Electric Auto Association

CURRENT EVENTS

Jul-Aug 2003 | Promoting the use of electric vehicles since 1967 | Vol. 35 No. 7 & 8

All types of EV, from tire-smoking Optima racers to electric tractor pulls.(Gordon Wong)

REV!2003

By Mike Hoskinson, VEVA member

[Note: the REV!2003 (Ride Electric Vehicles) Event was held on June 7 in Vancouver, BC, Canada. It is an annual Electric Vehicle Show and Ride event sponsored by the Vancouver Electric Vehicle Association, EAA Chapter.]

Gisele and I had a great time in Vancouver at the REV EVent. I had driven down in the Insight with Ken Norwick from Calgary. We used 35.6 liters of gas for 1000 km, not quite as good as Gisele's Insight drive of 1200 km on 38.5 liters 2 years ago but heck, we're 2 big guys and we had the air conditioning on most of the way.

There were a several EVs that I had not seen close up before. The City of Vancouver had loaned out their Think, Ranger EV, and a hybrid. There were several ITs from Dynasty, Think-like nEVs made locally, with different body configurations including a ragtop dune buggy. Really cool. Al Godfrey was there with his Porsche 928 with Siemens AC and a whole whack of Optimas. Beautiful car, nicely painted with a clean green battery box in the front and the motor in the armrest. I was comforted to see at least a small rat's nest of wires when he lifted up the carpet over the controller, which was where a back seat might have been. Makes me feel better about my project. I should have it tidied up by next year.

Gisele rode in one of the IT's. "Nice", she said, "but not as fast as an EV-1". The high point for me was driving the Ranger EV back to the city yard. Supremely cool. Imagine accelerating strongly in what looks like a standard pickup truck, with no noise, no vibration, no nothing except smooth power. Still not as fast as the EV-1, but Gisele said it was better in a way, because there was more room.

I hope she likes my Citroen. :)

Sorry that John Wayland could not make it, or Rich Rudman or Rich Brown. They had a local guy doing a burnout but he just burned the tires until one blew - impressive enough and a huge plume of smoke, but I would have preferred to see him take off too. Father Time was there. I did not get a chance to talk to him but boy did he have some interesting little EVs! One could only be described as a double-lawnchair electric bike, the minibike from hell. There was also an electric couch (I'm not sure if it was his too).

Our Insight was the only one of its kind, but there was a couple of Civic hybrids and Prii. We got a lot of attention with the Insight and Ken and I spent a good deal of time talking to people. Ken had brought a stack of EV handouts and a reprint of an article in the local AAA magazine about his Saturn EV. Most of the people I spoke to seemed more interested in the hybrid. I guess that's because you can just go out and buy one.

Some of the EV's (I have to admit) looked like rolling science projects from the 70's. I determined that mine would have at least a modicum of tidy wiring and I would not bring a car to a public show with unprotected high voltage leads and a sign saying don't touch. Gave me the willies to see that on one car.

Sadly, we did not win the electric bike. It would have come in handy here in Seattle, where I'm attending a course for a few days. They want $24 per day to park the Insight, $28 at the hotel. For that kind of money I expect carpeted floors and gentle music to soothe my car. And tires polished daily. Sigh. Maybe it's cheaper for electric cars.

As we were setting up, wiping the pollen off the Insight and getting registered, several electric bikes were cruising silently around the compound. One electric bike which greeted us was piloted by the high school other very impressive homemade bikes with their young drivers gliding around all day. There was a Segway, apparently, but the owner left early and I missed it. There were scooters zipping around all day. You had to

continued on page 4

IN THIS ISSUE

COVER STORY

Photos provided by various sources - see links at end of article

CE STAFF

Publications Committee:

Chairman - Ed Thorpe
CE comments, 2 Smith Ct., Alameda, CA 94502-7786, USA
E-mail: ceeditor@eaaev.org
Editors - Bob Oldham, Ed Thorpe
Publisher - Ed Thorpe
Assistants/Reviewers - Karen Jones, Scott Leavitt, Jerry McIntire, Bob Oldham

News in Brief:

Electric Vehicle Today

CE Reporters/Contributors:

As noted in articles

Photo Credits:

Typically author of article, except as noted.

Calendar of Events:

E-mail: cenews@eaaev.org

Advertising Manager:

CE Advertising
E-mail: ceadvertise@eaaev.org

Article Submissions:

The deadline for articles is the first of every month for consideration in the next issue of CE. Articles received after this date will be retained for future issues of CE. Contact the Publication Committee for more information at ceeditor@eaaev.org.

