ELECTRIC AUTO ASSOCIATION

CURRENT EVENTS

August/September 1991 | Promoting the Use of Electric Vehicles Since 1967 | Vol. XXIII No. 8

WORLD'S OLDEST ELECTRIC CAR RALLY

by Paul H. Brasch

Here it is! The information you have been waiting for! Here are the details of the world's oldest and best ever Electric Car Rally. And details about our best ever Symposium.

First of all the driver Registration is now $10 in advance and $14 at the event. We REALLY need to have you pre-registered as it takes too long to do this at the Rally. (The Registration form is inside). Mail the Registration fee and a COMPLETELY FILLED OUT form to Pat Hardage in advance. This means TODAY!

Remember that there is a tech inspection to be passed before you are an official entrant. This takes time, so YOU SHOULD ARRIVE BY 8:00-8:30 AM. The 9:30 time stated on the flyer is for the public. We hope to start the run at 10:00 am sharp and run till noon.

Lunch will then be from noon to 1:30 pm during which time the Electrathon Rally will take place at the far back of the parking lot. This is a first time ever event at our Rally, but then the Electrathon events are brand new to this country anyway. They have been holding them for several years down under in Australia. (See backside of flyer)

It is best to bring your own sack lunch, although some food may be available there. The Rally run will re-commence at 1:30 and continue to 3:30-4:00 max.

We will be inviting many purveyors to set up booths for display of EV related goods up-front near the start/finish line. Booth space is $25 and a 10' by 10' maximum area each is allowed. Nothing is provided and exhibitors should bring their own garbage cans and remove same. It can be very windy.

At this writing I have an unconfirmed word that we may have the FMC electric M113 (Bradley forerunner) armored personnel carrier on display. We had this at our Rally the last time in 1987. It is an electric powered version that blows the turrets off of the standard powered one in a drag race. They have videos of this. We will also try to get a solar car on display. The "Monterey", the "Vortex" and perhaps the "Doran" should all be there and either competing or on display. WHAT AN EVENT! But it doesn't stop there.

The next day is the Symposium, and I have 3 confirmed speakers at this time. Dr. Richard Post, physicist and world renowned expert on flywheel energy storage at Lawrence Livermore Laboratories will speak on flywheels for EVs. Ambrose Manikowski of Lockheed will speak on solid polymer Hydrogen fuel cells. And Chuck Lemme of Centerline Consultants and "Team Tucson" will tell us about a new attempt on the land speed record. (see ad) They want to break the present internal combustion record. I am also trying to get Dr. Steven Visco to reprise his May talk on Lawrence Berkeley Labs./ PolyPlus lithium-polymer solid redox battery. (see July issue)

The Symposium starts at 9:45 am at the Wymdom Garden Hotel (see flyer) and costs $15.00. Following the Symposium will be a Brunch at $10. Space is VERY LIMITED so send in your reservations for each IMMEDIATELY to Pat Hardage. (see flyer)

Following the brunch and OPEN TO ALL MEMBERS of the EAA will be a very short business meeting to elect a new Board of Directors and approve the new association Bylaws. After this will be the presentation of awards and prizes.

Now on to other matters. You will notice that this is a combined Aug. - Sept. issue. That is because I have been trying to pick up the pieces of how to do this newsletter almost single handedly. The brilliant help I have received from John Broenan on

Continued on page 14

Solar and Electric Cars Race for Clean Air

by Ruth MacDougall

Looking like spaceships on wheels, six cars powered by the sun rolled onto Highway 50 in Sacramento, California. Six days later the cars would finish their race in Los Angeles without using a drop of fossil fuel.

The event was the inaugural California Clean Air Race, held June 17 - 23, which showcased emerging clean fuel technologies. In addition to the six solar cars, the race featured several electric-powered vehicles, most of which competed in the last two legs of the race between Santa Barbara and Los Angeles.

Abundant sunshine was one reason California was chosen for the race. Another was to publicize the California Air Resources Board's 1998 requirement that two percent of the vehicles sold in the state be zero emission vehicles. This requirement increases to five percent in 2001 and ten percent in 2003. Presently only solar and electric vehicles meet this requirement.

"We think we have the answer to California's energy and pollution problem,"

Continued on page 2

INSIDE

Solar and Electric Cars

continued from Page 1

said Michael Seal, faculty adviser to the Washington team. "These cars run totally clean."

According to Dave Caditz, Stanford University students put this race together to make people aware of transportation alternatives. The race was sponsored by several electric utilities and state agencies concerned with air quality.

To kick-off the race there was a day of qualifying trials for the solar cars and an electric vehicle exhibition at the State Capitol. A wide variety of electric transportation was on display, ranging from an electric trolley to a solar bike. Electric vehicle manufacturers came from as far as Massachusetts to exhibit their conversion cars. Solectria showed its electric Chevrolet Geo, named the "Force" as well as a three-wheeled vehicle called the "Flash". The other three-wheeler, the "Doran" was the favorite of a local news crew. Some conversion vehicles had optional solar panels to trickle charge the battery whenever the car is driven or parked in the sun.

The solar and electric cars were constantly surrounded by curious onlookers, asking every question imaginable, about their performance. At noon these transportation pioneers raced down the street in front of the crowds of people in a "Solar and Electric Derby". Legislators, news reporters, and the public has a chance to ride in several sporty electric cars and an electric G-van during the afternoon ride and drive.

The next morning, cars lined up at the University of California, Sacramento, where the race was to begin. Silently the cars rounded the corner that began their warm-up lap around campus and past the green flag that waved them on to their zig-zagging journey through the state. The overnight stops were at Stanford University, CSU Fresno, Cal Poly San Luis Obispo, UC Santa Barbara and Cal State Northridge.

Drivers were crammed into cockpits so low to the ground, they experienced every bump and twist of the 670 mile course. Hair-raising experiences during the first day didn't stop these brave students from continuing the race. Only five miles from the starting line, the "Texas Sun" gave everyone a scare. Their canopy flew up into the air and came down right in front of the SAG vehicle. They stopped to pick up the pieces, finding the windshield badly in need of repair.

Their slogan "Don't Mess with Texas" prevailed. They drove on without a canopy, convertible style. It was a cooler ride but the aerodynamics were ruined. The wind resistance of an open cockpit slowed the car down so much that the California Highway Patrol stopped the car for going to slow, only ten miles from their first days destination, Stanford University. By the time they rolled in at eight o'clock that evening, they were ready to install a new windshield which had been fabricated in San Francisco that day, beginning a long night of work for the team. Texas eventually made up their time, taking only four hours more than the Viking XX's winning team.

Other teams enduring long hours of repairing and retesting their cars at on point or another. Cal Poly San Luis Obispo had trouble with their motor and then their motor controller, problems which they were never able to rectify.

Western Washington University had the most experienced team and suffered the least problems, having raced in the World Solar Challenge in Australia and the GM Sunrayce from Detroit to Michigan. This car also won the award for the largest solar array or the "Lots o' Watts" award, so it had some advantage over the other cars when passing through overcast conditions on the first and last day.

Each team determined the best strategy of speed and charging time, adjusting for the route. Several teams chose to remain at the mid-day pit-stops for up to four hours, taking full advantage of the sun for charging their batteries with their solar panels. These relaxing breaks allowed a camaraderie to develop among the teams. The pit-stops were located where the public could view the solar cars, and they were thoroughly enjoyed by the townspeople. Everywhere the cars went, heads turned, cameras snapped and smiles abounded.

