IN THIS ISSUE

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Article Submissions

The deadline for articles is the 25th of each month for the next issue of CE. Articles received after this date will be retained for future issues of CE. Contact the editor for more information.

Advertisements

Please refer to Advertising Rate Sheet on back page of CE or contact Susan Hollis, Advertising Manager.

Membership/Address Changes

For information on new membership or change of address, please send your requests to:
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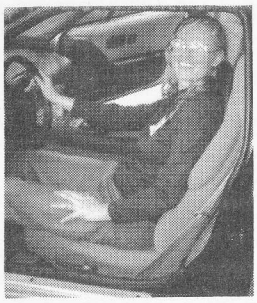
2710 St. Giles Lane
Mountain View, CA 94040



The Greening of CB

Your editor now has a "real" job and it is (gasp!) with EVs.

Will miracles never cease? Your editor now has a "real" job and it is (gasp!) with EVs! I am gainfully employed as an EV Technician/Specialist with Green Motorworks in Hangar 20 at the former Alameda Naval Air Station. Hangar 20 houses the CALSTART Advanced Transportation Hatchery business incubator program. Green Motorworks is handling/supporting the BART station car program and providing the 40 PIVCO Citibees for it. These cars are leased to program participants. Green would like to be able to sell the Citibee here in the US, but the car still has to meet the five-mile-an-hour bumper impact test and needs airbags. We are also trying to persuade PIVCO in Norway to let us manufacture the cars here in Hangar 20. Probably PIVCO would send the parts as kits and the cars would be assembled here.

So what do I do? Mostly stuff on the electrical side. I do everything from replacing plugs on the ends of cords, range-testing cars, diagnosing why chargers won't charge, installing data-loggers in cars (for UC Davis, not Green), giving opinions on air conditioning systems, to troubleshooting controllers. In short, if it's electrical and it breaks or needs modification, I'm the one. I also help Adrian, our mechanical tech, when he removes/installs motors or tests brake systems.

This job has shifted my center of gravity, so to speak, from Santa Cruz more toward Alameda. I still have the residence in Santa Cruz for weekends, but I stay in Alameda during the week. During all these changes, I forgot to pay my phone bill, so my Santa Cruz numbers got disconnected — apologies for all who were trying to get hold of me. That will get fixed. In the meantime, I can be reached at Green Motorworks in Alameda, (510) 521-4300. Also, you can contact me by e-mail, since I have my computer here and have connectivity through America Online. Actually e-mail is probably the best way, because (now that things have settled down) I do check it fairly regularly.

A Long and Winding Road

So how did I get this job? Well the path that led here was rather long and a bit convoluted. It involved #13 (my Porsche) and the fact that she's given me experience with the Electrosource Horizon batteries and associated charging system and Badicheq battery monitoring system (Green has two Citibees with a 120-volt version of the same system that is in the Porsche). Also, there is the fact that Green knew me through my work on CE. It also involved shopping cart racing and my participation in a recent Alameda shopping cart event at Hangar 20. During the event, Fang (my infamous shopping cart racer), decided to undergo spontaneous self-disassembly at high speed and ejected me rather forcibly onto the pavement. A helmet protected my brain from similar self-disassembly, but it was rather shaken up and demanded a short time-out — during which interval I got into conversation with Bob Reese, who is the vehicle service supervisor at Green's Alameda facility. I had previously dropped in to Hangar 20 a few times before to check out what was happening and had casually mentioned to Green that I might be interested in work-

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Membership Dues Increase

At the June 14th EAA Board meeting held in Sacramento, California, the National Board of Directors unanimously approved an increase in membership dues from $35/year to $39/year.

The increase is necessary to keep EAA financially sound. Increased publishing and mailing costs for the EAA EV's Buyer's Guide as well as increased printing and mailing costs for CE, are the reasons for this increase.

The cost of these two publications represent 70% of the EAA budget. An additional 17.5% is rebated to the local chapters.

The board constantly strives to improve the quality of the EAA publications. Improved publications are helping to improve EAA's image and attract new members. We are also increasing our visibility on the Internet. Some of this year's expenses went toward establishing our own web site — www.eaaev.org.

Note that EAA's dues have been $35 for more than ten years despite inflation in all costs.

Honda EV Plus

continued from page 1

wet before being connected, but the contacts do not appear to be open to the elements.

By the way, the Honda 220-volt charger is about 1/6th the size of the GM Magna-Charger, because most of the charging electronics are on board the vehicle. Charge time on 110 Volts is about the same as for the EV1, but on 220, it's about 6-8 hours primarily, I am told, to allow the Ni-MH batteries to cool down.

More like a Minivan?

I know you want to know how it drives, but please humor me just a bit longer. Remember that I mentioned that, from the driver's perspective, it seemed more like a minivan than a regular car? This holds true for the view outside as well as for the interior perception. The seats are higher than the EV1's and they feel completely different — not bad, just different. The view is panoramic, with virtually no blind spots. The car feels a bit narrow at first, although there is actually more lateral seating space per seat than in the EV1; but the wide console of the EV1 is missing, allowing the seats to be placed somewhat closer together. There is supposed to be ample rear seat capacity for two adults, but in trying the seats myself, with my legs together (thanks in all probability to my osteoarthritis), I had the impression that my knees were approaching my chest. It was in fact necessary to spread my knees to relieve that feeling. I am just under 5'8" — so I sincerely believe that my 6 foot+ friends would have a bit more difficulty than I. Therefore, I would judge the seating adequate only for children. Adults can decide for themselves on a case-by-case basis.

From an ergonomic perspective, the EV Plus is in some ways superior to the EV1. The window, heating and air conditioning controls fall easily to hand. For either heat or air, one simply dials in the desired temperature and the car does the rest. The air conditioner is virtually noiseless and will quickly seem freezing if set for too low a temperature. The steering column stalks are a little strange, with the high beam control and turn signal stalk on the left, the windshield on the right and the wheel tilt control beneath and to the left of the column. This, I am told, is to preclude the accidental release of the wheel altitude during normal driving. There is no cruise control in the EV Plus, nor is there a control to turn the regen function ("coast-down") off. It's always on.

The actual driving of the car was, well ... different. I stepped on the accelerator expecting to zoom off like an EV1. Instead, I got pickup reminiscent of my Volvo Diesel with a 4-speed transmission. This is adequate for normal freeway merging, but it leaves little or no room for a misjudgment. The car makes far less noise (whine) than the EV1, which I believe is due to the steel construction and a greater seating distance from the drive mechanism. Steering was not quick, but accurate and predictable. The turning circle of the Honda is several feet greater than the EV1, but the exact specification is not found in any of the currently available literature. The EV1 can make a U-turn on virtually any street in the area. The Honda turns many of the U-turns into K-turns. There was no problem in negotiating city streets or in parking the vehicle. In general, I believe that the public will find the Honda EV Plus a fine general purpose second vehicle suitable for multiperson commutes, if the people aren't too large and the commute not too long.

From a personal point of view, unlike the EV1 in which I immediately felt at home, I did not feel comfortable in the Honda. This is not to say that I could not get used to it, but the EV1 just "felt right" from the first moment I sat in the driver's seat and that feeling has not changed. For the record, my second Honda test drive felt a lot better.

In terms of sophistication and performance, what the Honda lacks in get up and go it gains in the air handling department. But in order to achieve the same mileage as the EV1 gets with lead-acid batteries, the Honda has to use Nickel Metal-Hydride batteries simply because it has all that weight to push around. The sales person indicated that 100 miles per charge was not at all unusual but Honda, like GM prefers to err on the conservative side.

I did a lot of soul searching before making the decision to lease the EV1. After seeing and driving the Honda EV Plus, I wouldn't trade the EV1 for a single day, but I'd definitely consider an EV Plus if I didn't have to part with the EV1.

My thanks to Allison Tozer of Costa Mesa Honda for her courtesy and forthrightness.

By now, you have all probably heard that the lease payments on the EV1 have been reduced by about 25 percent. If anyone was on the fence about leasing the EV1, based on the financial aspect, now's the time to take another look.

Now—how can I test drive a Sparrow for my next article? —GH

Pleasantly Quiet Debut for Honda's Electric Car in Sacramento

Sacramento -- Honda's two-door, four-passenger EV Plus has been well-received in Scaramento, where it is available for lease from Mel Rapton Honda on Fulton Avenue, the only one of four authorized EV Plus dealers in the US that is located outside Los Angeles.

Since May, three of the Hondas have been leased in Sacramento, and another two will be delivered in July, according to Joni Romer, the dealership's electric vehicle specialist.

Honda is offering the EV Plus for a $499/month, three-year lease. The lease includes unlimited mileage, comprehensive and collision insurance, and all maintenance -- including brakes and tires. This is about twice as costly as it is to lease a two-door ICE Honda Civic, but that hasn't seemed to deter people from leasing the EV Plus.

"We're not extremists, but we are concerned about [the environment]," said Sharon Lewis, who with her husband is one of the first Northern Californians to have leased the vehicle.

What Honda hasn't done much of is advertise the EV Plus. Perhaps that will change as California's zero-emissions mandate -- once set for 1998, but now pushed back to 2003 -- approaches.

Honda's manager of market development, Robert Bienenfeld, has advised that Honda will make 300 EV Plus models, considering the project to be an experiment that will test battery reliability and customer satisfaction with electric cars.

HONDA EV PLUS

Length: 13 feet, 3-1/3 inches

Height: 5 feet, 4 inches

Weight: 3,593 pounds

Battery: Nickel-Metal Hydride

Passengers: 4

Drink holders: 4

Top speed: 87 mph

0 to 60 mph: 18.7 seconds

Distance between charges: 125 miles, according to the EPA. Honda recommends keeping it to 60 to 80 miles.

Cars expected to be leased: 300 in the next few years

Cost: Leasing: $499 a month for 3 years, no money down. The lease includes all maintenance, 24-hour roadside assistance and comprehensive and collision insurance.

Charger: About $800, installation not included. (Rewiring a garage for the 220-volt/40 amp circuit charger could cost up to $1,000).

Electricity: The Los Angeles Department of Water and Power says customers eligible for its residential discounted rate will pay about $1 a night to recharge a car.

Features:

- Air conditioning
- Power windows
- Compact disc player
- Dual airbags
- Sunglass holder
- Fold-down backseat

Dealers: Four in California, including two in Los Angeles County
—Miller Honda, 5255 Van Nuys Blvd., Van Nuys
Scott Robinson Honda, 20340 Hawthorne Blvd., Torrance

Source: Los Angeles Daily News Sun, May 11 1997, Copyright 1997, Los Angeles Daily News Sun - Honda Joins Front Line on Electric Revolution

One thing that most people who have driven the EV Plus seem to appreciate is the vehicle's lack of noise, since -- just like other electric vehicles -- the EV Plus is so silent that sounds one doesn't usually hear in an ICE car become apparent.

Honda's engineers have otherwise fashioned the car to be much like their gas-driven products. Aside from the fairly "hi-tech" instrument panel, which has yellow and green lights to keep the driver informed of how the range is holding up, the car appears to be much like Honda's other models. The EV Plus is available in green, silver and brown, and comes equipped with standard air conditioning, a CD player and other amenities.

Source: San Jose Mercury News, San Jose, CA. Copyright 1997

LA Editor Drives Honda EV Plus

Los Angeles Daily News Business Editor Chris J. Parker concluded after driving a Honda EV Plus for a week that the car definitely "reacquaints us with our own lifestyle. But it may take some getting used to." He made that observation after riding with his wife as she made a lane change, flipping on the turn signal as she did so. When he pointed out that the car's multiple bar-type energy reserve indicator showed that she was not driving efficiently, she panicked and became convinced that she was doing something wrong, sucking too much energy from the car. She didn't connect the pressure of her foot on the accelerator with the loss in energy. Instead, Parker noticed, she no longer used the turn signals when driving the car. As he observes, for some people it's going to be a whole new way of life.

Lease Includes Insurance

Your life will be simpler, Honda hopes, when you take your smogmobile (or maybe your bicycle) down to the dealer and fork out $499 a month for an EV Plus lease. The lease includes all maintenance, 24-hour emergency roadside assistance, plus something extra; comprehensive and collision insurance. Having comp and collision covered makes the situation more attractive — for a new car they can be high. Honda figures that those alone are probably worth about $150/month.

Definitely An Interest, But ...

Parker also found out what EAA members already know from driving their conversions; there is definitely an interest among Southern California motorists. "In the seven days I drove an EV Plus", Parker observed, "I averaged two or three rounds of questions a day from curious strangers, plus countless double-takes on the Ventura Freeway. Still, there was the nervous co-worker who was concerned that it might rain while riding in the EV Plus and she might get electrocuted. The general public is obviously still in need of much education about EVs.

Although the Environmental Protection Agency gives the EV Plus 125 miles between charges; Honda recommends 60 to 80 miles, since driving conditions affect energy usage.

Parker commented, "It turns out normal freeway commuting and a sprinkling of congested street traffic don't affect it much at all."

He adds, "I drove up the Conejo Grade near Thousand Oaks, one of the steepest stretches of freeway in Southern California. The EV Plus was faster and more consistent than my truck but slower than my sedan, and by the time I reached the peak of the grade, the EV Plus gauge said I could only go about 12 more miles. Once the road flattened, the distance estimate improved."

"The speedometer is an oversized, digital readout with 6-inch-tall numbers. Those glowing numbers are going to make it very difficult for reckless drivers to say with a straight face to police officers that they didn't know how fast they were going." As an additional dis-incentive to lead-footing the car, the Honda's pleasant hum turns to a loud whine at speeds over 55 mph.

Built-in Conscience

The energy capacity display also shows not only the normal expected reserve, but the reduction in reserve caused by inefficient driving. This car comes with a conscience — you don't even have to use yours. The flaring yellow edges on the otherwise placid green bars give backseat drivers just the right incentive to hound you for energy wastage, making you lighten up on the pedal.

A charger at home and at the office lightened Parker's concerns about range, although most EV Plus lesees will have only the home charger. As GM does with the EV1, Honda will match the customer's needs to the capacity of the vehicle.

According to Robert J. Bienenfeld, American Honda's marketing manager, "It takes a special kind of person."So if you're that special kind of person, and most EAA members are, take Chris Parker's advice and take it for a spin. —CB

So what did Parker have to say about the new Honda?

"The EV Plus is a remarkable electric vehicle and a good automobile, too."

"The overwhelming feature of the passenger compartment is its dashboard, which looks like it was pulled out of Luke Skywalker's X-Wing fighter."

"How does it do on the Valley floor with air conditioning running full-blast? No problem. It played CDs while it kept the passenger compartment a brisk 69 degrees."

"...in an underground parking garage - where cement posts and speed bumps keep speeds down and create an in-and-out, left-and-right kind of drive - the EV Plus feels like a Fantasyland carnival ride (Sleeping Beauty, maybe, without the scary witch popping out from behind the rock)."

Clinton's Decision on New Clean-Air Standards May Boost EVs

May 25, 1997 — In choosing to side with environmentalists over big business and endorsing new federal clean-air standards approaching those of California (which maintains the strictest standards in the country), President Clinton may well boost electric vehicles.

The new clean-air standards issued by the US Environmental Protection Agency will:

(1) for the very first time limit pollution from very fine particles in the air; and (2) at last, after 20 years of Clean Air Act enforcement, tighten the limits on smog-producing ozone.

The EPA is aiming at preventing about 15,000 premature deaths each year that are linked to respiratory illnesses and, in particular, at improving conditions for the growing number of American children with asthma.

The new rules represent a failure for the multi-million-dollar lobbying campaign mounted by oil companies, utilities, automakers, miners and manufacturers to fight the EPA.

"This represents a major victory for public health," said Fred Krupp, executive director of the Environmental Defense Fund. "Despite an unprecedented assault by industry groups, the [Clinton] administration has come out clearly on the side of millions of American children and elderly who suffer respiratory problems."

The advancement of "clean," alternative sources of energy and transportation like EVs will presumably benefit from the new standards.

Source: San Jose Mercury News, San Jose, CA, Copyright 1997, SJMN

Editorial

continued from page 3

ing for them. When Bob realized that my brain was not fatally scrambled and could be relied upon to remain in good working order (assuming no more diabolical plots by Fang), we sat down and talked turkey about me working for Green three to four days a week. Both of us then made it happen.