Advertisements:

A full advertiser's information package and Rate Sheet can be sent by U.S. Mail or E-mail. Please contact Advertising Manager or CE Staff for details.

National EAA:

Web Site: www.eaaev.org
E-mail: contact@eaaev.org
Mailing: 2 Smith Ct., Alameda, CA 94502-7786, USA

Membership/Address Changes:
E-mail: membership@eaaev.org
Mailing: Electric Auto Association Membership, 4189 Baker Ave.
Palo Alto, CA 94306-3908, USA

www.eaaev.org

COMMENTARY: FUEL CELLS (AND HEVS) VS. EVS

By Dave Goldstein, EVA/DC President

The Autos today are a powerful globally integrated business with hundreds of billions of dollars at stake. They are risk-averse and politically very influential at the same time. And they are probably the world's most significant advertisers as well, so they are in a strong position to influence public opinion in many ways.

EVs and HEVs largely represent a high degree of financial uncertainty for them, although Honda and Toyota are gradually stepping out ahead of the pack on the HEV issue.

Also, EVs represent a clear threat to their huge investment in ICE technology and to their cash flow and profits from parts, maintenance and used car sales, since EVs tends to outlast ICEVs and require relatively few replacement parts.

So the name of the game is "Managing Risk"— i.e., maximizing ROI on highly profitable trucks and SUVs while minimizing expensive shifts in design, tooling and fundamental technology development. By promoting Fuel Cells, the Autos are essentially holding off regulatory attempts to promote cleaner cars NOW, in effect saying, "Just give us 10 years to develop Fuel Cell Vehicles. THAT's where the action is!" ;-) Only, they know darn well that FCVs and the H2 fueling infrastructure needed to support them won't be ready for at least 20 years or more!

In the meantime, they get the taxpayers in various countries (and in CA!) to *subsidize* the FC research while they get R&D write offs to minimize their taxes. Pretty sweet, huh! ;-)

It's all about making money— which is, after all, what the auto industry is about— and NOT about doing the things that make the best sense for the consumer or the environment, although they do TALK about that a lot.

In the meantime, they use the taxpayers' dollars to crank out a few dozen FCVs (@$1.2-2 million apiece) to keep the *illusion* alive that they are actually doing something!

The risk for the Autos is that the oil will run out or gas prices will escalate to the point that their trucks and SUVs are no longer in demand. At that point they will try to switch to diesels, if they can get away with it, ("WHAT carcinogens?" ;-) and reluctantly to more Hybrids. They will no doubt demand more government support for this, claiming that the environmentalists pushed them into FCVs prematurely! ;-)

EVs will be their last choice, because they have too much money at stake, and still don't see a strong enough "business case" to make that kind of changeover. An EV represents about a 70% difference in the automotive systems in a car or truck.

Range concerns are still part of this. Sad to say, but the 300-mile EV is not here yet. 150 miles is doable now and we will soon be at the 200-mile threshold.

Advanced battery costs— which are largely volume dependent— are a major issue for them. It's the old "chicken and egg" conundrum that we are all so familiar with. In order to get the costs down to an acceptable level to make a profit, there has to be a "market pull" of 30,000+ annual vehicles.

But behind that number, you have to make a major commitment with your suppliers— including battery companies— to provide those 70% different system parts, and that requires several years of preparation, hundreds of millions of dollars, and several more years of commitment to the market in order to achieve profitability.

GM *almost* got this right with the EV1, but changes in top management along the way caused them to abandon their marketing commitment and essentially guaranteed an economic loss that they now tout as evidence of "having tried but failed" to sell EVs. That's B.S. of course! They failed to try.

In the meantime, "Plug-In Hybrids" with a 60-mile pure EV range are even more doable and marketable, but still represent the kind of phase-shift in Autos thinking that the industry is not known for.

So it may take another oil shock or two, some financial convulsions— and/or enough consumers to revolt— to break the Autos out of their delirium.

Unfortunately, public policy officials are often not engineers. They tend to rely upon staff who are too easily swayed by the phony economic arguments, promises, heavy lobbying activities, advertising and PR that the Autos have presented. The industry motto— sadly, all too successful— continues to be, "If you can't handle the facts, dazzle them with bullwhacky!"

By comparison, we are still just a grass roots effort, totally outgunned by these "weapons of mass destruction." The electric utility industry, once our most powerful ally, has been ravaged by deregulation and scandal, and is no longer in a position to significantly help us. We are on our own, and it will likely take a major calamity, as I have said, to change the status quo.