The finish line was at the Museum of Science and Technology in Los Angeles. An exhibition of solar technology and electric vehicles greeted the racers there. This "SUN DAY" event was sponsored by California Solar Energy Industries Association (CALSEIA). The top four winners in each category are: (See Figure 2.1 below).

Cash awards and plaques were issued to the teams and electric vehicle racers at the closing ceremony. Many people, who came to see the solar cars, were introduced to electric vehicles for the first time and were very excited about the possibility of owning one and making a contribution to cleaner air. ■

Figure 2.1 Winners at CalCAR

Solar Vehicles - 669.1 miles		
Western Washington University	Viking XX	21 hrs 15 min
University of Texas at Austin	Texas Native Sun	25 hrs 58 min
Auburn University (AL)	Sol of Auburn	48 hrs 21 min
Stanford University (CA	SUnSUrfer	49 hrs 53 min
Electric Vehicles - 82.9 miles		
Solectria - Arlington, MA	Force	2 hrs 01 min
Venus Motors - Bakersfield, CA	Pickup Truck	2 hrs 40 min
Doran Motors Co. - Reno, NV	3 wheel Doran	3 hrs 14 min
Venus Motors - Bakersfield, CA	VW Rabbit	4 hrs 09 min

SOLAR OPAL

You asked for it Pb. So here is a do-it-yourself project that I did with all second-hand parts.

I started to build an EV April 10 1991. 30 days from the start, part time, I ended up with a 1979 Opal Kadet 2 door station wagon. All for a total of $2500.00 plus cost of solar panels.

When I started this project I didn't know the difference between a volt or an amp, or what a transistor or a diode was. I still am not telectrically inclined. I bought an 8 hp Baldor motor weighing 160 lbs. rated at 72 volts, plus a Willy 9 Controller and a 12/72 volt charger and some used 02 wire plus the 1969 Opal Kadet for $600.00. I invested about $200.00 for paint, brakes and carpeting.

I wired the car for 12 volts for my lights, horn, turn signals, etc. and a friend helped me hook up the controller. After I got the car ready and installed 12 Alco 2200 batteries I started driving it around town. It was a little slow. Then I decided to go to 14 batteries at 84 volts. This made a *world* of difference.

I have a standard 4 speed tranny, no fly wheel, no clutch. With the 84 volt system, I start off in second gear drawing about 150 amps and I accelerate to 30 mph in about 4 seconds. Then I shift to third gear and take it up to 35 or 45 mph. I always try to keep the current down below 150 amps. Sometimes under a load I may reach 200 amps momentarily but once I reach the speed that I desire, I lift off of the pedal and draw between 40-90 amps at 35 to 45 mph. I drive in third gear in the city of Phoenix most of the time. On the freeway however I do go into 4th gear at about 62-65 mph.

So far the longest trip I have driven without a charge is 35 miles - with very little loss of power. I installed 7 solar panels of 55 watts each at 17+ amps total. These panels put a trickle charge into my batteries. If I leave the car parked for a few days I don't bother plugging into a 110 volt outlet.

I have been averaging about 110 miles per week with about 8 -10 hours charging at 5 amps. I also had a charger built without a transformer and mounted in the trunk for $85.00. This charger will work up to a 120 volt system. I use a 30 amp circuit breaker.

In addition I had an 84 - 100 volt regulator built for $85.00 to shut off the current from the solar panels so I don't overcharge. The solarpanels are really handy if I travel a short distance say 5 - 10 miles and then I leave the car in the sun while I'm playing poker at the Moose Lodge or shopping. This recharges the little that I used up from my batteries.

At the time of this writing I am thinking of going to a 90 volt system even though the motor is rated 72 volts. I think it will take up to 96 volts easily without getting too hot. I drive my car almost every day 10 to 30 miles per day. If I drive over 100 miles a week I put a light charge in the batteries about once or twice a week.

As to my background: I am 68 and a half years old, the oldest NHRA driver in the world. I have been racing all types of race cars since 1949. I have won my share of championships, and won 6 grand prix in a row in my day. I don't drive much any more because I sold my dragster in September, but I do fill in once in a while.

Thanks from Gene Cosmano
Phoenix, AZ

Congratulation. Thirty days and $2,500 is great work Gene! You should have no problems with a 96 volt system if the controller is rated for it. Typically, 72 volt rated Prestolite or Advanced DC motors are run at 96-120 volts; so don't worry about the voltage on the motor. However, the current must be watched on a Baldor. Don't pull 300-400 amps much at your 90 or 96 volt system (if the controller allows this) or you may join those who have had some brush holder problems. If you want more power for acceleration consider the new Advance DC 19 horse unit. See the curves in the July C.E. insert.

Welcome to the EV world and thanks for the great story. - Ed ■

Electric Car Recharges in 15 minutes

IEEE Spectrum, 8/91

Nissan Motor Co., Tokyo, said it will introduce by 1993 electric cars using batteries that fully recharge in 15 minutes. That compares with 2 hours for the Impact electric car that General Motors Corp., Detroit, Michigan plans to bring out in the mid-1990s, and about 8 hours for a minivan Detroit's Chrysler Corp. also expects to sell by the mid-'90s. The range of all three electric cars on one charge will be the same: about 200 km. ■

CalCAR: The California Clean Air Race

by Bob Kincheloe

It all started last fall when Stanford graduate Dave Caditz wanted to build a new and better solar race car.

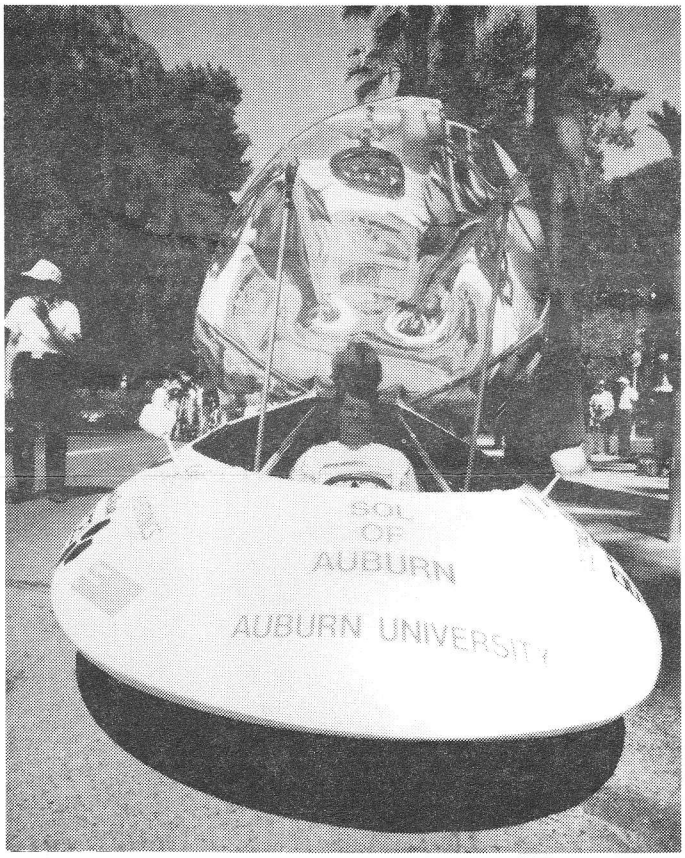
Several members of the Stanford solar race car team were driving back from a solar event involving their SUnSUrfer, the solar racecar built for the GM-sponsored SunRayce from Florida to Michigan last summer. It had been an intense effort. While they didn't win the SunRayce, as their faculty adviser for that project, I thought that they did quite well. With a limited budget they placed 7 out of 32 entries and had learned a lot.