I don't recommend crashing a shopping cart racer as a way to get a job in the EV field but, again, you never know....

Anyway, the arrangement has been working out both to Green's benefit and mine. One can forget how nice a comparatively high (as compared to previous) flow rate of the green stuff can be, especially if one is inclined to play with EV racecars and other automotive-shaped holes in the environment, which suck up money.

An EV Environment

I'm also in sort of a vortex of EV activity here at Hangar 20, between Green's Citibees, Zebra's Zebras, various Kaylor projects and vehicles, Jefferson Programmed Power's modified Tropica racer, CALSTART's plans for an EV race (more on that later) and various and sundry EVentures. The only problem with doing CE here is all the distractions!

A Pleased Porschie

#13 is as happy as a pig in...uh, mud (this is after all a family publication), getting regularly charged, running around Alameda like a demented electric torpedo, shooting down the runways, getting on the front cover of the Oakland Trib along with a Zebra and a PIVCO, making parts and lunch-runs and generally being excercised and appreciated.

She also likes snuggling up amid the flock of little Citibees — I'm almost afraid to leave her alone with them for too long — the result might be a baby Citibee-Porsche 914 cross.

That would be interesting — maybe a little Fourteener made out of Igloo ice-chest, undentable plastic. Cute too.

The Porsche is a seductive little devil and not just with those who drive her — I think she's already propositioned the JPP Tropica. Must be that Corvette rear end....

OK, back to reality (and literary cleanliness — this being a family publication, as I mentioned, or at any rate something that will probably be left out on the garage floor where the kiddies can find it).

Useful Stuff — the PowerPulse

I have also learned how to run battery discharge tests using a neat new automated discharger unit that Green recently bought. The thing has an RS232 serial port and I'm trying to see if I can hook it up to my 486 and print out disharge data and curves. That would be slick!

I've used the discharge unit to test the capacity of some sulfated batteries from a Kewet and also to evaluate the effectiveness of an electronic sulfation preventer/curer called a PowerPulse (see the tech articles in this issue for details and data). I have gotten surprisingly good initial results from a 12-volt PowerPulse. So good, in fact, that I asked Green to buy (and they did) a 48-volt unit to install on a car. Green has two Kewets, both with the same history (sitting) and decline in battery cpacity (fallen off to one-half). I am going to use one car as a control and the other as a test to see if the PP can revive the entire 48-volt pack. Both have Trojan 30XHS 12-volters in parallel packs. I did the initial test on one of those batteries, using another as a control. Basically, after having the PP on the test battery for four days, capacity as measured at a 25 amp discharge rate went from 33 Ahrs to 60 Ahrs. Trojan's spec on the battery is about 72 Ahrs.

I'll be discharging the two cars at 75 amps (the maximum rate that the discharger will allow). I'd like to do 100 amps to match up with Scott Cornell's and Bob Schneeveis' battery test procedure. I predict that the test car will go from a 14-mile vehicle to more like a 28-mile one. Wouldn't that be something!?!

I have had the PP on the test car for about two days now, so I'll be doing both a 75-amp discharge test and a for-real road-test. Stay tuned. —CB

Guidelines for EAA Awards

BY GEORGE GLESS

1. Awards given are: the EAA Fellow Award and the Keith Crock Award.
2. Number of awards presented each year: normally 2-5 Fellow Awards are made while only one Keith Crock Award is given.
3. Nominations may be made by: any EAA member, group of EAA members, an EAA chapter, or chapter representatives.
4. Eligibility: the Keith Crock Award is given for technical excellence and may be made to an individual, a group, or a company or other organization. The technical accomplishment for which the award is given may be in the form of a vehicle, a component, a drive system, supporting infrastructure, etc. The Fellow Award is made to individuals for outstanding activities in areas relating to support of the EAA, advancing the cause of electric vehicles, or other activities of benefit to the EV industry.
5. Each award recipient receives a plaque, which is presented at an appropriate function.
6. Nominations may be submitted in any form that clearly outlines the nominee and other pertinent information, such as the nominee's address, the type of award, etc. Sufficient information, such as text, pictures, etc. should be included to support the nomination.
7. Nominations are to be submitted to the EAA Board of Directors (see the contact address and telephone/fax number listed below) for final action.

George Gless
Awards Committee Chair
EAA Board of Directors
2940 13 Street
Boulder, CO 80304
Tel/Fax: (303) 442-6566

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EVA - "Customer Service is No. 1" ©

Sacramento Airport Launches Solar EV Chargers

Sacramento, May 23, 1997—A solar power-generating project launched earlier this month at Sacramento International Airport is also equipped with four electric vehicle (EV) charging stations and is now generating enough electricity to power 52 homes. The 128-kilowatt Sacramento Municipal Utility District (SMUD) "Solarport" located near the west terminal also provides shaded parking to 75 cars. Photovoltaic panels on the cantilevered structure track the sun's path as the earth rotates to capture the maximum solar energy possible.

Over the structure's expected 30-year design life, it's expected to save the equivalent of 825,000 gallons of oil that would have been burned to generate electricity, as well as to prevent the release into the air of 1.7 million pounds of carbon dioxide, 120,000 pounds of acid-rain components and 65,000 pounds of smog-forming compounds.

The airport's other clean-air projects include compressed natural gas (CNG) shuttle buses, methanol-powered pool cars and the alternative fuel infrastructure necessary to support the low-emission vehicles.

Source: CALSTART, 3601 Empire Ave., Burbank, CA 91505 USA. Tel 818-565-5655. Fax: 818-565-5610. E-Mail: news@calstart.org.www.calstart.org. Copyright 1997, CALSTART.

EVs are Product of the Present

EVAA & JD Power Associates

Ford's electric-powered Ecostar passes under the finish banner of the 1997 NESEA American Tour de Sol in Portland, ME. Ford is marketing an electric version of its Ranger truck to fleets, and plans to release several other models over the next few years.

San Francisco, May 20, 199 —Electric vehicles (EVs) are a product of the present, say the results of today's J.D. Power and Associates study on what consumers want in EVs. Those results say that 1 in 4 consumers would buy an EV today — if it meets their needs.

Bob Hayden, executive director of the Electric Vehicle Association of the Americas (EVAA) commented on the JDP findings.

Every major car company in the world is pursuing highly advanced EV technologies. Six, Detroit's Big Three and the three largest from Japan, are starting this year to sell EVs around the U.S. These early EVs will help each automaker better determine the needs of its customers—both fleet and retail.

At the same time, the J.D. Power study did not mention a key factor in EV acceptance—infrastructure. EVAA and its members also are working to develop the necessary infrastructure so consumers will feel secure knowing they will be as close to a fueling station in an EV as they are in a gasoline-powered vehicle.

Listening to the "voice of the consumer," as the J.D. Power and Associates' study emphaxsized, has been a major part of EVAA's strategy to help develop the EV industry.

Located in San Francisco, EVAA is the trade industry association working to advance EV commercialization in the United States, Canada and Latin America. EVAA's members include major auto companies, electric utilities, manufacturers of batteries and other EV components, universities and the U.S. Department of Energy. It also includes national EV industry associations in other countries in the American hemisphere. The Association serves as a clearing house for information about electric vehicles.

Source: PRN Newswire, 71 Stevenson Street, Suite 1120, San Francisco, CA 94105. Tel: (415) 543-7800. Fax: (415) 543-3555. E-Mail: eincande@prnews.attmail.com. www.prnewswire.com, Copyright 1997,

20 Chrysler EVs Bound for Customers, Most in California

The vehicles use a 75-kilowatt AC induction motor from Northrop-Grumman and are powered by 27 Electrosource advanced lead-acid batteries. The vehicles are going through testing at Chrysler testing grounds in Michigan and Arizona before delivery.

Windsor, Ontario, May 12, 1997 — Chrysler Corp. reports it has built 20 of its electric-powered minivans and will soon ship them to customers, mostly in California. The Electric Powered Interurban Commuter (EPIC) vehicles—basically standard Dodge Caravans assembled with electric drive systems—were built on the same production line as their gasoline-powered counterparts, which had been a Chrysler goal.

The vehicles use a 75-kilowatt AC induction motor from Northrop-Grumman and are powered by 27 Electrosource advanced lead-acid batteries. The vehicles are going through testing at Chrysler testing grounds in Michigan and Arizona before delivery. Fifteen are bound for California Navy and Air Force bases, two will go to Southern California Edison, and the remaining three will stay with Chrysler for ongoing testing.

HP, Siemens Team on Powertrain Standards

Palo Alto, May 12, 1997 — Electronics giant Hewlett-Packard and Siemens Automotive of Regensburg, Germany are joining forces to standardize the development systems for vehicle powertrain electronics, reports R&D Magazine. The two firms have reportedly signed an 18-month memorandum of understanding.

The agreement is focused on powertrain electronic control units, and developing standardized software development tools that can be used by any automotive supplier. HP is famous for its commitment to "open architecture"—industry standards that lower costs and increase compatibility of parts. Siemens is a leading automotive supplier and technology developer, active in conventional and electric vehicle systems.

Source: CALSTART, 3601 Empire Ave., Burbank, CA 91505 USA. Tel 818-565-5655. Fax: 818-565-5610. E-Mail: news@calstart.org.www.calstart.org. Copyright 1997, CALSTART.

"Slow Down"! TDS EVs Told

"The marketplace (for electric cars) is coming of age," said Roy Kilar, who drove a Ford-built Ecostar across the finish line of the 350-mile rally through the back roads of New England.

Portland, Maine, May 23, 1997—A road rally meant to showcase electric and solar-powered vehicles appeared to come of age Friday when police warned at least one competitor to slow down. The incident reflected the NESEA American Tour de Sol's transformation from a contest to catch the public's imagination into a race for the marketplace by major automakers nine years later.

"The marketplace (for electric cars) is coming of age," said Roy Kilar, who drove a Ford-built Ecostar across the finish line of the 350-mile rally through the back roads of New England.

The annual event, organized by the Northeast Sustainable Energy Association, still features plenty of weird-looking contraptions and science projects built by college and high school students.

Several hundred people, many of them schoolchildren, cheered as the vehicles crossed the finish line in downtown Portland. The event began Monday in Waterbury, Connecticut, and passed through Massachusetts, Vermont and New Hampshire.

Cars built by Ford, Toyota and Massachusetts-based Solectria engaged in a spirited final dash, with the Ford warned by a police officer to slow down as the pack approached Portland.

"It was neck-and-neck," said Solectria co-founder James Worden, whose car crossed the line first. Read more about the America Tour do Sol on page 22 in this issue.

Source: Reuters, 153 Kearny Street, Suite 301, San Francisco, CA 94108, www.reuters.com, Tel: 415-677-2544. Fax: 415-398-6593. E-Mail: webmaster@reuters.com. Copyright 1997.

Norway Betting on City-Bee

OSLO, May 13, 1997 — Norway could be a car-manufacturing country within a couple of years, producing the small electric City-Bee — a car built entirely from scratch and already being tested on Californian and Norwegian roads.

"We have an extremely good concept, built on plastic and aluminium, thereby making the car both strong and light," Pivco company marketing director Simen Bakken told AFP on Tuesday. "We have 100 electric cars already running as part of a test project. Most of these test cars are found in San Francisco in California, and all of the signals we have received are very positive," Bakken said.

In addition to San Francisco, City-Bees are running in three Norwegian cities: Oslo, Stavanger and Moss. "Large-scale test production will start next year, and hopefully we will start full production in 1998."

Large Norwegian companies such as Hydro Aluminium, Statoil and Norwegian Telecom have all invested in the City-Bee prototype. More than 50 million kroner (seven million dollars) have been injected into the initial development. No foreign companies have placed money in the project.

Some 175 people will work at the plant in Aurskog, east of Oslo, producing about 5,000 cars a year for the Nordic market only. The more optimistic estimates are for annual production of about 20,000 cars by the end of the century. "This will be a typical city car, and in no way can the traditional car be replaced by electric cars. But with our concept we think it is possible to survive even on a small production volume," Bakken stressed.

Norway is not the first country to look into the electric car market. "France is the front-runner among the established car manufacturing countries. But the concept of Peugeot, Renault and others is based on converting existing cars into electric cars. Our concept is a revolutionary one, and we are starting from scratch," Bakken said. Pivco does not fear any competition from France or other car manufacturing countries. "If Pivco or any other electric car producer succeeds, everybody will benefit because the price on components will be forced down, in particular the price on batteries," Bakken underlined.

The City-Bee has undergone accident and collision tests in Zurich, and all tests have shown that the little car is strong and thereby much safer than ordinary cars. The prototype weighs only 550 kilograms (1,210 pounds), but the goal is to shave it down to 450 kilograms excluding the battery. The cars running today have a top speed of 80 kilometers (50 miles) per hour, and can travel 75 kilometers between battery charges.

Pivco spokesmen say the price of a City-Bee delivered from the production plant would be between 60,000 and 70,000 kroner (under 10,000 dollars). "Our realistic goals are to keep the price below 100,000 kroner for the consumers," a spokesman for Pivco said.

Deutsche Post Tests Zinc-Air for Fleet

The German Postal Service is testing 50 cars and vans using a zinc-air cell developed by Israel's Electric Fuel Company. If zinc-air powered EVs can match the performance and costs of diesel-powered vans, Deutsche Post plans to buy as many as 25,000. Deutsche Telekom may buy as many as 15,000. With this volume, manufacturing costs may drop to the point where EVs could compete wheel to wheel with gas and diesel.

Zinc-air powered EVs are ideal for use even though the zinc cartridges in discharged cells have to be removed from the vehicle, placed in an electrolyzing bath and reinstalled. If a large fleet has a reprocessing facility on-site, battery packs can just be swapped, removing the spent cells and re-electrolyzing them while fresh cells are dropped in to keep the vehicles running. A battery swap at an automated exchange station takes only 10 minutes.

Zinc-Air Advantages

Zinc-air delivers 200 whrs/kg, which is 4x that of lead-acid and nearly twice that of nickel-metal hydride. In Bremen, Mercedes MB410 trucks with Electric Flow cells routinely go more than 155 miles before they reach the 20% emergency reserve. Smaller Opel Combo vans have gone more than 250 miles in tests.

Zinc-air technology also holds up in the cold, losing only about 10% of their capacity in weather that saps other battery types. It could become the energy storage medium of choice in areas such as northern Europe, Scandinavia, Canada and the northern US.

The zinc consumed in the reaction is fairly cheap, making the economics of refueling attractive. A study by Deutsche Post's in-house consulting arm estimated life-cycle costs of 99 cents per mile for electric versions of large Mercedes vans, including acquisition, operating expens-

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B.A.T.'s Zinc-Air 1,000-mile EV

BY CLARE BELL

CE's editor checks out the Kummarow zinc-air cells.

B.A.T.'s arrival at the Alameda Naval Air Station was auspicious — the rental truck carrying the EV was emblazoned with an aircraft carrier resembling the USS Hornet, which is berthed in retirement at the dock at Alameda NAS.

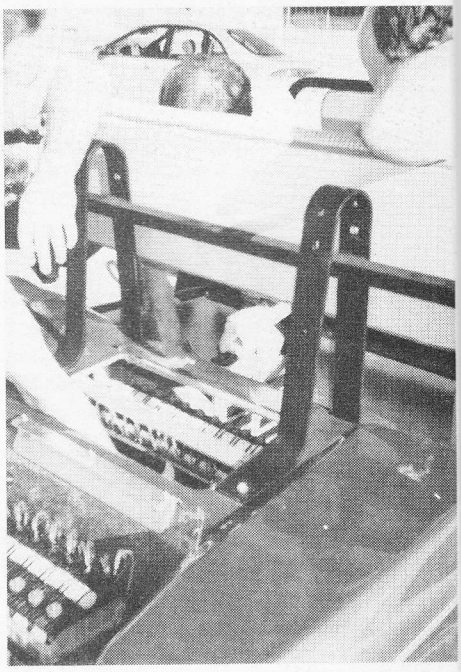
B.A.T.'s truck pulled in at about 3 in the afternoon on Friday, June 13. It unloaded behind CalStart's Hangar 20, near the rear door of Green Motorworks' shop. The Green gang (Bob Reese, myself and Adrian Fontaine) eyed the truck, wondering what sort of miracle it would disgorge. We had heard about the attempted record run scheduled to take place on the NAS aircraft runways. Although Green and other CalStart folks had not been formally requested to assist with the effort, we were, of course, intrigued with what we'd heard. Kurt Bohan and Roy Kaylor, from Kaylor Energy Products joined in, as did John Hutter, representing Calstart. The official certifier was Andy Burke from UC Davis' Institute of Transportation Studies. It turned out that Andy wouldn't be able to stay for the entire run. Joe LaStella asked if I could be the backup observer. Startled, but pleased, I agreed. I would move my camper down to the apron for the duration of the run, joining the team in their rented motorhome.