Postscript: For those who missed seeing Alec Brooks' excellent paper on BEVs vs. FCEVs, it is posted on the CARB website below. Be patient. It takes a while to download:

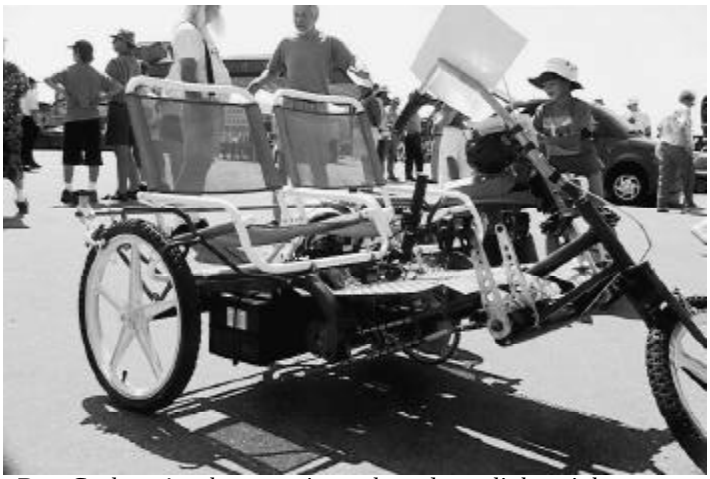
http://www.arb.ca.gov/msprog/zevprog/2003rule/1202wkshp/brooks.pdf

Is this the future of HEV's, the Toyota Prius? How about some HEV-20s?

There were a few new bike and scooter vendors this year, including Merida (left) and E-Go (right). (Gordon Wong)

Don Crabtree, the ever-innovative builder from USA, showed a new Jr. Drag Bike. (Gordon Wong)

The Canadian-built Dynasty IT nEV. (Dave Barnaby)



Don Crabtree's other creation, a brand new lightweight power-assisted tandem recumbent. (Gordon Wong)

Al Godfrey's 1978 Porsche928 conversion with Metricmind AC motor/inverter system. (Gordon Wong)

The '98 Ford Aspire from the University College of the Fraser Valley was a very neat conversion. (Gordon Wong)

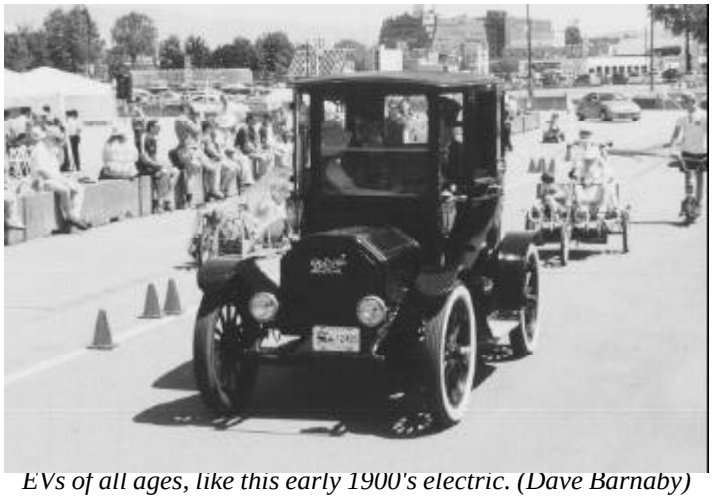
continued from page 1

keep your eyes open or you'd be run over by some crazed kid on a silent scooter or, for that matter, in an RX-7.

Sadly, I missed both electrathon races. For those who don't know anything about electrathon cars, these are home built one-person (usually a kid) cars that zoom around the track on one battery of regulation size. The winner is the one with the most laps in one hour. Some day, maybe, one of those "kids" will be me.

At the Science Centre next door there was a display of fuel cell technology. I did not get

There were even driving couches, like this wonderful ride. (Dave Barnaby)



EVs of all ages, like this early 1900's electric. (Dave Barnaby)

Electronthon racers. (Alvin Lee)

Electronthon racers. (Alvin Lee)

Awards given to some of the electrathon winners, with VEVA sponser banner in background. (Alvin Lee)

Electronthon racers. (Alvin Lee)

over there at all, but at the end of the day, as we were leaving, the fuel cell bus drove over to the 1912 electric tram for a photo op. I got some pictures of the Insight in front of this pair of beauties. Too bad I wasn't driving electric.

After the EVent we all met at the Red Dog brewery for a BBQ. Good beer, good company. The annual REV EVent is a super one-day holiday. Mark your calendars for next year. First Saturday in June, I believe.