Now they wanted to see it they could build a better car. Dave had been responsible for the SUnSUrfer's solar array. He figured that with a movable concertrating mirror and fewer cells they could get a cheaper and more efficient array that would have more power than the GM SunRaycer and maybe permit bettering GM's world speed record for a solar powered vehicle.

But how to get the team motivated? They needed a big race to shoot for. Not as big as the SunRayce (which cost over $1,000,000 to organize) but enough to attract other teams and support. Thus was born the idea of a six day California race from Sacramento to Los Angeles in the summer of 1991, from which resulted CalCAR, the California Clean Air Race. In addition to solar powered cars, it would also include electric commuting vehicles over at least part of the route, which extended midday pit stops to provide ample changes for public and media attention. In addition to the competition, the idea was to make people generally more aware and excited about EV technology.

Stefan Heck (the SUnSurfer team coordinator for the SunRayce) called SunRayce participants about the proposed California race. While some of the teams and cars were no longer functional, several where interested as were some of the several possible sponsors. The CA Highway Patrol (CHP) and Department of Transportation were contacted and indicated their willingness to cooperate. By March, however, there was still much to be done and Stefan left to spend spring quarter studying abroad.

At this point Dave Caditz (who was much more interested in building a race car than in organizing a race) took over. He got the help and support of the CA Energy Commission (CEC), the Air Resources Board (CARB), the Sacramento Municipal Utility District (SMUD), PG&E, LA Water and Power, CA Solar Energy Industries, the CA Museum of Science and Industry and others. Of particular assistance were Dwight MacCurdy of SMUD and Andi Liebenbaum (one of the SunRayce organizers). With a lot of intense effort by them and students from Stanford, Cal Poly at San Luis Obispo, Cal State Fresno, etc., in just 3 months they pulled it together and made CalCAR happen.



Monday June 17 was a beautiful sunny day. The race teams gathered early on the south mall of the State Capitol to show their cars and prepare for the race. There were many displays, booths, miniature electric cars for the children to drive, and interested spectators. All the solar cars were required to pass safety inspections similar to those of the SunRayce, and qualifying trials were run to determine starting positions. Governor Wilson was scheduled to speak at noon, but at the last minute he had a crisis with pending budget legislation, and had to cancel. Other government officials spoke words of support for energy conservation in general and EV's in particular and gave the race their blessing. I had been invited to be one of the race officials and so had the opportunity to observe the whole race.

Following the opening ceremonies, the solar cars made a symbolic start past the speaker's platform for the benefit of the public and the media. Of the 8 racecars that had planned to participate, 6 teams were actually able to participate in CalCAR. Auburn University from Alabama with their SOL OF AUBURN (that resembled the low streamlined profile of the GM SunRaycer that was described by the Sacramento Bee as somewhat like an overgrown insect) was there, as was the similarly shaped SUN LUIS from Cal Poly at San Luis Obispo and the TEXAS NATIVE SUN from the University of Texas at Austin. The Bee described Western Washington's VIKING XX as having a "narrow, cigar-shaped passenger compartment with two drivers sitting back-to-back supporting a two-sided solar array resembling half a lean-to" with a sloping top, arranged to be driven in either direction to maximize the solar radiation on their panels.

Sadly, the Stanford team did not complete their new SUNBURNER, so at the last minute they resurrected their old SUNSURFER with its barn-like solar array built to maximize array area. Cal State Fresno also did not finish their RACIN' RAYSUN in time to be in the whole race, but had an interesting design that consisted of a flat, thin aerodynamic body with a small bubble in the center for the driver's head. They were able to join part of the race later.

At 9 on Tuesday morning, the teams lined up in the prescribed order for the first leg of the race from the campus of Sacramento State University. After a pre-start procession around the campus they passed the starting line and headed for the heavy

Continued on next page

CalCAR: The California Clean Air Race

Continued from previous page

traffic of I-80 which they would follow to San Francisco, crossing the Bay bridge and then going down I-280 to Stanford to complete the first leg. Each solar racecar had a lead vehicle ahead of them to guide the racecar and warn the driver by radio of road conditions ahead. Behind each racecar was a chase vehicle with support crew and official observer, flashing lights, and signs warning approaching vehicles of the slow speed racecars ahead.

During the whole race, a team of volunteer amateur radio operators manned checkpoints, pit stops, the race headquarters RV, and roving vehicles looking for breakdowns, providing communications for coordination and emergencies. They did a magnificent job.

It quickly became evident that the Viking XX had a big advantage in power. With their large area of efficient space solar cells provided by GM for the World Solar Challenge race in Australia last November, producing about 1800 watts, they had much more than the other cars which range from several hundred watts to about a kilowatt. Their speed was limited mainly by their stability in crosswinds caused by the large side area and high center of gravity. Texas was capable of good speed but had a number of electrical and mechanical problems. The major one occurred during the first day while being passed by two large trucks on either side which created a vacuum that pulled off their canopy and windshield around the cockpit. It was hit by their chase vehicle and badly damaged.

Texas also had the misfortune on the first day to initiate a major controntation with the CHP. Even though arrangements had been made with them months earlier, information had apparently had not been given to the local officers. Texas was stopped on I-80 a few miles from Stanford for driving too slowly on a freeway and creating a hazard. The officer would not allow them to proceed until it was cleared with higher authorities (not even to move a short distance to reach a sunny spot out of the overcast where they could charge their batteries while waiting!) This threatened to stop the whole race since it was largely routed on freeways. After intensive negotiations, by Wednesday morning the Department of Transportation agreed to issue a permit that satisfied the CHP so the race was allowed to proceed with escorts provided by the CHP all the way to Los Angeles.

Under the race rules, if a solar car was unable to maintain adequate speed as required by the CHP or to proceed at any point (such as with mechanical or electrical problems or after sunset when batteries were exhausted) the car could be loaded into their trucks for transport with penalty in time based on the distance transported. Only Texas and Western Washington were able to complete the first day to Stanford under their own power. Some of the others had low power from their arrays, low batteries (which could only be charged from the solar radiation), or mechanical difficulties.

At Stanford the teams worked late Tuesday night to resolve problems. Texas was able to make a makeshift windscreen, and on Wednesday all started for Fresno joined by the team from Cal State at Fresno but with the exception of the San Luis which had a major breakdown in the motor controller. Because of concern for slow uphill speeds and high winds on Highway 152 between Gilroy and Los Banos, race officials decided to require all teams to truck their racecars over Pacheco Pass. This was the only part of the challenging route not attempted by the solar cars. At 179 miles, it was also the longest leg and not all cars were able to complete it on solar power. On Thursday, the route from Fresno to San Luis Obispo was also long (171 miles) and traversed extensive hilly terrain that again required some cars to be transported part of the way, although there were no major car problems. Fresno had dropped out since their car was really not finished.

On Friday, the 118 mile leg to Santa Barbara was mostly level. There the race was joined by five commuter EV's; two EV conversions by the Venus Motors Corporation of Bakersfield, A VW Rabbit and a GMC Sonoma pickup, a sporty 3-wheeler by the Doran Motor Company of San Luis Obispo, and two commuter vehicles designed by Solectria of Arlington, MA, which had solar cells on the roof to supplement battery power. (Only one of the Solectria vehicles, named the FORCE, participated in the whole distance; James Worden, founder of Solectria, drove their faster FLASH for a demonstration on the final leg to Los Angeles).