When the truck's door rumbled up, we expected to see the B.A.T. minivan come rolling down the ramp, since that was the vehicle used in the recent Utah zinc-air distance run. However, when the crew brought the narrow-tracked, open-seat long-wheelbase EV, eyebrows went up, including mine. What was this little beastie?

The new arrivals weren't terribly communicative, due to their need to unload, prep the Kummarow zinc-air

B.A.T.'s team fills the cells with sodium hydroxide (NaOH) electrolyte.

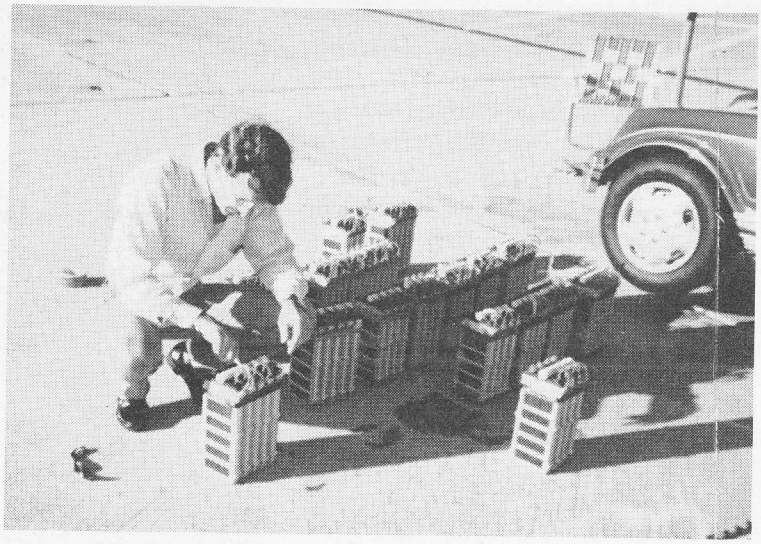
Team member Al hands a filled cell to team leader Joe LaStella.



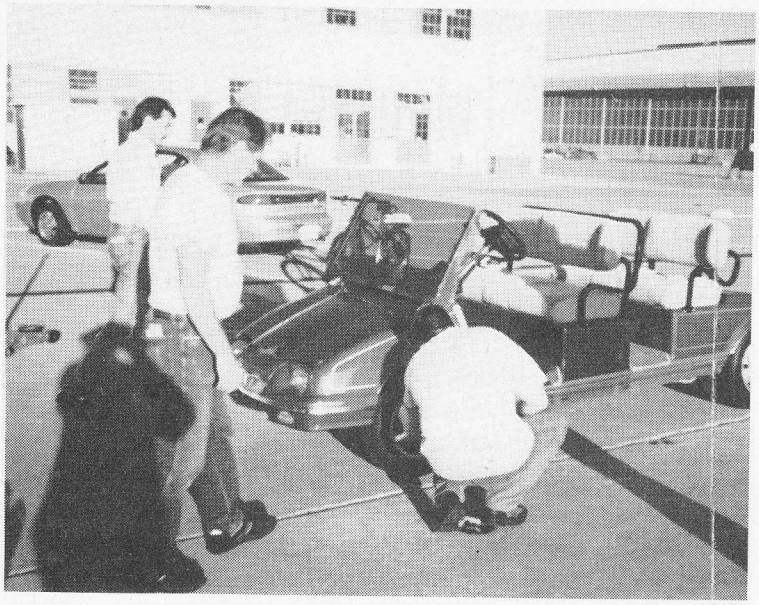
Battery jam! (Trouble fitting in the last cell.)

cells, install them and get their show on the runway, so to speak.

Some mis-communication resulted in momentary aloofness between the new arrivals and Green's crew, but Bob Reese broke the ice with B.A.T.'s Joe La Stella, to the benefit and relief of everyone. Soon I and others were helping out, showing our fellow EVenturers a power bandsaw they could use for the inevitable last-minute modifications on the EV. We also shared sodas, folding chairs with drink-holders and conversation. I asked permission to take some pictures and it was cheerfully given.



Joe LaStella checks seals on the zinc-air cells.



Team member Ken checks an interference problem between the tire and fender as team member Doug goes for the hacksaw and Joe LaStella looks on.

Why Zinc-Air?

I couldn't help wondering about the use of zinc-air cells. It was my impression that zinc-air was a technology more suited for use in fleets than individual vehicles. The present version of zinc-air cells cannot be recharged electrically, as are lead-acids, nicads or other EV battery types. The zinc cathode is consumed in the electrochemical reaction (see the tech specs below) and must be removed, placed in solution like a plating bath and regenerated by a combination of chemical and electrical energy. This, I thought, would require considerable investment in infrastructure, along the lines of the facilities built for the German Post Office, which is running a large zinc-air test fleet. (See the related story in this issue.)

However, the B.A.T. team had managed to simplify and scale down the regenerating bath and process involved so that it was feasible to support a single vehicle.

My skepticism began to evaporate, especially when I learned that the zinc-air pack —which they were filling with electrolyte, setting out and installing in the EV — could hold 60 kilowatt-hours!. This in a battery pack that weighed just 698 lb. For comparison, 20 deep-cycle 6-volts in an EV can hold 20-21 kilowatt-hours in a pack that weighs about 1100-1200. The higher-capacity sealed lead-acids can hold 12-16 kWhrs in 800 lb.

In order to inspect, test voltages, and ensure that each was properly sealed and not leaking, the crew set them all out on the concrete in groups of 4 or 5. The cells themselves were originally meant for uninterruptable power systems. Tall and skinny, they are designed to be locked together to form blocks of any voltage desired. With dimensions of 5 3/8" by 1 1/2" x 13", they looked like large books lined up together on a shelf. Overfilling and some faulty seals caused what appeared to be leaks, but they were judged to be minor.

The vehicle itself was unusual. B.A.T had taken a Club Car chassis, lengthened the wheelbase, re-designed the body and re-done the drivetrain. To gain maximum efficiency, they had used a DC servomotor system adapted from its original duty as a robotic arm positioner. Racks and containers were fabricated for the 698 lb. of zinc-airs, including filters to keep the incoming air as clean as possible. The screening used to hold the filter material in place proved to be a problem later (see below).

Where the vehicle would run was also in question. The original plans called for it to use the main runway, but there were several problems. One was a locked access gate. There may or may not have been a key or a combination available, but no-one seemed to have it. The second factor was the wind. Sweeping down the runway, it was far more than an onshore breeze. Fighting it would cost energy that couldn't be replaced, and shorten the EV's range. The turn from one runway to the other

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was an acute angle and judged too tight for the speed they wanted to maintain. La Stella and his team decided instead to use the aircraft apron that fronted the seaplane lagoon. Access there was easy, more buildings blocked the wind, and they could run an easy course with shallow turns.

While Ken and Robert checked the laid-out cell blocks, others worked on the vehicle itself, jiggling and bouncing it to check tire clearances. One front wheel was rubbing on the wheel-well. Doug, who did much of the mechanical assembly, cured the interference problem with a hacksaw, turning down Green's offer of a Dremel tool.

As the cell preparation and assembly went on, the team began to lose daylight. In order to finish and have the vehicle ready to run on Saturday morning, the B.A.T. team brought the vehicle into Green's bay in Hangar 20. Amid the PIVCO Citibees, Kewets, #13, Paul Brasch's VOLTS, JPP's modified Tropica and other various EVs, B.A.T.'s team lifted the cells into place, wired and checked them. For 181 cells, it was quite a job and they had to double- and triple-check to make sure that none of the blocks were wired backwards. Not until midnight did they call it quits, and there were still some minor tasks to be finished before rollout at 7:30 the following morning.

The team preps "Nellie" before the start of the record run.

Saturday morning, June 14, saw the modified Club Car emerging from Hangar 20, stuffed with its full battery pack (247 V open-circuit), riding on tires pumped to 55 psi, sipping amps very sparingly — on the order of 5-6 amps at a nominal pack voltage of 224 — to maintain a speed of roughly 20 mph. After a quick photo session, the EV headed out to the apron with its first driver, Al at the wheel. I accompanied them in my E-Porsche for the first lap and shot a picture from the car's window of the little EV whizzing along. It completed the first 1.3 mile circuit at a speed of 25 mph in 3 minutes and 40 seconds.

As the B.A.T. vehicle turned to the serious job of racking up the miles while conserving juice, Robert "circled the wagons," arranging the rental truck, B.A.T.'s motorhome and my camper (dubbed "The Ark") into a U-shaped enclosure to help block the constant wind.

Too Much Wind

The prevailing westerly, which funnels through the Golden Gate, gathering speed before it hits Alameda, proved to be much more of a problem than anticipated. The refreshing morning breeze kicked up into a relentless headwind in the afternoon, pushing the amp consumption up from 5-6 amps up to 8. This was too far over the rate needed to reach 1,000 miles. At 5 pm, the crew gave themselves and the EV a break, waiting until after sundown, when the sun-powered force of the wind died down. As the sky darkened, the team faced other concerns. The course ran close to the seaplane lagoon. Could the driver see well enough to avoid the edge? It would be an ignominious ending to the effort if the EV went for an unintentional swim.

The EV had lights, but they were halogens, aimed too low and much too bright, causing loss of night-vision and disorientation when the vehicle went from a lighted area near the hangar to

Joe LaStella looks on during roll out from CalStart's Hangar 20

the darkened portion near the lagoon. Robert, when it came his turn to drive, turned off the lights and drove by moonlight. Sighting the cones marking the route was occasionally problematic until Bob Reese came up with the idea of buying cheap flashlights and putting them inside each cone to provide illuminated markers.

Alarm spread through the team when the driver reported the vehicle had hit a glancing blow to something that sounded like a substantial piece of metal that had somehow wandered onto the track. Feeling very protective about their EV, the team located a loose grating and hurled it vengefully out of the way.

The team got another taste of the headwind problem when the car began to get behind in energy consumption versus mileage. Robert, now driving, reported 5 amps downwind, 7 amps upwind. When it got over 7, he would come in, coasting as far as possible without braking to increase distance traveled. The chilly wind in the driver's eyes proved to be another discomfort, endured with the aid of a scarf wrapped around the face and use of goggles.

After a brief rest around 11, they started up again at midnight by the light of a half-moon. Keith, one of the younger team members took over the wheel. He reported in on the walkie-talkie; the vehicle was using 5 amps on the downwind leg, 6 on the upwind leg, running 19.9 mph with a pack voltage (under load) of 241 volts. Ken, checking the pre-run calculations, said that if the vehicle maintained those parameters, they would slowly catch up, regaining ground lost to battling with the headwind.

Another obstacle on the course proved to be a metal bar. The team got rid of it before it managed to damage the EV's tires.

Sunday, June 15: Shortly after the vehicle took off, I retired to the Ark and rolled into my sleeping bag. However, my doze was soon interrupted by animated discussion just outside the Ark's side window. The vehicle had come in after less than an hour of running and the team already had some of it apart. What had happened?

TECH SPECS

Pack Voltage — 224V nominal in series
Pack Impedance — 6.0 ohms
Battery type — Kummarow Zinc-air cells, designed for use in UPS systems
Battery specs:
Dimensions for each cell - 5 3/8 " X 1 1/2" x 13" (minimum for clearance)
Number of cells — 181
Pack weight — 689 lb.
Vehicle — Club-Car chassis, extensively modified by B.A.T.
Motor — High-voltage DC servomotor, adapted from robotic arm control applications. Manufactured in Camarillo, CA
Tire pressure — 55 psi
Tires — Goodyear Invicta.
Crew — Joe La Stella; Robert Wegener — General Manager and crew chief; Ken, Keith; Al, Mike, Mary, Doug
Certifiers/ Observers - Andrew F. Burke, Clare Bell
Helpers/Cheerleaders/Logistics Experts — Clare Bell, Adrian Fontaine and Bob Reese of Green Motorworks, Kurt Bohan and Roy Kaylor of Kaylor Energy Products.

A Bad Moment

I tumbled out of the cabover bed in the Ark to learn the cause. Two of the zinc-air cells had leaked potassium hydroxide electrolyte, wetting and corroding the wire mesh that held the air filter material in place. It was zinc-plated screen — the standard galvanized stuff — and it formed a handy conductive path to short two cells. First, things got hot enough for Keith to smell trouble. Then abruptly, the voltage reading on the digital meter went to zero, forcing the vehicle to coast in for attention.

The problem affected five cells, located under the rear seat. Ken, Doug and Robert installed jumper leads around two and replaced three. The EV, down to 179 functional cells, pulled out again, trying to regain the ground it had lost to wind and problems.

Facing Defeat

The fight wasn't over yet. Having gone to bed again, I was awakened around 2 am and peeked fuzzily to find the EV back in the repair bay again, up on jackstands, its rear axle already removed and out on the ground. The

"Nellie" ready to go! No. 13 will accompany her on the first lap.

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driver had heard ominous noises from the back, sounding like a jumping chain or another problem with the ClubCar transmission. The car would still run, but mechanical friction would cause the loss of precious energy and force them to stop far short of the 1,000-mile goal. Exhaustion was starting to make tempers flare and the situation looked pretty bleak. I could do nothing except voice some encouragement, offer help if it was needed and leave it up to the team whether to abort the effort after less than two days. At this point, I thought they would. Too many things were going against them, including headwinds, battery problems, and now what looked like a crapped-out transmission.

Onward

Taking the same route as the disabled drivetrain, I flaked out and went back to sleep, thinking that when I woke up, I would see the team sadly loading the vehicle back into the truck and packing up. However, I hadn't reckoned with the team's persistence and Joe's direction in a crisis. The vehicle, I found was out running again!

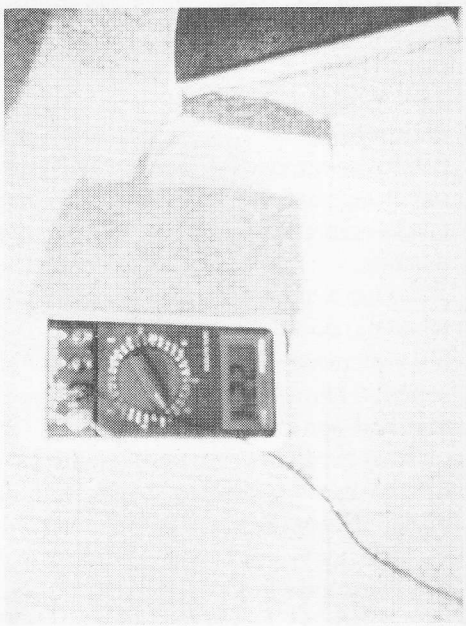
Having taken the transmission apart, they found that there was nothing wrong with it. They'd been faked out by the motor's behavior under low voltage — it had sounded like a transmission failure but wasn't.

At 9:30, after about 11 hours of driving, they'd reached 250 miles. With a sunny sky and gentle breeze, the car was running smoothly at an average of 22 mph. The only break was when Al, who was driving, came in for a rest.

During the interval, I learned a bit more about the cells. Their high capacity came at the price of low power from their original design for uninterruptable power systems. The power delivery depended on the diffusion rate of oxygen through the porous catalytic carbon that formed a critical portion of the air anode. Carbon dioxide (CO2), which entered along with the oxygen, had a tendency to dissolve in the potassium hydroxide electrolyte, causing what is known as carbonization. One could increase the efficiency and power of a zinc-air cell by "scrubbing out" CO2 before the air contacted the electrolyte-soaked carbon/platinum catalyst.

