhoven, Holland with a 746 cc, 2-cylinder, air-cooled engine. The car was very useful in that country due to its small size, light weight, and fuel economy. It was imported in 1973 for $700 and driven a total of 44187 miles prior to being recycled and repowered for electric drive in 1976.

The original conversion utilized a speed control system using a series of relays to supply 12, 24, or 36 volts to the DC drive motor from 6 golf cart batteries suitable for deep-discharge service. Conversion required about 4 months of effort after regular working hours. No special tools were needed, but outside machine shop and welding services were utilized. This design provided a top speed of 27 mph and sluggish acceleration. After driving the car for 8911 miles, the electrical system was upgraded in 1988 to improve performance and the body refurbished.

The car presently has a 48-volt system provided by 8 batteries. Four are mounted over the front axle and 4 over the rear wheels to provide proper weight distribution of the battery pack which weighs 526 lbs. The original curb weight of the DAF was 1454 lb. The conversion weighs 1989 lb.

The motor is a "surplus" aircraft generator rated at 28 volts, 400 amps, 15 horsepower. Because it was manufactured to military requirements, it can easily operate at 48 volts. The motor is directly coupled to the car's original driveshaft after removing the original engine. The motor was purchased for $38 in 1974.

Speed control is provided by an electronic device that regulates the battery voltage applied to the motor. The power transistor controller, designed and built by members of the FOX VALLEY ELECTRIC AUTO ASSOCIATION (FVEAA) cost $650.

The new system provides a top speed of 35 mph, the limit on any Oak Park street. It also provides aceleration that can keep up with Oak Park traffic. The car has been driven 2663 miles since upgrading in 1988 with an average energy consumption of 0.5 kwh/mile.

The car can travel about 20 miles on a single charge. Range is not a problem because almost everything I wish to buy is within 5 miles of home. Recharging the battery takes place when the car is in the garage. It takes about 20 seconds to plug in the battery charger located in the trunk. At present rates, electricity use amounts to 3.3 cents per mile of driving. Commonwealth Edison electricity last year was 78% supplied nuclear fuel.

Total project cost was $3150, including the original car cost and the 1988 upgrading. Sixteen years of experience has provided data showing the car's operating cost to be 37.1 cents per mile:

Battery replacement every 4 years	15.0 cents/mile
Insurance	12.5
Miscelleaneous (License, tires, etc)	6.3
Electricity	3.3

Depreciation has been an additional 19.3 cents per mile. Annual cost has been $392, far below the 1991 Chicago average of $5820 for a conventional car.

The car has been proven to be a useful URBAN TRANSPORTATION. When the weather is nice, I walk or take my bicycle; when it is bad or if I have packages to carry I take the electric. For trips around the Chicago area, we use our compact car. For longer trips the "Boulevard Barge" is available. The car has proven to be a life extender for our conventional cars because they are no longer used for short trips that cause periodic tune-ups and reduce engine life due to cold starts.

Sanyo's Solar Car Runs at Night

Reprinted from R&D Magazine
April 1992

Japan's Sanyo Electric Co. Ltd. has developed a solar hybrid car that also runs in the dark. The car is driven by a nickel-cadmium rechargeable battery that gets its power from an amorphous silcon solar cell when the sun is shining and from a fuel cell when it's not. The solar cell charges the battery fully in six hours, allowing the two-seat car to cruise at 20 to 25 mph for two hours. The fuel cell provides enough electricity to keep the car going for another hour. Sanyo spent $380,000 to develop the vehicle. It hopes to license the technology to carmakers.

Did You Know That...

Extracted from
Solar & Electric 500 Program

The sun is our greatest energy resource, providing the earth with roughly 100,000 times more power than all the utility plants combined. Two days of solar radiation falling on the earth equals the world's total fossil fuel reserves. As we search for ways to displace polluting fuels, the natural energy sources, if properly applied, take on tremendous importance as a cost effective and environmentally sound answer.