The final two days of the race were even shorter; 91 miles from Santa Barbara to Northridge on Saturday. Then the final 30 miles on Sunday (SUN DAY) to the enthusiastic crowd at the rally and displays around the finish line in front of the California Museum of Science and Industry in Los Angeles. Welcoming remarks by officials including Councilman Marvin Braude (known for the Braude initiative to obtain 10,000 EV's for Los Angeles) were followed by comments and presentations of awards by CEC Chairman Charles Imbrecht.

Western Washington's Viking XX had the lowest total time; completing the 669 mile race in a driving time of 21 hours and 18 minutes for an average speed on solar power of 31.4 mph, followed by the Texas Native Sun (including penalties) with 25.8 mph. Sol of Auburn and the Stanford SUnSUrfer came in 3rd and 4th, followed by the Sun Luis which limped the last few miles with a jury-rigged motor and controller and crossed the finish line.

The crowd was also quite interested in the EV commuter cars. While not designed for long distance at highway speeds, their attractive appearance and stamina were impressive and all completed their part of the race. The Solectria "Force" at 40.7 mph had the highest average speed over the 82 mile route which included some difficult hills.

Thus CalCAR came to a close, with most people agreeing that it had been a great success. There were no accidents or injuries, the teams had a marvelous experience and learned a great deal as did the race sponsors about how to organize and conduct such an event. There was considerable interest and publicity for emerging solar and EV technology, and plans are in progress for another, and perhaps bigger, CalCAR event next year. I think Dave Caditz, however, will have gone on to other things; finishing the SUnburner for one thing. ■

Here Come the FlyWheelers! A New Breed of Zero-Pollution Long-Range Cars ©

Member Union of Concerned Scientists
Jerry E.Loomis, Physicist, 3220 Oakwood Lane, Beaumont, TX 77703

The sky is blue and air is clear over Los Angeles as your flight comes in for a landing at the airport. You disembark with your family and go to where your automobile has been parked in the parking lot for the past month while you have been in Hawaii.

You walk up to your 4,000-pound automobile, get in, and turn the key. There is no grinding of starter motor or sputter of an internal combustion engine as it struggles unsuccessfully to pull enough gasoline through the fuel lines to revive the engine to life after a month's vacation.

Instead, the electric motors surge to life instantly and silently, powering your vehicle out of the parking lot and onto the road.

You live a little over 200 miles away, just north of Morro Bay. You check your energy gauge; you still have enough energy in the storage system to make the trip.

Your car phone chimes and you answer it. Your brother is calling. He works with you on the farm you own together. He says your new solar-powered desalinization plant has arrived; you can now convert sea water to drinking water and use it to irrigate your crops.

You drive to the freeway, enter the on ramp, and accelerate your 4,000-pound automobile onto the freeway with the smooth, powerful acceleration of a sports car. You move into the lane to your left, ease off the accelerator, and cruise down the freeway at the speed limit.

You switch on the car radio and listen to the news. Economists report that the U.S. trade deficit is a thing of the past, now that we are no longer importing foreign oil. The U.S. economy is up, largely due to the nation-wide conversion to electric cars, which cost much less money per mile than gasoline-burning cars. The conversion to electric trucks and trains has lowered the cost of shipping goods, and the conversion to electric tractors and harvesting equipment has lowered the cost to the farmers in growing their crops. This has increased our exports of grain, which has long been our leading national export, and has helped to end the trade deficit, giving us a trade surplus similar to those we used to enjoy before rising oil prices started altering our economy, back in the days when our country was the number one creditor nation in the world, instead of the number one debtor nation in the word.

The auto industry has recovered from its recession, during which it lost billions of dollars, closed down several plants, and terminated many thousands of workers' jobs. The auto makers who survived their recession are those who converted their plants to the manufacture of zero-pollution cars. They are now manufacturing products people want, and people are buying them. Auto workers are working again, and are taking home paychecks.

The new electric auto conversion industry is doing very well, converting polluting gas-burning cars to electric cars. This is providing many thousands of new jobs for people, and is helping to raise the economy.

> You are driving a freewheeler - a new breed of zero-pollution long-range electric car.

The oil companies which have survived their recession are those which stopped trying to drill for oil in the Alaska Wildlife Refuge, Antarctica, our other wildlife reserves, and our national forests, and went out of the oil business, converting their resources to the development of nonpolluting electric power.

There have been no more spills since then.

The Center for Disease Control announces that cancer deaths have dropped dramatically in Los Angeles, New York, and other large cities because of the lowering of the air pollution levels in these cities since the conversion to zero-pollution electric cars. The Center also reports a remarkable drop in cancer deaths near large oil refineries, since these refineries have been closed down.

Scientists report that the Greenhouse Effect is now under control because of the conversion from polluting fossil fuels to completely nonpolluting sources, clean power from the sun, wind, and the sea.

There is no more danger of the increased heat from the Greenhouse Effect causing a permanent draught throughout the best farm lands in the world, including the American Midwest, drying them up into completely barren Sahara Deserts, destroying the entire world's food supply.

There is no more danger of the Greenhouse Effect melting the polar ice caps into the ocean and raising the level of the ocean three hundred feet. Ten thousand years ago, the temperature of the earth was four degrees Fahrenheit higher, and the level of the ocean was three hundred feet higher than at the present time.

One fifth of the people in the world would have lost their homes under the sea.

The Greenhouse Effect would have caused more hurricanes, and much more *severe* hurricanes, which would have swept much further inland than ever before. The new coastline itself would have been much further inland than the coastline before the rising of the sea.

The news commentator concludes by remarking that converting to electric vehicles and clean power sources has been cost effective in terms of saving life on our planet.

You drive over 200 miles at the speed limit. When you exit the freeway north of Morrow Bay, you pass a service station. You check you gauge; there is still plenty of energy to get you home. You drive on home, park in the garage, and plug into your special high-amperage power supply.

Seven minutes later, your energy storage systems reads 100% full.

What kind of car are you driving?

You are driving a flywheeler - a new breed of zero-pollution long-range electric car.

What kind of batteries give this electric car a range of over 200 miles?

It has no batteries. The power to the electric motors is generated as needed by spinning flywheels which turn electric generators.

Each flywheel is securely mounted inside its own ten-inch cubical box. Each flywheel, including case, weighs 13 pounds and can, if called upon, deliver 85 kilowatts (115 horsepower to the electric motors which drive the car.

Each flywheel module will store one kilowatt-hour. With 870 pounds of lead-

Continued on next page

Here Come the FlyWheelers!

Continued from previous page

acid batteries, the GM impact has a range of 120 miles. If these batteries were removed and 400 pounds of flywheel modules where installed, the Impact would have a range of over 300 miles.

Larger, heavier cars need more power, but they also have more room to carry the flywheel units which will give them the extra power they need. Sixty of these small modules, at a combined weight of 780 pounds, will store enough energy to drive a 4,000-pound car over three hundred miles.

What spins the flywheels? An electric motor is built inside each flywheel. At home or a service station, this electric motor is plugged into a high-powered charger and used to spin the flywheel to full capacity. This takes as little as five to ten minutes, depending upon the power of the charger.

How long will the flywheel spin? More than two hundred days. These flywheels spin inside a vacuum chamber, and this prevents air friction from running them down. They spin on magnetic bearings, and this prevents the friction of bearings from running them down. In the laboratory, in higher vacuums, flywheels have run-down times of two years!