When the vehicle rolled out again at 10:00, Joe LaStella was in the drivers' seat, easing the little beastie back up to constant speed. I was growing fond of the EV and her determined crew. Had anyone given the valiant little Club Car a name? No. There was a brass nameplate on the front, but no moniker engraved. I reserved a few brain cells for the task of coming up with a suitable name.

Throughout the morning they kept going while I bugged out to attend an EAA Board of Directors meeting up in Sacramento. In the afternoon, when I got back, the EV was fighting the headwind again, sucking up an excessive 10-11 amps. Again the team pulled her back into the sheltered area between the two motor homes, waiting until the wind died.

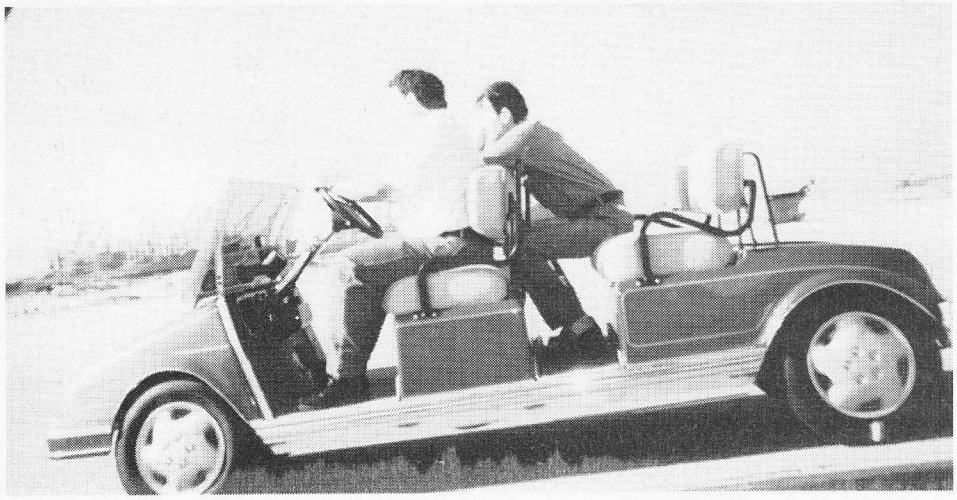


Pack reading holds steady as "Nellie" rolls along.

At 8 pm, the vehicle was back out again, with Al at the wheel, and approaching the 220 mile mark.

At 19.6 mph, drawing 6.2 amps, pack voltage under load was holding at 201. During the next lap, current consumption rose to 6.7 and the voltage dipped slightly lower to 199. On turns, it went as high as 7. It popped right back up to 234 open-circuit. The 35 volt drop between open-circuit and loaded voltage is characteristic of a zinc-air. It also allowed the team to calculate the battery pack impedance, which was 35V/6.7 amps, giving 5.22 ohms total or 5.22/179 = 0.029 ohms per cell.

In the morning on Sunday, the vehicle ran well, the wind had stilled and they were rapidly making up ground they had lost the previous day. During one of the short rest intervals, the team removed the two cells that had shorted the previous night. Despite this loss, the vehicle was doing as well in terms of energy consumption versus mileage as if they were still in the pack. At 23 hours of



Team member Al takes the wheel for the first lap, with Joe LaStella riding in the back. (Photo taken from No. 13.)

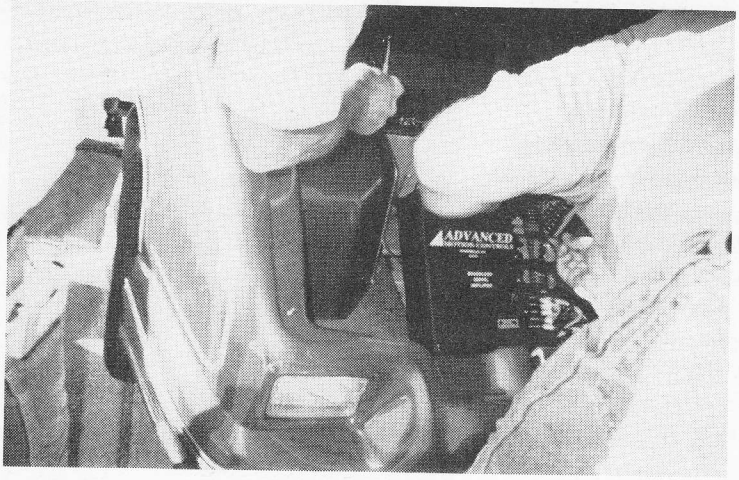
driving, they had passed the 350 mark and stopped for a check of the cells.

"Depends" by Hefty

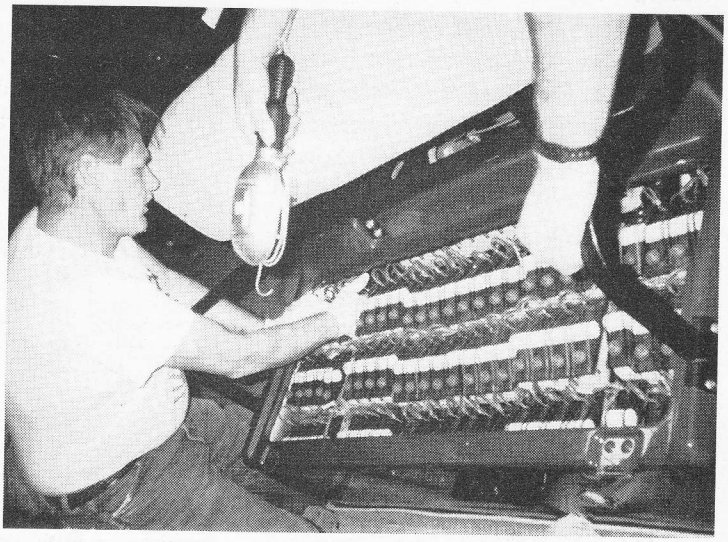
The previous night's problem had not entirely gone away. Seepage was still corroding the zinc-plated screen that helped retain the air filters. There was evidence of corroding and conductive paths that could possibly lead to the same sort of failures that had put the car out of action before. Team leader LaStella, saying that they'd caught up and had the time, directed the team to remove the zinc screen and line the battery boxes with non-conductive 10-mil. plastic. The operation was accompanied by comments about "battery diapers" and "Depends" by Hefty. The EV sallied forth again with Al at the helm. By 8:30 PM, "Nellie", as I had dubbed her, completed 400 miles.

Nellie in the Groove

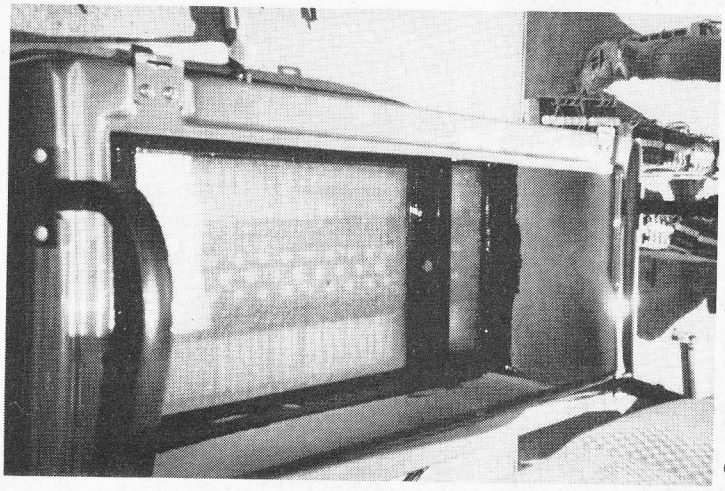
On Monday morning, June 16, I rolled out of my sleeping bag aboard the Ark and queried the status of the team. What was notable was that everybody had got some sleep the previous night. Nellie was running "true to form," "in the groove," and if the wind didn't pick up too soon, she'd probably pull another 200-300 miles past her little Invictas. Al reported pack voltage under load was holding nicely at 203-204 volts. I left to go to work at Hangar 20 and played with PIVCOs all day. Everything went well for the B.A.T. team until the wind kicked up around 4 pm. Again Nellie came in and the team waited for the wind to die down. Perversely, it wouldn't and hours dragged by. Roy Kaylor suggested running Nellie inside a hangar. Some NAS hangars are huge, although many are either partitioned inside, inaccessible, in use or stuffed with equipment. Kurt Bohan of Kaylor Energy Products and myself went on a midnight raid to see if we could get into any of the hangars. NAS had supposedly locked them up, but they'd apparently run short of padlocks and substituted nuts and bolts. — no match for the ingenuity of the intrepid personnel from Kaylor and Green. By midnight, Nellie was running 16mph squared ovals in half of Hangar 39 while said intrepid personnel were dozing on a platform in the center.



Crew chief Robert adjusts the controller to maximize efficiency.



Midnight crisis loomed when an external short caused to cells to fail.



The zinc-plated screen used to hold the air filters in place became a current path when the cells leaked slightly. The team stripped it out.

At about 3 am, I took over the piloting job and ran Nellie in the hangar until 6:30 in the morning. Then I crapped out and crashed in the Ark. Needless to say I was very late to Green that morning, but Bob Reese understood. I actually did get something constructive done that day, which was amazing.

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Tuesday, June, 17

Nellie ran on the outside course, steadily racking up the miles. The limiting factor was the endurance of the team, since the vehicle seemed to be capable of sailing merrily on until the cows came home or until everyone collapsed from sheer exhaustion. When I got back to the wagon circle in the evening, Nellie was still running, although starting to buck the wind again. I took over driving at some point (I don't remember) and took Nellie to the 800 mile mark. Again, when the wind pushed amperage over 7, Nellie retreated back to the hangar. This time I got to bed at a less obscene hour and functioned reasonably well at Green, although I remarked to Adrian that I could have used a brain transplant if he'd had a spare on the shelf.

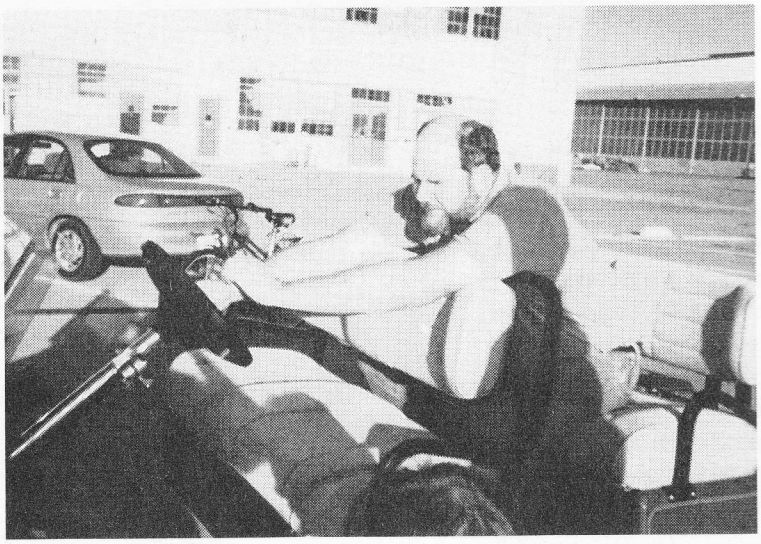
"Four, Three, Two, One — Ooops!"

Returning to the scene at 5:00 pm, I was delighted to discover that Nellie had passed the 997 mile mark at 4:30 — inside the hangar — and was still running strong. The team brought her out onto the apron for a wild and windy final three miles. Crew Chief Robert had Doug do the honors at the wheel and sent him off. At 5:19 pm Pacific Daylight Time, the odometer (actually a bicycle pedometer) showed 999 clicks. Doug brought the EV around one more time, expecting the display to turn slowly to 1,000.

Together the team began the countdown as Nellie rolled past them and then looped back. The team shouted the countdown as the driver announced it over the walkie-talkie.

"Four, three, two, one!"

But the mileage indicator wasn't showing triple zeros. It had pulled a fast one on the team, resetting instead to 987! Even a reset to start would have documented something, but jumping backwards more than 10 miles showed only that the generalized perversity of the universe was operating. Wearily cussing out four-digit pedos and this one in particular, the team scrambled to get the meter reading in accordance with the mileage covered. (B.A.T. held a press conference the next day and the milemeter had to demonstrate that the team had achieved the landmark it claimed — see below.)



The team kept up a sense of fun; Robert demonstrates real "backseat" driving.

Several more frenzied laps and some fiddling got the vehicle to the point where the press would believe that they had indeed covered the distance claimed.

Then the team stood back to catch their breaths

Powered By Zinc-Air and Coors Light

The brief flurry over the lying pedometer didn't obscure the realization for long.They'd done it. One thousand miles on one charge of zinc-air cells. Cheers mingled with the pop-splish-fizz of opening beer cans as Hans Kummarow announced he was off to buy the champagne. Doughty Nellie, however, was ready for more running. The team obliged her, running additional laps to get well over the 1,000-mile mark. They needed some cushioning, just in case the odometer was miscalibrated or any other final check calculations showed that they hadn't reached their goal after all.

Nellie cheerfully ate up about eleven more miles before Robert let her in to join the celebratory wind-up.

"Powered by Zinc-Air and Coors Light," announced Doug as he got down off the seat brandishing a beer Not to mention guts and grit.

Wednesday, June 18: B.A.T had announced a press conference for 10 that morning. I managed to play hooky from Green long enough to join it. In addition, they'd keep Nellie running for some distance past the triple-zero, just as additional insurance against a malfunctioning odometer or miscalibration. B.A.T. didn't take any chances of having the run declared less than 1,000 miles when the final check calculations verified the final mileage.

Joe LaStella promised that he would get the media and he did. Present for the final legs were CNN, the local CBS affiliate KRON-TV, Channel Four and ABC Channel Seven, when crew chief Robert put Doug at the wheel for the last several laps.

When the media arrived, looking enthusiastic, eager and friendly, Nellie drove over and parked before the crowd.

CNN interviewed Joe La Stella, spiffed up in suit and tie beside the triumphant little EV. They also took footage of Robert and the rest of the crew, looking very "techno" with their white lab coats with the B.A.T. logo on the pocket. One of the TV stations had arranged for another EV to be present as well — the orange Fiat Spider conversion that won the 1996 EAA National Rally. The station cameraman filmed

from the Fiat (obviously for comparison purposes with the zinc-air driven EV) and then went for a ride on Nellie herself.

Hans Kummarow spoke about his company's battery technology (also with CNN, I believe). Within two hours, the gathering broke up and Nellie headed out once again to stack some extra distance over what she'd already done.

The team figured that she probably had another 200-300 miles left in her; however, word came down from on-high that the aircraft apron was needed by a low-rider car show that was setting up for the following weekend. Nellie's guys had already exceeded the time allowed for the run. It was time to wrap it up. Robert kept the vehicle running while the others packed the truck, cleaned out the rented motorhome and got ready to cruise on back to LA.

When everything was ready and it was Nellie's turn to get loaded (everyone else had already been), she'd completed 1098.5 miles and the zinc-airs were still unfazed.

I waved the team off the following morning.

Later Hans Kummarow said that his company was thinking of doing a zinc-air reconstitution facility at Calstart that could not only be used by the station car fleet (if any were switched to zinc-air) but could support private vehicles as well.

Nellie had made her mark. Good job, B.A.T.! — CB

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es and resale value. That compares with a predicted $1.01 per mile for diesel versions in year 2000.

Bremen Facility

The Electric Fuel zinc-air storage system consists of 22 series-connected individual cells in the form of flat rectangular cassettes. Packed together they form a block. Blocks are placed on easy-to-exchange battery trays, allowing quick installation and removal from the vehicle.

A six-block tray has an energy content of 37.5 kWhrs.

Automated battery refueling systems mechanically replace depleted zinc anode cassettes with freshly regenerated ones. Electric Fuel built the refueling system for Deutsche Post in Israel and shipped it to Bremen. It has also done the same for Electric Fuel's strategic partner in Italy, Edison SpA.

The 100 kg/hr zinc regeneration plant in Bremen, Germany provides and regenerates zinc for the test fleet of 64 vehicles. The Mechanical section of the plant handles zinc anode components. Fresh zinc is regenerated in the electrowinning process.