How do the flywheels generate electrical power to send to the electric motors?

The electric motor built inside each flywheel is also an electric generator. When it receives power from the charger, it acts as an electric motor which spins the flywheel. When it is no longer plugged into the charger, and the flywheel is spinning freely, the same electric motor acts as an electric generator, providing power for electric motors which power the car.

Why are these flywheels so small and light? Wouldn't you be able to store a lot more energy in a heavy steel flywheel?

No. This is absolutely *not* the case.

Smaller and lighter is faster and more powerful. These flywheels are made of graphite-fiber composites that are much lighter and much stronger than the strongest alloy steel, and so are capable of spinning much faster than steel flywheels of the same size, storing thirty times the energy per kilogram that the steel flywheels could store.

The amount of the energy storable in a flywheel is proportional to the mass of the flyweel, the square of the radius, and the square of the angular velocity of the flywheel.

$E = 1/2\, mr^2\omega^2$

E = energy, **m** = mass, **r** is the radius from the center of spin, and ω is angular velocity of the flywheel. We can increase the energy of the flywheel by increasing its mass, its radius, or its angular velocity.

But there is a limit to how much energy we can store in a flywheel. This limit is set by the tensile strength of the material of the flywheel, the strength that keeps the flywheel from flying apart when it spins.

The centrifugal ("center-fleeing") tensile force which tears flywheels apart at too-high speeds is proportional to the mass, the radius of the flywheel and square of the angular velocity of the flywheel. The larger and heavier the flywheel, the greater the centrifugal force at any given speed. Centrifugal force, **F**, is given by this equation:

$F = mr\omega^2$

Note the similarity in the equation for the energy, **E**, and the force, **F**.

$E = 1/2\, mr^2\omega^2 = 1/2\, r(mr\omega^2)$ Since $F = mr\omega^2$ we can substitute F for $mr\omega^2$ in the energy equation:

$E = 1/2\, rF$

We see from this that the kinetic energy of a spinning flywheel is proportional to the centrifugal force. Thus there is no way we can increase the energy without increasing the centrifugal force. If we increase the mass, the radius, or the angular velocity of the flywheel, we will increase not only the kinetic energy, but also the centrifugal force.

If the centrifugal force becomes greater than the tensile strength of the flywheel, the flywheel will fly apart. Therefore, the amount of kinetic energy storable in a flywheel is limited by the tensile strength of the material in the flywheel. The breaking point of the flywheel is reached when the centrifugal force acting to pull the flywheel apart is exactly equal to the tensile strength which is holding the flywheel together.

Suppose we have two flywheels of the same size, but one has four times the mass of the other. Both flywheels have exactly the same tensile strength, and so the maximum centrifugal force each one can withstand will also be exactly the same. These two forces can be equated, using the equation $F = mr\omega^2$.

For the heavy flywheel, let the mass equal 4m, and for the light one, mass equals m. For the heavy flywheel, the angular velocity equals ω, and for light one, angular velocity equals ω_L.

$F = 4mr\omega^2 = mr\omega_L^2$

From this: $4\omega^2 = \omega_L^2$; and $\omega_L = 2\omega$

This shows we can increase the angular velocity of the lighter flywheel until it is twice the angular velocity of the heavy flywheel. At this point, both flywheels have reached their limit, the same limit, as both flywheels have exactly the same tensile strength and thus exactly the same breaking point.

Let us see how much energy is now being carried by each flywheel.

Heavy Flywheel: $E = 1/2\,(4m)r^2\omega^2 = 2mr^2\omega^2$

Light Flywheel: $E = 1/2\, mr^2(2\omega)^2 = 1/2\, mr^2(4)\omega^2 = 2mr^2\omega^2$

The kinetic energy carried by the light flywheel is exactly the same as the kinetic energy carried by the heavy flywheel! This proves that two flywheels of the same size and tensile strength will carry the same maximum amount of kinetic energy, no matter how much heavier one flywheel is than the other. The limit of the energy is set by the tensile strength of the flywheel material, regardless of the weight.

Steel is much denser than graphite, so a graphite-fiber-composite flywheel with the same tensile strength as steel would carry much more energy per kilogram than the steel flywheel, even if the graphite fibers where not stronger than steel.

But these graphite fibers are not only much lighter than steel; they are much stronger than the strongest alloy steel. Graphite fibers now in production have a tensile strength of up to 1,500,000 pounds per square inch.

These two significant advantages, much lighter density and much greater tensile strength, give the graphite-fiber composite flywheel the capacity to store on the order of thirty times as much energy per kilogram as the steel flywheel.

Consider how important this is for an electric car. We would need 3,000 pounds of steel flywheels to store the same amount of

Continued on next page

Here Come the FlyWheelers!

Continued from previous page

energy we can store in just 100 pounds of graphite-fiber-composite flywheels.

In the near future, we may see graphite fibers, or other fibers under development, manufactured at even higher tensile strengths. These new higher tensile strengths will increase still further the speed and energy capacity of flywheels.

If we double the tensile strength of the flywheels, we double their energy capacity, and thus double the range of the car. Then the 4,000 pound car with 60 modules will increase its range to over 600 miles.

In case of an accident, what happens to these flywheels?

Smaller is safer. There is a spin-dampening material built into the side of the containment case which will quickly and easily run down the spin of the small flywheel in case of an accident. The small flywheel will stop spinning quickly if the mechanical bearing comes into play in case of an accident. There is impact-resistant composite fiber on the wall of the housing as well as inside the vacuum housing.

Even if the graphite-fiber-composite flywheel itself should break up, it would break up into soft, harmless "cotton candy". A steel flywheel breaks up into flying shrapnel, which can be deadly.

In the same kind of accident, a gasoline tank can explode as a fire bomb!

How can such a small electric motor inside the small flywheel be so effective?

Smaller and lighter is faster and more powerful. The smaller the size of the flywheel rotor, the faster it can turn the electric motor inside it, and the more revolutions per minute made by the electric motor, the greater the horsepower it can produce. A typical small electric motor running at 1,800 rpm will produce one horsepower. The same electric motor if it could run at 210,000 rpm, would produce 115 horsepower! This can be done inside the vacuum within the flywheel casing with the flywheel using magnetic bearings.

The very high speed of this small electric motor enables it to impart full power capacity to the flywheel in 5 to 10 minutes, depending upon the power supply available.

The same principle is true when the small motor is being used as a generator.

Even if the graphite-fiber-composite flywheel itself should break up, it would break up into soft, harmless "cotton candy".

The same small motor, when being spun at high speeds by the freely spinning flywheel, can produce a peak power of 115 horsepower (85 kilowatts), thus generating the high power to accelerate a large, heavy car with the powerful acceleration of a sports car.

The extremely high speed of this small electric motor/generator gives the storage system a very high "turn-around efficiency", kilowatt-hours out compared to kilowatt-hours in, up to the order of 98% (From 60% to 70% efficiency is typical for lead-acid batteries.) This allows 98% recovery of energy during regenerative braking, increasing the range of the flywheeler car ever further, especially in stop-and-go city traffic, where the gasoline burning car wastes a great amount of energy, and also puts out great amounts of air pollution as it sits idling at the red lights.

Smaller is handier. Smaller flywheel units are easier to manufacture, service, and place into the car. They are small, like batteries, and can be used to replace batteries in electric cars already in use. But these little units weight only 13 pounds each.

How much will these flywheels cost?

In the beginning, they might cost several times as much as the best lead-acid batteries. But they will last 20 years or more. They will definitely be cost effective. After they have been in mass production for a time, the cost per module will drop, making them even more cost effective.

Who is working on this project, and where is the work being done?

Dr. Richard F. Post, Senior Scientist, Physics, with the Magnetic Fusion Program of the University of California Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550, has worked out the concepts of the flywheel car. The actual flywheel project is being carried out by the laboratory's Engineering Division.

How soon will these flywheels be available?

Prototype flywheel modules might be available in one to three years, depending upon how quickly the work can be done. And how quickly the work can be done depends upon how well the project is funded.

Is there anything we can do to speed up the project?

Yes, definitely. The U.S. Government and the auto makers have joined to fund the U.S. Battery Consortium in order to provide research and development for batteries suitable for electric cars. Let your elected officials and the auto industry know that you favor the flywheel project.

Elected officials and business people listen when voters and customers talk. One Congressman said that for every letter they receive, they estimate that five hundred other people feel the same way as the one who wrote the letter.

Another thing you can do - a very effective thing - is to drive your own electric car right now. Buy it, build it, or convert it. You can buy an instruction manual, and if you need some help, you can contract with your mechanic to help you make the conversion.

You can be sure that the auto makers and other related businesses are watching, year by year, to see how many new electric cars are registered in this country. Let yours be one of them.

And some time in the near future, when you are putting batteries into your electric car, they might not be batteries at all. They might be *flywheels!*

Editor's Note: Hear Dr. Post speak in person at our symposium (see insert). It is nice to see competing technologies (flywheel, Li-polymer, etc.) vying for the energy storage market. This can only help our cause. ■

Nissan, Toyota Charge Into Electric Car Business

Toyota City, Japan (AP) - By the early 21st century, that perennial car of the future - the electric-powered vehicle - might finally start rolling out of one of the sprawling factories that dominate this huge corporation town.

One need look only across the Pacific to California to find out why. Toyota Motor Corp. and other Japanese automakers have shifted their efforts to develop electric-powered vehicles into high gear because a new California clean air law mandates that by 1998, 2 percent of a manufacturer's sales in the state release zero emissions. Five years later, the level rises to 10 percent.

Detroit appears to have taken an early lead in the race. America's Big Three - Ford, Chrysler and General Motors - already have joined forces to develop new battery technology to power the cars.

But the Japanese companies are determined not to be left behind. "Of course there has been a lot of influence of the California law on our efforts," Masahiro Ohkawa, a project general manager of Toyota's research and development planning division, said in an interview in this city 150 miles west of Tokyo.

Among factors that could help the Japanese in the race for what could be the most important new automotive market in the coming century is a genius for taking new technologies and improving them to fit consumer needs. An expected government-led program to tackle the huge problem of battery development should also help.

Keith Donaldson, a Tokyo-based auto analyst for Salomon Brothers Inc. believes the high cost of developing the new cars will "play to the strengths" of Japanese companies that are in relatively healthy financial positions. Major Japanese auto manufacturers cannot ignore the new California law because the state accounts for a substantial chunk of sales in the all-important U.S. market. Toyota, for example would have to sell 4,000 to 5,000 electric vehicles in California in seven years to comply with the statute.

Toyota has therefore created a new organization within it's production division to develop marketable electric vehicles. The company, which has focused its energies on electric-powered vans, is again studying an electric passenger car.

At Nissan, the nation's second-largest car maker after Toyota, spending for electric-vehicle development is up 30 percent from last year, said Masato Fukino, senior project engineer for the company's Vehicle Research Laboratory. "We think we have to concentrate development resources much more than before" he said in an interview in Tokyo. Nissan and Toyota have so far produced only a handful of prototype vehicles such as electric-powered vans, some of which have been sold for experimental use.

The Environment Agency announced Monday that it will lease 14 Toyota-made electric vans, with maximum speeds of 53 mph and a range of 100 miles on a charge that takes 10 hours to build up, to governments in severely polluted cities. But engineers shake their heads when they realize they must sell thousands of vehicles in California by 1998. The host of technical problems that must be surmounted includes developing a battery that lasts long, recharges quickly and has plenty of pep.

Nissan has trumpeted it's development of a "super quick charge" battery that can achieve 40 percent recharging in six minutes, but Fukino acknowledges there's still a long way to go. "At this state, the electric vehicle is very expensive and performance is very poor. Nobody wants to buy that kind of car."

Ohkawa agrees that it will be "quite difficult" to meet the sales requirements stipulated by California. He believes U.S. manufacturers will initially have the inside track in California, in part because local governments can be expected to set up recharging stations and battery disposal standards that favor Detroit's models.

Fukino notes that the GM Impact, an electric-run passenger car prototype, is more advanced than anything Nissan has now. But when asked if his company will catch up, he smiles and says, "yeah ... in the near future".

The powerful Ministry of International Trade and Industry is expected to provide a boost of perhaps $100 million over a decade for a project to develop a lightweight lithium battery, Fukino said. Lithium batteries would be lighter and cheaper than other varietes, with the potential to provide more power for longer distances, but scientists have yet to figure out how to make such batteries safe.

Editor's Note: They obviously are not aware of LBL's solid re-dox lithium battery. (See July issue of current events) ■

North Bay Chapter Reforming

First Meeting of the North San Francisco Bay Chapter of the Electric Auto Association.

Saturday, September 21, 1991
9:45am to noon
Rohnert Park Library Conf. Rm.
6600 Hunter Drive

- Go east off Hwy 101 on RP
- Expressway
- Turn Right on Commerce
- Left at the next light to the library

We have this room one time only. Bob Wing, Chapter President, will discuss the mechanical, electrical and safety considerations for the conversion of a vehicle to battery operation. There will be at least one EV at the first meeting. Bring your EV if you can. Future meetings will be held on the third Saturday of each month at the CitiBank conference room in Novato. Enter the Novato Fair Shopping Center off South Novato Blvd. The conference room entrance is on the right just 40 feet from the bridge you just crossed. All interested persons are invited to come to our first and subsequent meetings.

Bob Wing
P.O. Box 277, Inverness, CA 94937
(415) 669-7402

NEWS RELEASE

August 23, 1991

"Voltsrabbit" Kit on Way!

Electro Automotive, leading retailer of electric vehicle components, swept the trophies for road-going electric cars in the nine days of the Clean Air Revival/SEER '91 in Pacifica and Willits, California, August 3-11.

At the Clean Air Revival, the "Monterey" won the Speciality Class in the rally. The "Monterey" is a fiberglass sports car built with Electro Automotive components, and will soon be in production from California Electric Cars, Inc., in Seaside, CA. This is the same car that took fourth place in the Solar & Electric 500 in Phoenix in April.

Second place in the Specialty Class was won by the "Vortex". The "Vortex" is a composite monocoque three-wheeler built with Electro Automotive components. Plans for the car are available from Dolphin Vehicles of Sunnyvale, CA. The "Vortex" also won the Mayor's Cup for Best Design.

At the Solar & Electric Expo & Rally, the "Vortex" won the Commuter Class and the Best Engineering trophies. Electro Automotive's own "Aztec" won the Conversion Class of the rally. The "Aztec" is a VW-based kit car that serves as Electro's display and test car.