Electric Fuel built this $8M pilot plant in an unused building belonging to a power company in Bremen. The utility is also a partner in the test.

Vehicles

The 64-vehicle fleet consists of GM-Opel Corsa Combo pickup trucks and Mercedes-Benz MB410 vans, all fitted with Electric Fuel's zinc-air system. The Mercedes MB410 uses a 12-block 75 Kwh battery tray. Snap-on mounting locks and a patented single multi-connector make the exchange quick and easy.

The Bremen experiment is designed to test the projections mentioned earlier above. One piece of analysis, however, still remains uncertain; namely, the real-world resale value of electric vans. The study assumed that the used sale price would be about $21,000 or 40% more than the diesel version. It is also unclear if the small businesses that typically buy used vehicles will go for electric vans, but if a government organization as large as Deutsche Post blazes the way, the notion seems plausible.

Although Deutsche Post has not officially released the results, at least one driver of an electric mail van hauling up to 1.5 tons of letters on daily rounds is delighted. Performance? He says he's had it up to 110 km/hr or 70 mph.

Partners

Other participants in the Deutsche Post program in Germany include Deutsche Telekom, Mercedes-Benz, GM-Opel, Siemens, Uhde, Webasto, certain German municipalities and electric utilities. The field test is continuing through 1997.

Zinc-Air in Italy

Electric Fuel's strategic partner in Italy, Edison SpA, has installed zinc-air systems in the SEAT Marbella compact car as well as a Fiat Ducato van. Edison SpA plans to expand zinc-air battery program to include other vehicle types.

Edison SpA is working to commercialize the technology in southern Europe. The Italian firm operates a regeneration plant near Turin in Italy and is using the electric Fiat and SEAT vehicles in demonstration drives for fleet users and auto manufacturers.

Elsewhere

Vattenfall AB, Sweden's largest utility, has obtained rights to Electric Fuel's system in Scandinavia. Vattenfall plus the Swedish Post have joined the Deutsche Post field test. Vattenfall operates EVs in Sweden that are serviced by the Electric Fuel infrastructure in Germany.

In Holland, Electric Fuel is engaged in a program with the largest Dutch province of Gelderland. It utilizes the zinc-air system in "train taxis" cabs that transport people between train stations and final destinations. The project is managed by KEMA, an international consulting and management organization specializing in electric energy systems. Other Dutch partners include the electric utility NUON. —CB

Sources: "Big Charge for EVs?" by David Woodruff, Business Week, November 18, 1996 (McGraw-Hill Companies, Inc.) and Electric Fuel Inc. brochure.

9th Annual NESEA American Tour de Sol Showcases Market-Ready EVs

Ford's ecostar passes under the finish banner of the 1997 NESEA American Tour de Sol in Portland, ME. Photo Credit: Clay Turnbull, NESEA.

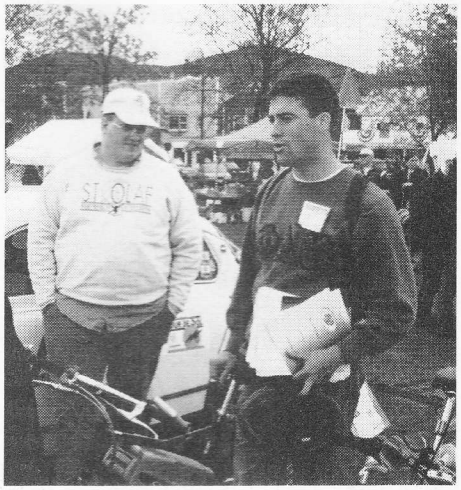
Greenfield, MA, May 31, 1997 — In spite of cloudy skies and cold north winds, record crowds visited the 9th annual Northeast Sustainable Energy Association (NESEA) American Tour de Sol and witnessed new performance records set by the latest electric vehicles built by major car companies, students and individuals from around the US. The American Tour de Sol traveled 350 miles through the challenging terrain of the White Mountains as the EVs drove from Waterbury, CT to Portland, ME during the week of May 17-24. Eight displays of the vehicles were held in Connecticut, Massachusetts, Vermont, New Hampshire and Maine.

The full results of the 1997 Tour de Sol are posted at NESEA's website (http://www.nesea.org).

"When we started the event nine years ago, we never dreamed that major car companies such as Toyota, Ford and Solectria would be showcasing and marketing electric vehicles at the NESEA Tour," said Nancy Hazard NESEA's organizer of the Tour de Sol.

A new event range record of 249 miles was set for the Production category by the Solectria Force, using Ovonic nickel metal hydride batteries. "A few years ago we worried about electric vehicles getting to the finish line, now we worry about them speeding," remarked Robert Stempel about the final push to the finish line. Stempel, for-

A family shops for a non-polluting electric car at the NESEA American Tour de Sol. Market-ready electric vehicles built by Toyota, Solectria and Ford are fun to drive, quite, use no gasoline, and are good for the environment. Photo Credit: Clay Turnbull, NESEA.



Rick Shanahan explains how the Charger Bike works to spectators at the 1American Tour de Sol. It was designed and built by AeroVironment in Monrovia, CA, for bike police forces and others. Photo Credit: NESEA.

mer chairman of General Motors, is the Chair of Energy Conversion Devices, producer of the Ovonic battery, which was developed by support of the US Department of Energy. GM plans to use Ovonic batteries in their EV1 electric sports car.

The Solectria Force captured the price in its category, while the Ford Ecostar, entered by Northeast Utilities, also set a new event range record of 202 miles for a production utility vehicle.

Student and individually-built vehicles made a strong showing too in several categories, including the Commuter category. Chico State University captured the prize for best range by driving 140 miles on a single charge.

The US DOE Hybrid category, which was new last year, had seven entries. A number of different fuels were used in their on-board generators and the cars were typically able to drive over 200 miles, with Connecticut State University's Kineticar taking first place with a range of 379 miles.

The Sol Survivor, from Peterboro, NH, demonstrated the ability to generate 27 percent of its energy from solar panels on the vehicle (entered in the Solar Commuter category), despite the heavy cloud cover.

Four electric bicycles in the One-Person category were great crowd pleasers. The Charger bicycle, which is being marketed primarily to bicycle police forces, took first place.

"Most people don't realize that electric vehicles are entering the market," said Hazard. "General Motors and Solectria have vehicles on the road today,

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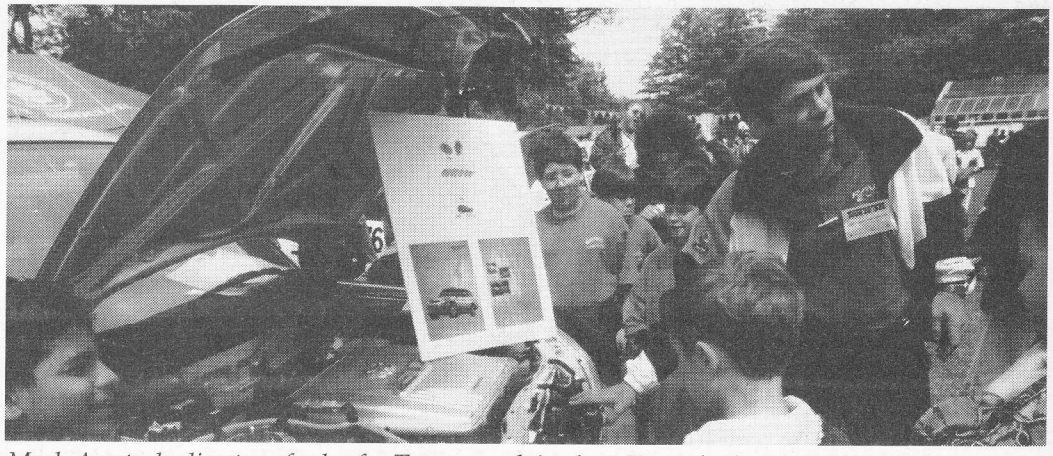
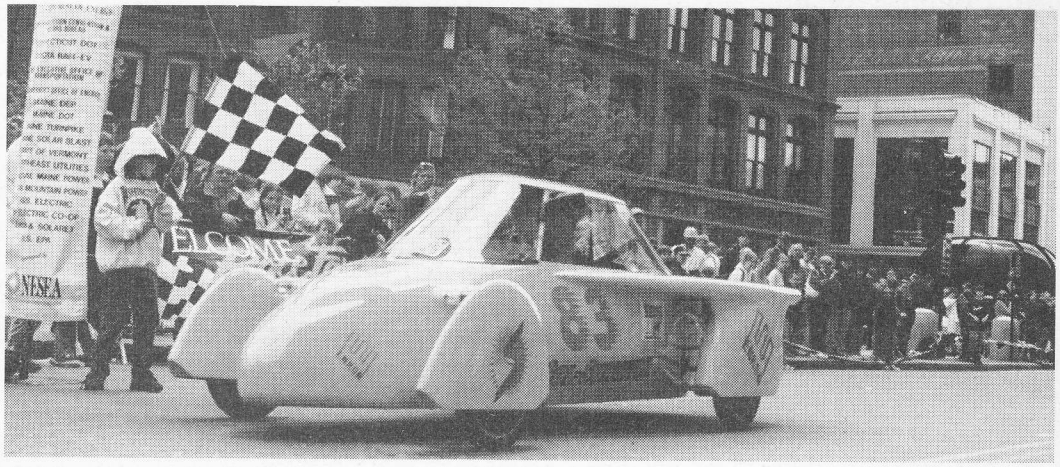


Mark Amstock, director of sales for Toyota, explains how Toyota's electric RAV4 works to students visiting the NESEA American Tour de Sol. Photo Credit: Jack Groh, NESEA.

The Riverside team poses for a group photo next to their solar electric van during the 1997 NESEA American Tour de Sol. The only middle school-built entry, students are proud to be learning about and promoting environmentally friendly electric vehicles. Photo Credit: Richard Ritter, NESEA.



Sol Survivor at the finish line at the 1997 NESEA American Tour de Sol, in Portland, ME. This two-person solar-assisted electric vehicle built by students and other interested people in Peterborough, NH, was sponsored by Enron, and took first place in its category. Photo Credit: Clay Turnbull, NESEA.

Battery Testing

Two 30XHS batteries were removed from a 48 Volt Kewet El-Jet3 that had sat unused for at least a year. One was designated as a test battery, the other as a control battery. Both were assumed to have roughly the same history in terms of cycling, since they were from a nearly new pack that had dropped to about half its capacity due to sulfation. The discharge was done with a new automated Zivan discharge unit running at 25 amps in order to compare with the manufacture's stated reserve capacity data for the battery. End of discharge shutoff voltage was 10.2 V (1.7 V/cell) under load.

I made some prelinimary tests with the discharger to get an idea of what the battery capacity actually was. The preliminary tests ran at 50 amp, as well as at 25 A discharge, and some went to a lower end-of-voltage. A preliminary test on an entire pack in a Kewet El-Jet 3 car was run at 75 amps, which is the maximum discharge current the system allows. I would like to do 100 Amp discharges in order to compare results with Scott Cornell and Bob Schneeveis, who do 100 A for an hour.

Discharge data was taken by hand roughly every five minutes, with longer intervals when the voltage stayed steady.

The manufacturer's data was given as 175 minutes at 25 A drain or 4375 Amp-minutes or 72.75 A-hr.

Preliminary Results

The designated test battery was then cycled several times, each time using the discharger. It was immediately recharged.

The first time the battery was charged up to 13.9 measured on the charger, 13.2 after being taken off. I would have liked to get it up to 14.5 at least, but was limited by the 12V charger.

The first dishcarge was done at 50 A to 9.4 V/cell, which is pretty low (1.57 V/cell).

At a 50 A discharge, the battery gave 39 Ahr and ran a total of 47 minutes; however, that was to 9.4 V per cell, which is rough on the battery.

FIGURE 1

Battery Discharge Data

Elapsed time	Vbat	Amphr
0:00	13.2	0000
1:46	11.3	0044
2:11	——	0054
2:13	10.7	0055
2:26	10.3	00061
2:27	10.2	00061

This then gave:

25 amps X 147 min = 3675 Amp-min or 61.25 Ahr.

61.25 Ahr/72.75Ahr = 84% of theoretical capacity.

The battery appeared to improve from a reserve capacity (25 A discharge) of 36 Ahr to 61 Ahr.

FIGURE 2

Results - Control 30XHS Battery

Starting voltage — 13.2 after being off charge for 30 minutes.

Elapsed time	Vbat	Amphr
0:00	12.4	0000
0:01	11.3	0000
0:02	11.3	0000
0:03	11.3	0001
0:04	11.3	0002
0:05	11.3	0002
0:09	11.3	0003
0:10	11.3	0004
0:13	11.3	0005
0:15	11.3	0006
0:20	11.3	0008
0:28	11.2	0012
0:36	11.1	0015
0:37	1.0	0015
0:41	11.0	0017
0:45	10.9	0018
0:46	10.9	0019
0:52	10.9	0021
1:05	10.8	0027
1:15	10.5	0030
1:16	0.3	0031
	10.2	0032

This total of 32 Ahrs is fairly in-line with my previous result for the pre-PowerPulsed test battery

At a 33 A discharge, the battery went to the same depth in 60 minutes, which gives 2280 Amp-minutes.

At a more reasonable rate and depth of discharge, namely 25 amps to 10.2 V/cell, the battery gave 36 Ahr.

This confirmed my qualitative impression that the pack from which this battery came had fallen to about half capacity.

These were relatively new batteries that had sulfated from disuse. Since I'd bought a 12-volt PowerPulse unit for one of my electric cars, just to experiment with, I then installed the PowerPulse on this battery and let it run for four days. The PowerPulse remained in place during all subsequent charges and discharges on this battery.

For the first 2 days, this cell stayed on charge with the PowerPulse. The EOC on-charge voltage was 14.0 V.

It was then discharged at the 25 amp rate to 10.2V.

Only a few data readings were taken during this discharge, since I became intrigued by this battery's performance only after it passed its non-PowerPulsed capacity reading and kept, as they say of the Eveready bunny, "right on going."

Elapsed time is in hours:minutes. Temperature was not measured exactly, but it was hot in the hangar, probably somewhere in the mid-to-high eighties.

(See Figure 1.)

Results — The Real Thing

Encouraged by the preliminary results, I decided to do some more extensive testing.

Selecting a neighboring battery from the same car as the control, I charged that one up to 13.9 V under charge (vigorously gassing), then discharged it at 25 A to 10.2 V measured under load. Again, data was taken by hand. Both batteries were charged and discharged alternately during testing so that the control would have as many cycles as the test battery.

The fact that the battery did not show as much reserve capacity this time is probably due to temperature, as it was able to reach 60 Ahrs in a slightly longer period after a short rest.

To me this is indicative that the improvement caused by the PowerPulse was not just a fluke and that it was indeed holding up.

Conclusion: The 12-volt PowerPulse unit did indeed restore capacity in nearly new batteries that were left to sulfate.

FIGURE 3

PowerPulsed Test 30XHS test battery:

After 4 days on PP, intermittantly on charger:

Charged to 13.9 as measured under charge, starting voltage 12.6 after being off charger for 2 hours. The hangar temperature was slightly lower than during previous discharge, more like the mid-seventies.

Elapsed time	Vbat	Amphr
0:00	12.6	0000
0:01	12.0	0000
0:01	11.8	0000
0:02	11.6	0000
0:03	11.6	0001
0:08	11.6	0003
0:11	11.6	0004
0:19	11.6	0007
0:32	11.5	0013
0:39	11.4	0016
0:53	11.4	0022
0:58	11.3	0024
1:05	11.3	0027
1:10	11.3	0029
1:15	11.3	0031
1:20	11.2	0033
1:45	11.0	0043
	10.9	
2:03	10.8	0051
2:16	10.2	0056

Shutoff

At 3 minutes after shutoff, Vbat came back up to 11.3-11.4 V. Just out of curiosity, I decided to restart the discharge.

Elapsed time	Vbat	Amphr
2:17	10.9	——
2:22	10.?	0059
2:27	10.2	0060

Since there are, unfortunately, many of these in the EV world, the PP should find a lot of use.

As a result of the preliminary discharge results, I ordered a 48-volt PowerPulse unit and have installed it in the Kewet after replacing the two test and control batteries. Green Motorworks has two of these Kewet El-Jet Threes, both virtually identical and with the same history. I have range-tested the non PP-ed Kewet and got a dismal 14 miles at a constant speed of 30 mph.

If the PP works as well on the whole pack as it did on the single battery, the PP car should have roughly double the range of the non-PP car.

I'll report the range test results later. Bob Schneeveis is also doing a similar comparison test and, if I bug him enough, maybe I can get his results as well. He tests at a 100 Amp discharge, so that gives a truer indication of behavior during actual EV service. —CB

Pulse Technolgy

In August 1990, when engineers at the Stennis Space Center evaluated a crude solar device with a small circuit board attached, they discovered that the pulsed power it utilized would "prevent sulfate accumulation on battery plates, maintaining peak performance." Based on this report, patent numbers 4871959, 5084664, 5276393 and 5491399 were assigned to this circuit and a group of products derived from it. These were then tested by the US military and, after 3 years of extensive testing, they found that these devices do indeed prevent sulfation and can reverse it even if it is firmly established.

Sulfation - Why Batteries Fail

Lead acid batteries utilize a transfer of energy from sulfur in sulfate form (SO4-2)to the lead in lead plates. During discharge, sulfate moves from lead sulfate Pb2SO4 paste on the plates to liquid electrolyte, where it goes into solution as ions. In theory, all of the sulfate molecules return to solution. In practice, during discharge some of the sulfate molecules reach such a low energy level that they do not redissolve. Instead they remain attached to the plates and eventually crystalize. Once the sulfate crystal is seeded, it grows, gathering other low-energy sulfate molecules and binding them tightly. They are lost from the electrolyte, causing loss of battery capability and capacity. They also coat the plates, contributing to the same process.

Normal recharging is not sufficient to put these crystalized sulfates back into solution. Over time the sulfate buildup accumulates and chokes the plates. The amount and hardness of the sulfate crystal deposit is a result of time, state of charge in the battery and usage cycle. Equalize charging can return some of these crystalized sulfates to the electrolyte; however, not all of them do return, and the remaining portions of the exposed plates tend to get overcharged and damaged.

"Sulfation can cause significant loss of capability and capacity in lead acid batteries." "Over time the sulfate buildup accumulates and chokes the battery plates." "Pulsed technology devices can excite and break up the molecules in the hardened sulfate crystals by elegantly plucking them off the plates."

How Pulse Technology Works Shaking Crystals Apart

Individual molecules and crystal matrices are not the stiff, solid constructions that we imagine. They bend, twist, dance and vibrate, their chemical bonds behaving a lot like mechanical springs. Even in a crystal lattice formed by a salt like Pb2SO4, atoms are not fixed in place, but vibrate and move around. These oscillations have a sort of natural frequency, again, like a spring. Like a spring or a pendulum, the molecular motion can be driven by energy inputs at the right frequency (like pushing a kid in a swing — you have to push at the right time). If a molecule or crystal is subjected to energy of the correct frequency, the bending, twisting or vibration increases to the point where it shakes the molecule or crystal apart. This is called having a magnetic moment at a resonant frequency.

When the frequency for lead sulfate is applied to a crystalline deposit, the individual ions that make up the matrix are excited to this higher energy state, thus breaking the bonds of the structure. These freed ions can then accept charge and return to solution to become active electrolyte once again.

Giving Just the Right Stuff

This is accomplished in the pulsed technology devices by subjecting the hardened sulfate crystals to a DC current pulse. The device controls the rise time, pulse width and frequency. Because it is running at a resonant frequency, it requires only fairly low energy input to keep the molecules excited and breaking themselves apart. In practice, the required pulse must have a rise time fast enough to trigger a wave of at least 2 to 10 Mhz at a pulse width of less than 0.3 microseconds. The pulse repetition frequency is not as critical and can run anywhere from 2 to 20 kHz, depending on load and power supply used. The pulsed technology devices use a current pulse amplitude of 400 milliamps. It is so low in wattage that it can be supplied by the battery itself.

Instead of having to brute-force sulfate crystals back into solution or knocking them off the plates by heavy overcharging, this technology elegantly plucks them off the plates, freeing more plate area to take on charge and restoring the chemical energy storage capacity of the electrolyte.

Economic and Environmental Considerations

Although the lead-acid battery is not excessively expensive, its cost rises dramatically when one includes the cost of downtime, disposal and labor hours. These problems, in combination with society's heavy reliance on the lead-acid battery, have pushed the search for an alternative, with limited success.

It is estimated that over 80 percent of discarded batteries have not reached their full cycle lives, but have died prematurely from sulfation-clogged plates. Saving these and/or extending their lives by pulsed technology devices would reduce the number of lead-acid batteries being discarded and improve even further the lead-acid's minimal (because it is commonly recycled) effect on the environment.

If, as it appears to be so at this writing, the pulse technology is effective, then:

1) Battery life will be dramatically extended.
2) Battery efficiency will be improved by maintaining 100 percent of capacity.
3) Recharge time will be reduced.

4) Battery capacity will increase so that batteries last longer between recharges.

Lead-acid battery EVs will be able to go more miles, perform better, recharge more efficiently and require fewer battery replacements.

The US Air Force thinks this technology works. Its consolidated Status Report, June 16-December 15, 1993, says:

In conclusion, the Solargizer (an early solar-powered version of the pulse technology) worked by removing sulfation from the battery plates as the manufacturer claimed. Extensive use of the Solargizer could result in significant savings. It is unknown exactly how long a battery will last with the Solargizer connected, but it is estimated that at least eight to 10 years of life can be added.

A number of vendors are now making variants of this technology. The best-known and most-tested so far that CE knows is Pulse-Tech Products Corporation, 131 Premier Drive, Irving, TX 75063. TEL: 1-800-580-7754. Fax 214-550-1062. Website: www.pulsetech-products.com."

Source: PulseTech Products, technical document (Feb. 27, 1997)

NESEA

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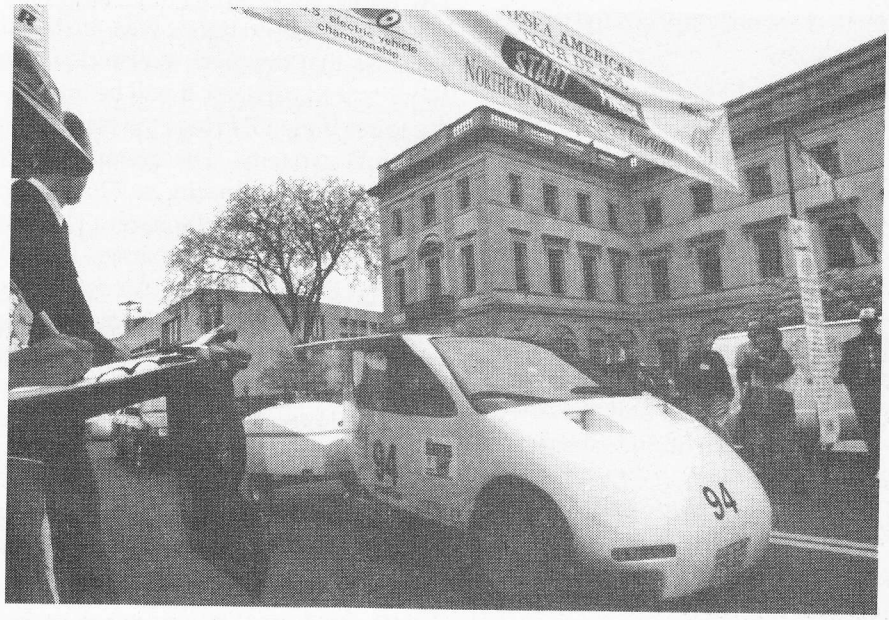
The media greet their home town favorite at the finish line in Portland, ME at the 1997 NESEA American Tour de Sol. Built by high school students in Falmouth, ME, students feel proud to be building and demonstrating environmentally friendly electric vehicles.Photo Credit: Clay Turnbull, NESEA.



One of the most futuristic looking hybrid vehicles in the 1997 NESEA American Tour de Sol passes under the start banner in Waterbury, CT. Built by Tom Hopper, of Concord, NH, the car carries two people, and has a trailer with a generator in it which can be attached to the electric car for long trips. Photo Credit: Jack Groh, NESEA.

and the other major automakers will have product available to fleet buyers within several months."

NESEA is seeking interested sponsors, entrants and host towns for the 10th annual Tour de Sol, which is scheduled to go to Washington, DC in May of 1998.

Source: NESEA, 50 Miles Street, Greenfield, MA 0130. Tel: (413) 774-6051. Fax: (413) 774-6053.

Battery revival — PowerPulse unit

The following is some recent e-mail correspondence I had with Doug Pratt ("Dr. Doug"), Technical Editor at Real Goods Trading Corporation (E-Mail: doug@realgoods.com; Website: www.realgoods.com) on the subject of battery revival by pulsed technology devices:

Hi Doug,

I've been playing with an electronic sulfation preventer device called a PowerPulse. Richard Perez, from Home Power, apparently tested this and got results that were so good he hesitated to publish (also because the dealer that carried them went belly-up, but the company didn't.)

Have you folks at Real Goods looked into this unit? It does seem to revive sulfated cells. I tried a 12V unit on a Trojan 30 XHS out of an EV that had sat for a year. Using a 25 amp discharge current, I got only 33 AHrs out of the battery. After putting the PP on it for about 4 days, I got 61 Ahrs out. A control battery out of the same pack that was not treated with the PowerPulse, but similarly charged and discharged only yielded 32 Ahrs with little or no improvement from cycling alone.

I used a Zivan battery discharge unit and I have the discharge curve data (taken by hand, but I will get it into digital form.)

These results impressed me enough to buy a 48-volt unit for one of Green Motor's Kewets. I've just installed it, so we'll see what happens.

Will this device just knock the sulfated crystals off, I wonder, or will it actually break the chemical bonds and return the ions to the electrolyte? If so, it might be a better solution than EDTA, which is a chelating agent. PP seems to give a fast burst of 400 milliamp pulses on the order of 18 KHz every half-second or so.

"Will this device just knock the sulfated crystals off, I wonder, or will it actually break the chemical bonds and return the ions to the electrolyte?

The cost of the 12V unit is $70; the cost of the 48V unit is $170. The company is PulseTech Products Corporation, 3131 Premier Drive, Irving, TX 75063; TEL 1-800-580-7554; Fax 214-550-1062. I ordered my 48V unit one day and recieved it a day and a half later.

Green has two identical Kewets, both the same age and both having had the same history (sitting). I've put the 48V PP on one of them and will use the other as a control. I did a battery discharge at 75 A on the pack of the control car and got a result indicating that the pack had fallen to about half capacity. The range we've gotten on the PP car before the PowerPulse was installed indicates that this pack is also down to about half its capacity. It will be interesting to see if the PP brings the pack up to near-full capacity. The manufacturer claims a reserve capacity of 72 Ahrs for the 30 XHS at 25 A discharge. The last time I checked the PP-ed battery, I got 61 Ahrs and then 60 Ahrs (colder day, lower temperature), which indicates that the improvement seems to be holding.

Could it be that (unlike a lot of the battery additives that have been hyped — although not EDTA — this thing actually WORKS?

My preliminary results indicate that it does. —CB

Hi Clare,

The pulser units (there are several manufacturers now, I believe) DO actually work. Batteries deliver DC, and engineers have done their best over the years to give nice clean DC back to them for charging, but it appears that isn't what keeps them happiest. I first became aware of this when Trace came out with their first generation of inverter/chargers. The somewhat crude charger just whacked the top off each incoming AC cycle, so their charger had a big 60-cycle ripple. The battery guys loved them! They discovered that the Trace chargers would revive older batteries, and generally stuff more energy into almost any battery with a few miles onit.

We've known for a long time that higher voltage charging would force more sulfur ions back into solution, that's all that "equalizing charges" are. The problem is that any parts of the cell plates that aren't sulfate-coated get cooked by higher voltages. Well, duh! How about limiting the high voltage to quick little pulses? Normal plate areas don't get cooked, because the pulses are so quick and dissipate almost instantly, but the high voltage is still doing its magic on the sulfation. The applications you're using the PowerPulse on are almost ideal for producing extraordinary results. New batteries that have simply been sitting for months to years are great candidates for pulse revival. None of the lead has flaked or sagged off the plates, they've simply become sulfated. Batteries that are seeing regular exercise and a charging history that doesn't routinely undercharge them will see lots less improvement, as sulfation doesn't build up much on cells that are actually working for a living. Kinda like moss on a rolling stone.

Hope all this helps.

Best Regards, Doug.

More PowerPulse Testing In-Vehicle Experience

Further PowerPulse testing confirms truly encouraging revival results for underused batteries that have become heavily sulfated." "Well-known and well-tested PP technology is readily available on the market at relatively inexpensive prices."

Such encouraging results were obtained for the separate battery test that I went ahead, got a 48-volt version of the PowerPulse and installed it in a silver Kewet El-Jet 3 These Kewets are supposed to be 25-mile cars; however, this one had fallen off to less than 15 miles due to non-use and infrequent charging. After a week on the PP unit, I put the car on charge prior to range-testing it. The batteries behaved significantly differently under charge after PP treatment.

Gassy Batteries

Before they would gas vigorously at 13.9 V per cell and wouldn't go above. The charge current never tapered and remained at 19-20 amps. According to Green Motorworks' office in LA, the charger had been properly set up. I was suspicious about that, since it seemed to be overcharging the batteries and never tapering.

Nicely Behaved

After PP, the charger behaved as advertised. Charge current began at 24 amps as measured with a clamp-on Fluke meter, stayed relatively steady until pack reached gassing voltage of 58, then began to taper. The car was put on charge at about 7:00 pm the night before range-testing. At 9:30 pm, the on-charge voltage was 58V, current was 22 Amps. At 11:00 pm, the on-charge voltage was still 58V, current was 12 amps. At 1:30 am, current was 10 amps. At 8:00 am the next morning, voltage was 58.3 V and current had tapered down to 5.5 A as measured on the Fluke meter. At 8:15, current was 5.3 A, voltage was 57.3V. (Might I have mis-read 8:00 am voltage?)

Range Test Results

At 9:00, current was 5.1 amps and voltage was 57.3V. The car was taken off charge and range-tested on the Alameda Naval Air Station aircraft apron near the seaplane lagoon. I made a quick trip outside the base for apple fritters, then started the range test, running the long oval on the apron holding 30 mph. I used the "sport" setting. The speed was not allowed to vary more than about plus or minus 3-4 miles from 30 mph until the very end of run. The car held 30 mph easily for 23 miles, then I noticed a slight power fall-off, especially in turns. From 23-25 miles, the car could sustain 30 mph on straightaways; it fell to 25 on turns. At 25, power sagged off and the car couldn't maintain 20, so I ended the range test and returned to the hangar.

RANGE TEST RESULTS

Beginning to end of the test — 9:00 to 11:00 am

Nominal capacity per battt — 12V x 60 Ahrs = 720 Whrs

Nominal capacity of pack — 720 Whrs x 8 batts = 5760 Whr or 5.760 Kwhrs

27miles/5.760 kwhrs = 4.69 miles per kWhr

25 miles/5.760 kwhr = 4.34 miles/Kwhr

The red Kewett, (non-pped control car) range tested out at barely 14.5 miles — so 25/14.5 miles = 1.72 x improvement.

News in Brief is compiled by Ruth M. Shipley from information supplied by the Environmental Information Network. If reprinted, please credit CE and Ruth Shipley.

Hydrogen Reformer Introduced

A patented hydrogen reforming unit by Phoenix Gas Systems, a subsidiary of Hydrogen Burner Technology (HBT), reportedly can strip pure hydrogen from any hydrocarbon fuel, perhaps solving the problem of providing fuel cells with hydrogen, said Greg Hummel of Phoenix Gas. HBT is now manufacturing and shipping its Underoxidizer Burner to industrial hydrogen producers, including BOC of the United States and Merchant Gas of Japan. Hummel said HBT's first units, which are able to produce about 500 cubic feet of hydrogen per hour, were sold for about $150,000. HBT expects to begin shipping 3,500 units by mid-1997. The reforming units could be carried on-board a vehicle, allowing the vehicle to use the existing gasoline and diesel fueling infrastructure.