In addition, Electro Automotive set a conversion record at the Clean Air Revival, where a diesel Rabbit was converted to electricity in four days. This demonstration was done to debut the prototype of Electro Automotive's "Voltsrabbit—Recycled Rabbit" kit. This is a complete bolt-in conversion kit for Rabbits, including all components and mounts, power brakes, and suspension components. (No batteries included.) The kit will be available for sale by November 1st, for approximately $6,500.

This "Voltsrabbit" competed in the rally at SEER '91 just three days after completion, and covered more than 50 miles on a single charge, a very respectable showing for a car with batteries and motor that have not been "broken in".

Electro Automotive is a mail-order supplier of components for road-going electric cars. The company is based in Felton, CA, and has been in business since 1979. ■

FOR FURTHER INFO:
SHARI PRANGE
Phone: (408) 429-1989
Fax: (408) 429-1907

RESULTS 1991 East Bay Rally Around Lake Merritt

ID#	Name	Vehicle Type	Vehicles Wt./lbs	Battery Wt./lbs.	# of Laps	Total Miles	Mileage Rank	Mi/Ton of Batteries	Battery Rank	Battery % of Wt.	Total Time * in hr:min	Avergage mph *
3	Lloyd Wenzel	74 Honda Civic	2750	1210	15	58.5	1	96.89	3	44.00	3:08	18.67
2	Anna Cornell	75 VW Rabbit	2800	922	12	48.8	2	101.52	2	32.90	2:54	16.14
5	Milford Stults	68 VW Fastback	2760	1136	10	39.0	3	68.66	5	41.20	2:29	15.70
6	Jim Van Scyoc	81 Vanguard Commutacr	1400	562	8	31.2	4	111.03	1	40.10	3:01	11.60*
9	Jeff Snow	85 Ford Escort	3000	1200	8	31.2	4	52.00	7	40.00	1:57	0.67
7	Wm. Hunt S.M.U.D.	91 GMC Rally Stx			8	31.2	4				1:56	16.14
4	Bill Nalbandian	75 Honda Civic	2780	985	7	27.3	5	55.43	6	35.40	1:39	16.55
1	Margaret Milton	75 VW Rabbit	2850	1059	7	27.3	5	51.56	8	37.20	1:44	15.75
8	John Masylina	83 Renault	2530	12v/630	6	23.4	6	74.29	4	24.90	1:29	15.78
10	Dave Cole	66 Dodge Dart	3100	12v/704	1	3.90				22.70	0:16	
11	Lou Macmillan	69 VW Wagon	3000	1024						34.10		

* Total time is total run time/Avg. mph includes stops

EAA Participates in Stanford Concours d'Elegance June 23, 1991

1991 East Bay Rally

Solar City Fair 1991 San Jose, California October 5, 1991

The Northern California Solar Energy Association (NCSEA), together with the Electric Auto Association, the City of San Jose-Office of Environmental Management, and other organizations, are sponsoring the 1991 Solar City Fair to be held on Saturday, October 5, from 9 a.m. to 5 p.m., at Plaza Park in Downtown San Jose.

This is the first City sponsored event totally dedicated to renewable energy and energy efficiency and we are excited about the tremendous interest generated for the event to date. The fair will consist of an extensive display of alternative vehicles including electric vehicles, University solar cars, Electrathon and natural gas vehicles. There will be a wide range of exhibit booths displaying solar and energy efficiency products, exhibits by major environmental organizations and university environmental groups, "diaper derby" solar kiddie cars, children's activities, stage speakers, live music and food.

At 11 a.m., there will be a parade of electric and solar vehicles around Plaza Park. In addition, there will be a short course track to provide electric auto rides to the public.

Other co-sponsors and promoters of the Fair include PG&E, the San Jose Chamber of Commerce, the Downtown Business Association, Metro Newspapers, KEZR Radio and KNTV Channel 11.

We encourage all EEA members to attend the 1991 Solar City Fair and exhibit your vehicles. The booth/exhibit cost for electric vehicle businesses is $75; *there is no cost to individual exhibitors* and non-profit organizations.

Please call Valerie Howard with NCSEA at (408) 371-9122 for further exhibit and program advertising information.

Let's show our stuff to San Jose. - Ed ■

MEMO

TO: EAA Participants in Clean Air Revival

FROM: Peter Barnes

SUBJECT: Thank you!, results, and loose ends

I wish to express my somewhat tardy but sincere thanks and appreciation to you for helping to bring about and successfully complete the picnic, rally, rides, and display of vehicles at the Clean Air Revival in Pacifica. A special thanks to those who brought and participated with their vehicles and to Don Gillis and the San Jose EAA for their participant rides, and help and support.

We had over 20 vehicles on display Saturday with a total of 20 entries in the rally. Not with-standing our lack of experience we had a fun and successful rally. The rally winners were:

Conversions
1st Scott Cornell, Pleasant Hill, East Bay EAA, 1966 Karmann Ghia
2nd Chuck Olson, Santa Clara, Silicon Valley EAA, 1965 SAAB
3rd Gene Cosmano, Pheonix, solar assisted Opal Wagon

Specialty cars
1st Craig Campbell, Seaside, " Monterey "
2nd Steve Pombo, Dolphin Vehicles, Sunnyvale," Vortex "

Two and Three Wheel conversions
1st Bob Schneeveis, Palo Alto, Silicon Valley EAA, BMW sidecar

Participant from farthest away - Gene Cosmano, Pheonix, AZ

Mayors Trophy (Best Looking) - Dolphin Vehicles, Vortex

Chamber of Commerce Trophy (Most practical) - SMUD - G-Van

With a few more helpers we should be ready to do this again next year if the opportunity occurs. We even have a booth to keep out the sun (and fog). Thanks again for your help and participation.

Aug 12, 1991

ADS WANTED

We want advertisements for the EAA Newsletter. If you would like to submit an ad, please contact Paul Brasch for price and specifications.

Paul Brasch, Editor
1968 Elden Drive
San Jose, CA 95124-1313
(408) 371-5969

Calendar

September 13-15 WHOLE LIFE EXPO at the new San Jose Convention Center,EAA, Electro Automotive, and California Electric Car will be participating. Booth 102. Come see us there.

September 14 East Bay chapter - Show and Tell

September 21 WORLDS OLDEST - 19th Annual Electric Car Rally, 1184 N. Matilda, Sunnyvale. Reg. & inspections to start at 8:00 - 8:30. Electrathon rally during lunchbreak 12:00 - 1:30.End at 4:00 pm. (see insert) $$$$$ Cash Prizes $$$$$ $100/50/25 & $75

September 21 First meeting of North Bay chapt. EAA 9:45-noon, Rohnert Park Library.

September 22 Symposium, Brunch, EAA election & Bylaws approval, followed by presentation of awards. Wyndham GardenHotel 1300 Chesapeake Terrace, Sunnyvale.(see insert)

October 5 NCSEA Northern California Solar Energy Association show in San Jose in the park in front of the Fairmont. This is called the Solar City Fair 1991. (see news item)

October 12 East Bay chapt. Lect. "Road EVs"

October 26 EVAOSC Electric Vehicle Association of Southern Calif. will hold its 1991 Rally, starts 8:00 am at Milliken Ave. near the the old Ontario Motor Speedway. Info - (714) 986-2472.

November 6-10 Seattle KINGDOME, 1992 International AUTO SHOW, EVs will participating.

Continued from page 1

setting up a new format for, and the production of, the June and July issues has ended. He has major new work and study commitments and thus cannot continue.