(HYDROGEN TODAY, 1997)

Glacier Bay Develops AC System

Engineers at San Mateo, CA-based Glacier Bay, Inc. are developing an environmental control system (ECS) that can be used in EVs and hybrid EVs (HEVs). Glacier Bay made modifications to its existing marine heating, ventilation and air conditioning (HVAC) system. These included a much smaller and lighter compressor, evaporator and condenser, in addition to the development of a compressor able to produce greater speeds than the marine HVAC unit. The new system also had to be configured to handle variable input voltages supplied by EV and HEV motors. Glacier Bay tested the system in a Pivco City Bee EV used in a station car program. The company is conducting further tests on the ECS to determine the unit's operation efficiencies.

(CALSTART TECH NOTES: FEB.)

GM Developing Hybrid Power Systems

General Motors (GM) is collaborating with Williams International on the development of a gas turbine to be used to power a hybrid EV. Use of the turbine could increase vehicle fuel efficiency by as much as 50%. The Partnership for a New Generation of Vehicles (PNGV) is considering gas turbine engines as one of its primary power sources. An advantage to using the turbine in conjunction with an electric drive system is that it can extend the potential range of an all-electric vehicle. GM also is working on the development of other hybrid propulsion systems that include a flywheel alternator starter input differential combined with a diesel engine, and a system that includes an electric motor for rear-wheel power and an internal combustion engine for front-wheel power.

(USCAR MILEPOSTS: SPRING 1997)

AC Propulsion Cuts Drivetrain Cost

In an effort to increase manufacturing efficiencies and bring its product to more customers, San Dimas, CA-based AC Propulsion, Inc. has lowered the price of its AC-150 EV drive system. Depending on production volume, the system will now cost as much as 12% less, and the company has cut the single-unit price of the AC-150 by almost 20% since last year. The AC-150 includes the company's patented 20-kilowatt Reductive Charger, which can charge EV batteries in as little as one hour. The unit is now available for $29,500, in quantities of ten. The 200-horsepower AC-150 uses control of the motor's magnetic flux to maintain the system's efficiency. While the cost of the unit is relatively high, the company believes that the unit can significantly boost a vehicle's range.

(AC PROPULSION RELEASE: APR. 28)

NiH Battery Breakthrough in Japan

Scientists in Japan have made a development breakthrough that could make the use of nickel hydrogen (NiH) battery technology applicable for EVs. Researchers from the Government Industrial Research Institute in Osaka, working with nonwoven fabric manufacturer Kanei Juyo Kogyo Company, have developed a method for coating the separators between negative and positive electrodes that can help to eliminate battery discharge at high temperatures. Using the new process, researchers were able to limit the self-discharge of the battery to two-thirds the normal amount. The new material boasts an ion exchange capacity 10 times greater than materials currently in use, in addition to greater strength and ability to maintain the battery's electrolyte.

(NIKKEI ENGLISH NEWS: APR. 23)

Renault Develops Hybrid Car

The Pangea, a 4x4 hybrid electric-liquefied petroleum gas (LPG) vehicle that carries fuel reserves on its own integral trailer, was unveiled by Renault at the recent Geneva Motor Show in Switzerland. The concept car — which includes observation and measuring equipment, a multi-media workstation that handles video-phone and other links and navigational aids — has been described as a laboratory on wheels. The Pangea, which is Greek for "the whole of the Earth," operates on either batteries or a turbine-driven generator, or both simultaneously. The turbo-generator runs on LPG or propane. When running on batteries alone, the vehicle has a range of about 60 miles. But when operating on both electricity and propane, the vehicle reportedly can drive more than 310 miles before refueling.

(UTILITY & TELEPHONE FLEETS: MAY)

NHTSA Releases EV Safety Brochure

The National Highway Traffic Safety Administration (NHTSA) has published a pamphlet documenting the proper safety precautions to take when an EV is involved in an accident. EV batteries can be hazardous in an accident because they contain caustic liquids and may have toxic and flammable fumes and vapors. Further, there is a possibility of electric shock, since EVs use voltages as high as 300 volts of direct current. The brochure, "Approaching Alternative-Fueled Vehicle Crashes", gives tips for identifying EVs and the proper procedures to take if the vehicle is on fire or leaking fluid. Contact: NHTSA. Fax: 202-366-7721. World Wide Web: http://www.nhtsa.dot.gov.

(UTILITY & TELEPHONE FLEETS: MAY)

Oil Industry Blocks Hydrogen Infrastructure

The president of the International Association of Hydrogen Energy and head of the University of Miami's Clean Energy Research Institute believes the main impediment in the establishment of a hydrogen infrastructure lies in the unwillingness of the petroleum industry to cooperate with hydrogen manufacturers. Speaking at a meeting of the Department of Energy's Hydrogen Technical Advisory Panel in Alexandria, VA in March, T. Nejat Veziroglu said petroleum companies "produce large amounts of hydrogen," as part of their normal refining operations. "But petroleum companies consider hydrogen as competition. They want to delay the production of hydrogen as much as possible. Because of this we are trying to produce hydrogen from existing fuels."

(HYDROGEN AND FUEL CELL LETTER: MAY)

Electrolyser Develops Hydrogen Refueling Device

Electrolyser Corporation Ltd. recently announced the upcoming delivery of its new Hydrogen Vehicle Refueling Appliance (HVRA) to British Columbia's BC Transit agency. The device will be used to refuel BC Transit's fleet of Ballard Power System hydrogen fuel cell buses later this year. The HVRA, code-named SFG-400, is currently in early stages of development under the company's SunFuel Division. The device is a grid-connected hydrogen generator based on unipolar electrolysis cell technology. It includes single point connection, modular design, a built-in dispenser for "time-fill" vehicle refueling, an automatic control system for unattended operations, and automatic feedwater supply.

(HYDROGEN & FUEL CELL LETTER: MAY)

Cocconi Says EV1 Has Major Flaw

Alan Cocconi believes that GM's decision to use an inductive charger for the EV1 was a major mistake. Cocconi is an electrical engineer who worked on the EV1's predecessor, the Impact, but has since gone on to form his own company. The Impact had a conductive charger but GM chose to use an inductive charger in the EV1. GM believes the inductive charger is safer, but Cocconi disagrees. Because the inductive system requires EV1 owners to have a $2,000 charger installed by a local utility, Cocconi believes this "worked as a very effective sponge to soak up all the federal and state dollars that could have gone into creating a much cheaper and pervasive infrastructure" for EVs. Cocconi has developed a drivetrain that he feels can outperform the EV1 in range and battery charging time.

(SCIENTIFIC AMERICAN: MAY)

GM Cuts EV1 Lease Payment

General Motors Corporation recently announced plans to cut the price of the EV1 by 25% with the hope of expanding the market for the vehicles. The company will lower the monthly lease rate for the $34,000 vehicle from $530 to $399, including the lease of a home-charging station, as well as pay for 50 more charging stations. GM officials cited a high price tag and a 70 mile-per-charge city driving range as the drawbacks of the vehicle, which was introduced in December on a lease-only basis. Since then, only 176 EV1s have been leased at Saturn dealerships in Los Angeles, San Diego, Phoenix and Tucson. The company had anticipated leasing 100 cars per month.

(LOS ANGELES TIMES: MAY 2)

LA Receives Funding for EV Programs

The Los Angeles Departments of Water and Power (DWP) and Environmental Affairs have received $862,500 from the

continued on page 32

News in Brief

continued from page 31

Mobile Source Air Pollution Reduction Review Committee (MSRC) for the installation of EV charging stations and other EV activities. Los Angeles was one of seven bidders for $1.6 million in funding available through MSRC's Quick Charge - Electric Vehicle Corridor Communities Program. The funding will be used to support EV infrastructure and programs in Los Angeles, Orange, San Bernardino and Riverside counties. A total of 200 new EV charging stations, featuring inductive and conductive charging equipment, will be installed at 42 proposed sites, including the J. Paul Getty Museum, the Los Angeles Zoo and the Cedars-Sinai Medical Center.

(DWP NEWS: MAY 9)

Tough Road Ahead for GM Ovonic

Weak demand, high cost and tough competition are just some of the obstacles faced by GM Ovonic LLC, which plans to launch production of its nickel-metal hydride (NiMH) batteries this summer. However, Ovonic cannot afford to wait, since the U.S. Advanced Battery Consortium will not fund further Ovonic research after this year. Ovonic faces tough competition from Matsushita of Japan, as well as the risk that NiMH batteries will be overshadowed by the introduction of lithium batteries, which offer greater range and lower cost. Ovonic is automating its production process to reduce the $60,000 cost of hand-built batteries. Despite this, the company may never achieve the consortium's goal of $4,500 for an EV1-size battery pack.

(AUTOMOTIVE NEWS: MAY 12)

EVAA Offers Charging Directory on Web

To help the general public locate EV charging stations around the nation, the Electric Vehicle Association of the Americas (EVAA) has included a free directory of EV charging stations on its web site. EVAA developed the directory as an updated, electronic version of two print publications — "Electric Vehicle Charging Sites Directory" and "Profile of Electric Vehicle Charging Sites" — issued by the association in March of last year. At least 975 non-residential charging outlets and 188 locations in 25 states and the District of Columbia were identified. Web surfers can find the site at http://www.evaa.org/library/index.html. Simply click on a shaded-in area on the U.S. map and a list of EV charging sites is given for that area.

(EVAA RELEASE: MAY 14)

Nissan Unveils New Hybrid Vehicle

Japan's Nissan Motor Company recently announced that it has developed a fuel-efficient, hybrid EV system that features markedly reduced tailpipe emissions. The new Nissan system combines a gasoline-powered engine with an electric motor and generator, and boasts nearly twice the fuel efficiency of conventional gasoline-fueled vehicles. Nissan said the new hybrid emits about half the carbon dioxide emissions of a conventional automobile. Additionally, the hybrid cuts emissions of carbon monoxide and other pollutants by about 95%, compared to current vehicles. Nissan said its hybrid uses improved lithium-ion battery technology developed jointly with Sony Corporation. The lithium-ion battery is smaller and lighter than conventional electric vehicle battery systems.

(AP: MAY 16)

Ford Develops Hydrogen Fuel Cell

Ford Motor Company has divulged its plans to have a fully-integrated hydrogen fuel cell-powered research vehicle ready for evaluation by 2000 in a joint effort with the Department of Energy (DOE). The automaker said it is planning "a hydrogen configuration, which means the hydrogen will be stored on-board and used directly as needed for power." Other automakers are working on fuel cell technology that reforms hydrogen from other fuels. For example, Daimler Benz has invested in hydrogen storage in the form of methanol, while Chrysler said it will extract hydrogen from gasoline. Ford is working on the fuel cell vehicle under its P2000 project, which is associated with the Partnership for New Generation of Vehicles initiative.

(FLEETS & FUELS: MAY 19)

Hybrids May Overtake EVs

Many participants at the recent International Symposium on Automotive Technology and Automa-tion believe that hybrid EVs are the car of the future. Japan's biggest car company, Toyota, announced that it will introduce a hybrid gasoline-electric powered car on the local market by the end of 1997. Toyota's hybrid vehicle reportedly offers twice the fuel economy of conventional gasoline vehicles. The automaker said its hybrid vehicle gets 79 mpg, with a massive reduction in carbon dioxide and nitrogen oxide emissions. Many symposium participants said the fuel cell is the long-term replacement for the internal combustion engine. Fuel cells can propel electric motors with the use of hydrogen that can come from a variety of sources, including ethanol, propane, gasoline or natural gas.

(REUTER: JUNE 19)

Unique Mobility Showcases EVs at Summit

Unique Mobility recently showcased its Ethos 3 EV passenger car and Sniper EV motor scooter at the Summit of the Eight conference in Denver, CO. The Ethos 3 EV is a four-door, four-passenger EV that can accelerate from zero to 60 mph in nearly 11 seconds. The EV, which is

equipped with a 53 kilowatt electric powertrain and Ovonic NiMH batteries, was developed through a joint venture by Unique Mobility and Turin, Italy-based automaker Pininfarina S.p.A. The companies plan to develop additional models of the Ethos 3 EV for automotive original equipment manufacturers worldwide. The Sniper EV motor scooter was developed by Unique Mobility and Kwang Yang Motor Company, Ltd. of Kaoshuing, Taiwan. It reaches speeds over 40 mph and has a range of 40 miles with lead-acid batteries and over 75 miles with NiMH batteries.

(UNIQUE MOBILITY RELEASE: JUNE 19)

Automakers Balk at EV Mandates

Even though automakers recently began selling EVs in California, they seem pessimistic about meeting the state's 10% EV mandate by 2003. Several automotive executives said it is up to the battery makers to make big breakthroughs and lower costs, as well as extend a car's range on a single charge, before automakers can meet the goals. In order to meet the mandate, GM said it would have to sell more than 35,000 EVs, based on its 1996 sales of 355,453. But since it began marketing the EV1 in December, the company has delivered only 185 of the cars. Overall, sales of EVs in California would have to reach between 100,000 and 150,000 by 2003 to meet the state's mandate. Most automakers say they will eventually switch to NiMH batteries.

(REUTER: JUNE 16)

Nickel-Hydrogen Battery Plant Opens

The first-ever nickel-hydrogen battery production facility became operational recently in the city of Shenyang, capital of the Liaoning Province in northeast China. The plant will produce 30 million nickel-hydrogen batteries and 300 tons of hydrogen-rich alloying powder at full capacity. The facility's products are expected to be used in a variety of applications, from computers and appliances to EVs. The plant will produce 13 varieties of batteries in three different categories. The plant is run by local battery producer Zhongliao Sanpu Battery Company, Ltd., which hopes to produce 10 million batteries -- including 100,000 mobile phone batteries -- and 200 tons of alloying powder this year. The plant is expected to reach a daily output level of 100,000 batteries by July, 1998.

(XINHUA: JUNE 14)

Galtech Motor/Generator Patent Approved

Mesa, AZ-based Galtech Semiconductor Materials Corporation recently announced that its motor/generator technology patent, including some 22 claims, has been approved by the U.S. Patent Office. "In a controlled laboratory environment, the permanent magnet, brushless DC motor/generator technology delivers electrical power at new levels of performance and efficiency not seen in today's state of the art motors and generators," said Galtech's president and CEO Russell Chapman. "Our motor/generator could provide the ideal source of energy for electrically powered vehicles that require optimum performance, vastly extending the present driving distance and significantly reducing the present number of batteries required to power current electric vehicles short distances."

(GALTECH RELEASE: JUNE 10)

Electrolyser Develops Hydrogen Fueling Stations

After several years of quiet development and very little publicity, Electrolyser Corporation of Etobicoke, Toronto has presented a glimpse of its current hydrogen refueling station projects and plans for the future. The company said it plans to demonstrate its refueling system in Vancouver's upcoming fleet of three Ballard proton exchange membrane fuel cell buses this fall. The systems will be able to deliver about 66 cubic-meters-per-hour of gaseous hydrogen that will be electrolyzed using non-peak Vancouver grid electricity which is mostly hydropower-generated. Thus, the fuel will be virtually emissions-free. Capacities of these hydrogen generators will range from small home size to charge EVs to very large sizes linked to the electricity grid for centralized hydrogen production.

(HYDROGEN & FUEL CELL LETTER: JUNE 1997)

Utility Donates EV Kits to School

Southern California Edison recently donated EV classroom kits to the Transportation Career Academy Program at John Glenn High School in Norwalk, CA. Each kit includes suggestions for lesson plans and a 16-page booklet on technical, environmental and infrastructure issues. The students participating in the program will work in groups to build 25 model cars. They will also examine topics such as transportation as a human need, urban air pollution and ways to mitigate pollution, building model EVs and measuring range, redesigning to enhance performance, transportation infrastructure and design structure, and various types of batteries in model cars.

(SOUTHERN CA EDISON RELEASE: JUNE 6)

JUNE 14, 1997 MEETING MINUTES

The members of the EAA's national board of directors attended the local Sacramento chapter's meeting on Saturday, June 14, 1997, and then adjurned to conduct national business at 12:30 pm.