I cannot thank him enough for helping engineer the first major change in our newsletter since it's start. Good luck and best wishes John.

Inside this issue are pictures from the June Stanford Concours D'Elegance and the July East Bay Rally. Also East Bay Rally results. The first week of August saw the Clean Air Revival in Pacifica with a large turn out of EVs and displays (see memo). Hot on the Revival's heels was SEER, the Solar Electric Expo and Rally in Willits. This reporter attended both and was very impressed with the huge crowds at the 2nd year event at Willits. Five to Six thousand people attended this year I am told. I will have more to say about these events in next months C.E.

Upcoming is the Whole-Life Expo at the San Jose McEnery Convention Center September 13-15. The EAA will have a booth there with the "Monterey" on display. We will be sharing with them (California Electric Cars) and Electro Automotive. This will be a great opportunity to promote EVs and our Rally which takes place the next weekend.

Then on October 5th is the SOLAR CITY FAIR 1991 in downtown San Jose, across from the Fairmont Hotel. This event is presented by the Northern California Solar Energy Association (NCSEA) and the EAA and others (see news item).

Lastly, all members should read the proposed new Bylaws and the statements about and by those running for the Board of Directors. Then you should mark your proxy and either mail it or bring it with you to the business meeting. If you want this association to improve and grow we have GOT to have your participation.

Speaking of participation - you can help publicize the Rally by copying the flyer and posting it anywhere you think of. Baring a major disaster, this will be the most fantastic EV Rally ever. With your help it will be even better! See you there!

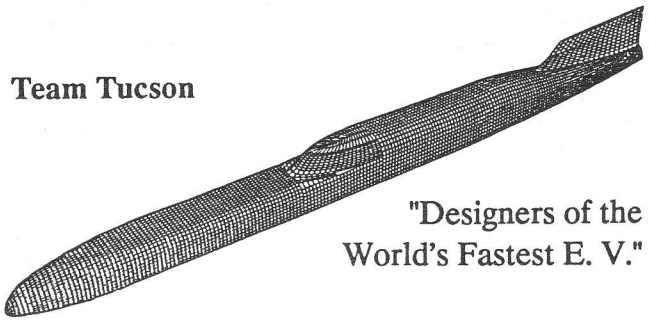
Pb (Paul Brasch) Editor

HELP WANTED

We need help on this newsletter. We need articles, reports, how-to stories, etc. We would especially enjoy getting how-I-did-it stories about member's recent conversion experiences. Don't worry about your writing ability, - send in the facts and your phone number and I will turn them into an articles for us all to enjoy and learn from.

Paul Brasch, Editor
1968 Elden Drive
San Jose, CA 95124-1313
(408) 371-5969

Team Tucson



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at the E. A. A. Rally
September 21, 1991

Roger will discuss the Team's goal to build a 450 MPH electric "streamliner." Hedlund has held the F.I.A. record for electric vehicles since 1974.

For more information, please contact:
Chuck Lemme
2102 East Hawthorne
Tucson, AZ 85719
(602) 624-3649

Want Ads

ELEC. CAR, 1960 NSU Prinz Car relic or 400-A Westinghouse motor alone worth price. Nds brake wk & batteries, $525 Roy A. Renner, 20480 W. Walnut Dr., Sonora, CA 95370 (209) 532-9785

ELEC. CAR MOTOR, Honeywell 48 volt, d.c. 75 amp., 3600 rpm $100; almost new. Timed charger $25. (415) 367-9177.

EV FOR SALE: 1981 Jet Industries Ford Courier Pickup. GE series motor, 23 hp. New PMC Mosfet controller, new batteries (20). 16k mi. on truck. Peppy. $8500 (415) 527-4852.

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WILLIE controllers tested and repaired. Used controllers bought and sold. For additional information, call or write Vandy Enterprises Inc., 515 S. Esquire Way, Mesa, AZ 85202. After 4pm, MST weekdays, (602) 967-6901

The EAA is not responsible for the accuracy of the ads.

EAA Chapters

ARIZONA

- **Phoenix**
  Lee Clouse (602) 943-7950
  P.O. Box 11371, Phoenix, AZ 85061
  Meetings: *4th Saturday/month 9am – Noon*
  Even months: *Chapman Chev., Baseline Av. at McClintock.* Odd months: *Lou Grubb Chev., 27th at Camelback, Phoenix*

CALIFORNIA

- **East Bay**
  Jim Danaher (415) 339-1984
  1986 Gouldin Rd., Oakland, CA 94611
  Meetings: *2nd Saturday/month 9:30 – Noon*
  PG&E Service Center, 4801 Oakport St. (880 frontage road south of High St.), Oakland
- **North Bay**
  Bob Wing (415) 669-7402
  P.O. Box 277, Inverness, CA 94937
  Organizing meeting Sept. 21, 1991
  Location to be announced. (See inside)
- **Peninsula**
  Jean Bardon (415) 355-3060
  540 Moana Way, Pacifica, CA 94044
  Meetings: *1st Saturday/month 10am – Noon*
  San Bruno Public Library (downstairs), San Bruno.
- **Silicon Valley**
  Paul Brasch (408) 371-5969
  1968 Elden Dr., San Jose, CA 95124-1313
  Meetings: *3rd Saturday/month 10am – 1pm*
  Hewlett Packard Santa Clara facility, Stevens Creek Blvd. at Lawrence Expwy., Santa Clara
- **San Jose**
  Don Gillis (408) 225-5446
  5820 Herma, San Jose, CA 95123
  Meetings: *2nd Saturday/month 10am – Noon*
  1592 Jacob Ave. (near Meridian), San Jose
- **Los Angeles**
  Irv L. Wiess (818) 841-5994
  2034 N. Brighton "C", Burbank, CA 91504
  Meetings: *1st Saturday/month 11am – 1pm*
  Pasadena City College, 1570 E. Colorado Blvd., Rm. E220, Pasadena

NEVADA

- **Las Vegas**
  Gail Lucas (702) 736-1910
  Desert Research institute
  2505 Chandler Ave., Ste. 1
  Las Vegas, NV 89120 E X A S

TEXAS

- **Houston**
  Ken Bancroft (713) 729-8668
  4301 Kingfisher, Houston, TX 77035

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  19547 23rd N.W., Seattle, WA 98177

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  293 Hudson St., Hackensack, NJ 07601

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  Bob Batson (508) 897-8288
  1 Fletcher St., Maynard, MA 01754

SOUTH FLORIDA

- **Ft. Lauderdale**
  Steve McCrea (305) 463-0158
  101 SE 15th Av., #5, Ft. Lauderdale, FL 33301

VANCOUVER, B. C.

- **Vancouver**
  VEVA (604) 987-6188
  543 Powell St., Vancouver, BC V6A 1G8
- **American Solar Car Ass'n.**
  Robert Cotter
  P.O. Box 158, Waldoboro, ME 04572

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- **EVCO** (604) 987-6188
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  George Gless (303) 442-6566
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  John Stockberger (708) 879-0207
  2S 643 Nelson Lake Rd., Batavia, Il 60510

For info on the EAA, send SASE to the address below or call (415) 591-6698, (415) 685-7580 or (408) 371-5969. Please call weekdays 10am - 5pm Pacific Time.

EDITOR: Paul Brasch DESIGN/PRODUCTION: Susan A. Hollis (PCTEK) CONTRIBUTIONS: MacDougall, Kincheloe, Loomis, Cosmano, Newell

August/ September 1991

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