In attendence were members Tony Cygan (co-chair), Stan Skokan (treasurer), Clare Bell, Bill Wedmore, and George Gless. Proxies were received from Harold Bell, Anna Cornell, and Tim Loree. No proxies were made available from Steve Lough, Ken Koch, or Peter Barnes. There were enough board members available to form a quorum and the meeting was confirmed as valid.

Tony Cygan acted as Secratary (with volunteer, George Wilson, also agreeing to act as a temporary Secretary).

General discussions opened the meeting, when new board member, Bill Wedmore, asked if there were any information packets available for new board members. Stan agreed to provide Bill, George Gless, and Tim Loree copies of the EAA's Bylaws. It was also agreed that a standard information packet for new board members would be developed by the next board meeting.

Meeting minutes from the April board meeting were circulated for comment to those who hadn't received a copy. A motion to accept the minutes was made by George Gless, seconded by Clare Bell, and then approved by all the board members.

Committee Reports

Stan Skokan made the Treasurer's Report. Stan said that the EAA treasury had bottomed out at $1,500, but is now moving back up and was at $5,500 as of June 14. Stan believes that EAA is on the road to recovery and he doesn't have any real concerns right now. Stan said he had collected outstanding debt from some EAA creditors that were related to the EAA EV Buyer's Guide. Sue Hollis billed EAA for printing/prepress costs and then billed the advertisers. Some of our advertisers have still not paid thier printing bill.This will be handled differently next year when the EV Buyer's Guide is done.

If the EAA runs a double issue of the Current EVents newsletter for July/August (rather than single issues for both months), it should be possible to save perhaps as much as $1000 in costs. (See below regarding the July/August issue of CE.)

In addition, the 1998 EV Buyer's Guide should cost less than the $13,863 that was spent for 1997, since all of the layouts, and other up front work have been completed. But Stan added that the EAA needs to come up with approximately $10,000 by the end of 1997 to pay for it.

It is noteworthy that Real Goods Trading Company bought $750 worth of 1997 EV Buyer's Guides.

All treasurery records were received from Mike Slominski and all of the Mac to PC conversions were completed for purposes of electronic record keeping.

George Gless made the awards report. George made a motion that the EAA work with the NEVDRA (National Electric Vehicle Drag Racing Association) to support their proposed, new Ed Randberg Cup. Ed passed away earlier this year and was a major influence in racing EVs. Stan seconded the motion and it was then approved by all board members. George will contact the NEVDRA to coordinate this.

George also requested that a Call For Nominations for the Keith Crock andEAA Fellowship Awards be placed in the Current EVents newsletter. Clare agreed to insert this into the next issue of CE. (See above in this issue.)

Clare Bell made the Current EVents report. Clare advised the board that she has a new job and that this caused her to miss the deadline for the July issue of CE. There was some discussion of combining the July and August newsletters. A motion was made by Stan Skokan to combine the July and August issues of CE. Clare seconded the motion and it was approved by all board members.

Clare introduced her new Assitan Editor, George Wilson. George's nam was given to Clare by Stan, and Georg was in attendance at the meeting to se what is going on with EAA and get a sense about the organization. Georg may run for a board spot in the nex election.

Clare will be running stories on Bil Warf's prototype NEV (neighboorhoo EV) "the Perigrin" and on B.A.T.'s/Joe LaStella's record run with the Zinc-Ai battery at Alameda NAS.

Clare may get a pager to help keep in contact with the board, given her current job and living situations.

Tony Cygan made the Website Report. Tony advise that the new EAA website was activated May 1st. It is — http://www.eaaev.org/

This should be the address that is listed in Current EVents, and in any EAA Press Releases or other public forums.

Tony also turned in $399 worth of receipts to Stan for reimbursement for the website ($299/year) and the domain name ($100 for 2 years). EAA's ISP (Internet Service Provider) allows 50MB of disk space for EAA's use with the website account.

Tony advised further that the new ISP provides local phone numbers in California and permits EAA up to 20 individual e-mail accounts. This will enable EAA board members to have e-mail under the www.eaaev.org address (e.g., cygan@eaaev.org). Tony will provide sign-up sheets for the e-mail to those board members who want to take advantage of it.

Old Business

Budget—Stan reiterated to the board the need to raise $10,000 by year-end 1997 to help pay for the 1998 EV Buyer's Guide. The board discussed this at some length and the following options were suggested to raise at least some of the funds.

1. Raise member dues to $39/year (as they have not been increased in many years)

2. Stop chapter rebates (which would not be popular with the individual chapters).

3. Provide EV Buyer's Guides in lieu of chapter rebates for a period of time (the chapters would still be able to recover their funds by selling the EV Buyer's Guides)

4. Give members an option to receive the EV Buyer's Guide or not when they renew (if they choose not to receive it, then they will still pay $35/year, otherwise they will pay $39/year).

5. Increase ad rates in CE and the EV Buyer's Guide (this would not affect costs for this year, but would presumably improve EAA's finances in later years).

After considerable debate, Stan made a motion to raise dues by $4 to $39 per year, starting as of July 1, 1997. This was seconded by George Gless and then approved by all the board members.

Stan will also send a notice to all chapter board members to solicit their feelings about sending the EV Buyer's Guides in lieu of rebates and about stopping or cutting back on rebates for a period of time.

Clare will look at the ad rates and into adjusting them accordingly. It was noted that the EAA doesn't want to raise them too much as this could have a negative impact on the number of current advertisers; but it was also noted that the current rates may be on the low side.

New Business

EAA Elections—It was decided to try and get back to the previous schedule of electing board members by year-end. For this purpose, the next elections will be held no later than December 1997. Tony Cygan volunteered to head the Elections Committee.

Next National EAA Board of Directors Meeting—The next national EAA meeting will be held on Saturday, January 24th, 1998 to coincide with the elections. The location has not yet been determined.

A letter was received (and circulated by the board) from Mike Thompson regarding his not being involved with the website issues (i.e., regarding the website's name and content). Tony reminded the board that Mike was instramental in getting the website redesigned by Ziff-Davis last year. Tony also advised the board that he encouraged Mike to provide content for the new EAA website and that it would be posted on the site. Mike told Tony that he may run for the board this year. The board discussed Mikes concerns and concluded that they seem to have been addressed adequately. The members also hope that Mike will run for the board, as the EAA needs more new blood.

The next meeting will be held at Stan Skokan's house in Redwood City, CA on Saturday, August 23, 1997, at 10:30am.

There being no further business, the meeting was adjourned at 3:30 pm.

EAA BOARD OF DIRECTORS

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EAA CALENDAR OF EVENTS

Welcome to the Electric Auto Association calendar of events. Listed are events of direct or related interest to Electric Vehicle Enthusiasts and Alternative Transportation Technology Businesses. If you know of an event that should be listed, please email event information to Kathy Watson (evchdlr@primenet.com)

August 23-24

EVN-Cup 1997, Austria, Central Europe. Last year we had 5000 visitors and about 80 participants. There are different races, EV-cars, prototypes, bikes, and also carts. Everyone who completes the whole race independent of their result gets a specified amount of money. For further information contact: Claus Drennig via e-mail: c.drennig@magnet.at. Fax: +43/1/7147463, tel: +43/1/7147463

August 30

Toyota-Optima Electric Drag Racing Championships. The location is Woodburn Drag Strip (30 miles south of Portland). For further information contact Gerhard Wagner: (503) 254-7612. E-Mail: ecar@europa.com.

Sept. 20

Silicon Valley Chapter Rally and Show, Stanford University at Galvez and Sierra. This is the big rally at Stanford that was so much fun last year. And not only the EV1 but also Honda and Toyota vehicles will be there. Contact: Will Beckett. Tel: 415-857-3859. E-Mail: beckett@legalsmtp.corp. hp.com. Good job Will!

Sept. 22-25

Fifth Grove Fuel Cell Symposium, London, UK. This symposium will provide you with an up-to-date review of fuel cells and their use, focusing on the following themes: business development and investment opportunities, key technological advances and system demonstrations, leading edge research results. International speakers are supplemented by a technical poster session. Contact: Sharron Emsley, Conference Organizer, Email s.emsley@elsevier.co.uk, fax: +44 1865 843958, tel: +44 1865 843721

Sept. 29 - Oct 1

S/EV97 Symposium and Trade Show, Hyannis, Annual conference organized by the Northeast Sustainable Energy Association. More than 130 speakers and 60 exhibitors in the electric and hybrid electric field. Contact: NESEA, 50 Miles Street, Greenfield, MA 01301, tel: 413.774.5051, fax: 413.774.6053. E-mail address: nesea@nesea.org

The intent of this Calendar is to provide a comprehensive list of events that will help to increase awareness and participation in the ever growing intereabout and use of Electric Vehicles. Your support and input is greatly appreciated. Thank you. Produced by Kathy Watson (evchdlr@primenet.com)

Call for Articles

CE is constantly on the lookout for interesting stories on EVs and EV-related technology. If you have an interesting story about your EV or technical information other EAA member would like to read, please submit your article to CE.

Articles may be sent to the the Assistant Editor by the 25th of each month for the next month's issue. E-mail to the Assistant Editor (See address on page 2) or mail 3.5-inch diskette submissions in "text" format, (PC) or (Mac).

Please send color photographs when avaialable. Photographs (color or black & white) provide better printer output than digital images. All relevant photos, in whatever format will be appreciated.

CE is also interested in articles from our advertisers/sponsors. Share your expertise with the EAA members by contributing articles in your area of expertise. Contact the Assistant Editor for more information.

MEMBER WANT ADS

For Sale

1987 Ford Escort--For Sale due to illness. No engine, Russco Motor and Controls and Adapter Plate, Lester Charger and other controls and instructions. You just put it together. $2000. Call Jack (707) 263-3319. (California)

1984 English For Van Ecostar model, right drive, 120v/550A, Prestolite, 20 US 220ah batts, 100 cycles, 3000 lbs, E-meter, DC/DC, Lester 220/120v 25a charger, fast, functional, useful, $7500/obo. Call for video. Call Eric at 1 (800)-289-8203 wk or (714)770-8541 hm (Irvine, California)

1985 Fod Tempo, 4-dr, 4 passenger, 5-spd. transmission, Curtis controller, Sevcon DC/DC, Zivan charger, 120VDC, NEW - 18x6V Trojan T125 batteries, 70 mph, 40-50 mile range, E-Meter; $5500. Call (310) 532-4536. (California)

PMC-21 controller, "China" motor, Kaylor adapter plate with clutch and flyweel for air cooled VW, Westberg volt & amp meters. All in very good condition. $800 takes all. (408) 338-0116 evenings. (California)

1983 Grumman Postal Delivery Van. 84 volts, Curtis PMC-21 controllers, Prestolite motor. Needs batteries. Two out board 220 volt Hobart chargers included. $857. Call Jim @ (916) 873-1788. (California)

WANT ADS: Print clearly or submit typed copy of your ad with your name, address, and phone number. The EAA is not responsible for the accuracy of ads. Want ads must be received before the 1st of each month and must include payment to run in the next issue of CE.

$10 for the first 35 words. Each additional word, 25 cents. Want Ads are available to EAA members for the sale of electric vehicles, equipment and parts only. If you want to run your ad in more than one issue, please specify and include payment for each issue requested.

For corrections or updates, please send a written note or fax to EAA Want Ads @ 408.374.8750. Photographs of your vehicles may be submitted with your ad. If room is available, we run one photo each issue. These photos will not be returned. Send your Member Want Ad request and check made payable to: EAA Want Ads, 18297 Baylor Avenue, Saratoga, CA 95070.

AD RATES

Full pg color	7.25" x 9.25"
1 ad	$300 ea

Full page	7.25" x 9.25"
1 ad	$400 ea
3 ads	$300 ea
12 ads	$250 ea

1/2 page	7.25" x 4.50"
1 ad	$250 ea
3 ads	$175 ea
12 ads	$125 ea

1/4 page	3.50" x 4.50"
1 ad	$200 ea
3 ads	$150 ea
12 ads	$100 ea

1/8 page	2.0" x 3.5"
1 ad	$150 ea
3 ads	$100 ea
12 ads	$75 ea

Ads may be placed for 1, 3 or 12 months. Camera-ready copy for each ad must be submitted along with payment. Ads may be submitted on diskette in TIF or EPS format on the PC or MAC. For 12 ads, an invoice will be billed quarterly. A minimum of 3 ads is required to be prepaid.

Ad Deadline

The Deadline for camera-ready copy is the **1st of the month**. Copy received after the 1st will be run in the next issue. Ads will be placed in the priority received. Prepaid ads will receive 1st priority. Make check payable to EAA. Camera-ready copy and payment for the ad should be sent to: EAA AUTO ASSOCIATION, 18297 Baylor Avenue, Saratoga, CA 95070

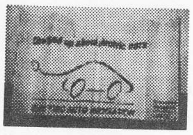
Advertising Manager

Susan Hollis, PCtek
Advertising Manager
OFFICE: (408) 374-8605
FAX (408) 374-8787
EMAIL: pctek@ix.netcom.com

CE ADVERTISERS

EAA **Reprint** Order Form

100% Cotton Cap
Forest Green
'Charging into the Future' EAA Logo
CAP001.....$8.00



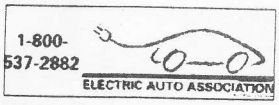
Auto SunShade
SS001.....$8.00

T w/EAA Logo
TS001...$14.50

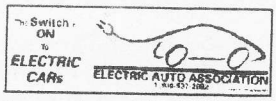
Thermal Mug
MUG02...$6.50

Porcelain Mug with
'Charging into.....Future'
MUG003.....$5.50

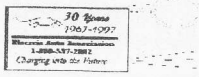
Window decal 'The Switch is on to Electric Cars' Black and Red printing. 3 x 9 inches
DC001.....$3.50



Bumper sticker 3.75 x 15 inches
BS800.....$3.00



Bumper sticker 3.75 x 15 inches
BS002.....$3.00



EAA Key Chain , w/LED light
KC001.....$2.50

Printed materials

CE	Selected Current EVents ***(specify specific issue)***	$3.00 each issue
CEFY	Current EVents - Full year ***(specify specific year)***	$20.00 each year
PB001	Discovered:The Perfect EV Battery	$ 2.00
FW001	Flywheel Energy Storage	$ 5.00
BG1997	1997 Buyer's Guide to Electric Vehicles (Apr 97 issue CE)	$ 6.00
BG1996	1996 Buyer's Guide to Electric Vehicles (Feb 96 issue CE)	$ 5.00
BG1995	1995 Buyer's Guide to Electric Vehicles (Feb 95 issue CE)	$ 4.00
TT001	Team Tucson Land Speed Record Plans	$ 5.00
IDX001	EAA Current Events Index - 10 Years!	$ 4.00
XA100	EAA XA-100 Hybrid	$ 5.00

Other EV Items

PN001	Ball point writing pen with EAA and 800 number	$1.00
CS001	Current Solutions/Motor Show Video Tape (14 minute runtime)	$15.00
WL001	Window Literature Holder (fits pages 8.5 x 11 inch)	$25.00
PARK01	'EV Parking Only' Sign (18"x12") green icon on white background	$25.00

Electric Auto Association **Reprint** Order Form
Send order to: EAA Reprints
5820 Herma St., San Jose, CA 95123-3410

Name_____Phone_____
Address_____
City,St,Zip_____

Item#	Size	Quantity	Item Description	Unit Cost	Amount

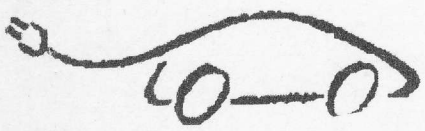
Subtotal	
Postage (10% of subtotal, for USA*)	
Handling	$2.00
Total	

Make check payable to: **EAA** (US dollars)

* for Canada add 15% or for other foreign destination add 25%

ELECTRIC AUTO ASSOCIATION
2710 St. Giles Lane, Mountain View, CA 94040

• Address Correction Requested •



NON-PROFIT
ORGANIZATION
U.S. POSTAGE
PAID
SUNNYVALE CA
PERMIT NO.
420

• Time Dated Material - Please Do Not Hold •