Additional pictures available at:
http://gwinfo.net/rev2003/photos/

EV GRIN - THE SIGHT OF LIION BATTERIES

By John Wayland, SEVA member

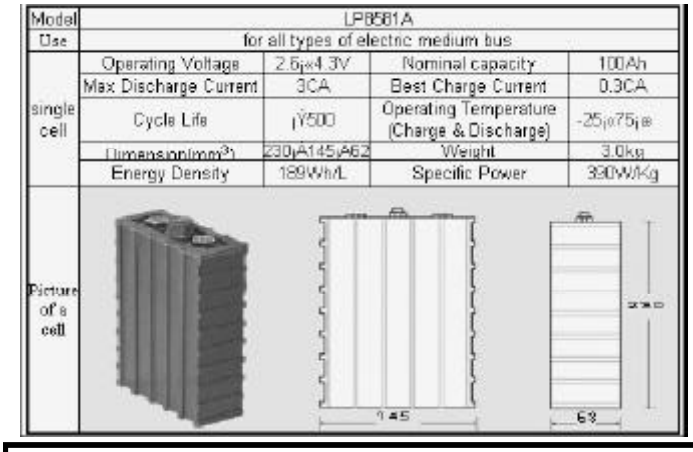
Actually, the other night, he was in trouble! You see, he had invited me, Plasma Boy, to come over to play, and to see his ocean of Li-Ion batteries, just before we were both to head to downtown Portland for our monthly OEVA meeting. Victor lives about 6 miles south of me, as we are both on the east side of the Portland metro area. The drive to Victor's place is fun in Blue Meanie, either via the I-205 freeway for higher speed cruising, or via a long 35 mph street, 92nd Ave. that takes you on a more leisurely drive past tidy neighborhoods and two city parks shrouded in tall Douglas Firs. Both routes take you to Flavel Street that turns into a winding one mile uphill pull to Victor's home…that spells fun high amperage acceleration and cornering bliss, exactly what Blue Meanie does well.

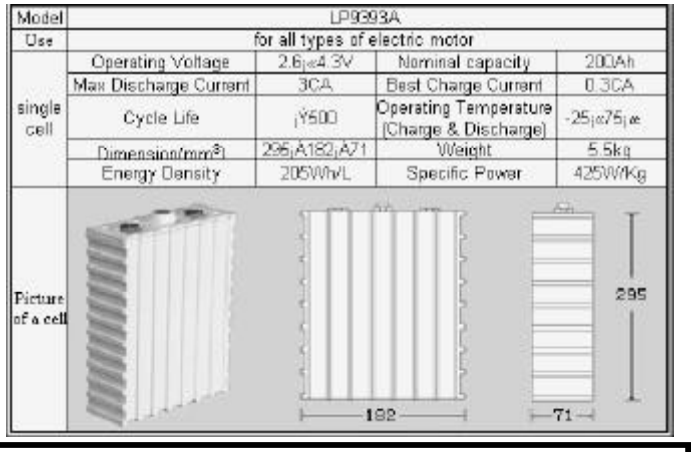
I unplugged the Meanie from the 240 vac outlet in my backyard EV shop after its spunky 'tweaked' PFC20 had just finished jamming the small but feisty pack of 13 Optimas with 29.3 amps of juice. As I readied to leave to see 'the newest thing in EV batteries', I was reminded of a certain Plasma Boy who had been in Victor's position nearly a decade before, that is, buying and shipping in full pallets of 'the newest thing in EV batteries', a strange six pack of beer shaped battery called an Optima. Many were very skeptical about my over flowing zeal over this new, high powered (power density, not energy density) lead acid battery that in my prediction, would revolutionize the conversion world of backyard-built EVs. Here was an EV battery, that unlike the more conventional and traditional 6V wet cell golf car batteries, was 12V, totally sealed and maintenance free, light weight at just 45 lbs. (when compared with two 6V, 61 lb. golf car batteries wired in series to get 12V), could be mounted in places unthinkable with wet cell types. The battery looked cool as hell for show car excitement, and most importantly of all, it could dish out 1000+ amps repeatedly to deliver new levels of EV performance to the streets. Instead of continuing to make excuses for batteries with corroded terminals, acid stained parts, and rotten egg smells, the Optimas ushered in a near era for backyard built EVs where gold plated terminals and bright yellow batteries under clear PlexiGlas were actually cool to look at. Here was a battery (along with Hawkers) that made it 'possible' to put together higher voltage strings at acceptable weights, for muscle car type performance, fast charge fill-ups, and the ability to convert regular cars without loosing the back seat, the trunk, or having the completed EV weigh in like a beached whale. The Optima Yellow Tops changed the way conversion EVs were looked at, and the hot rod EV was born.

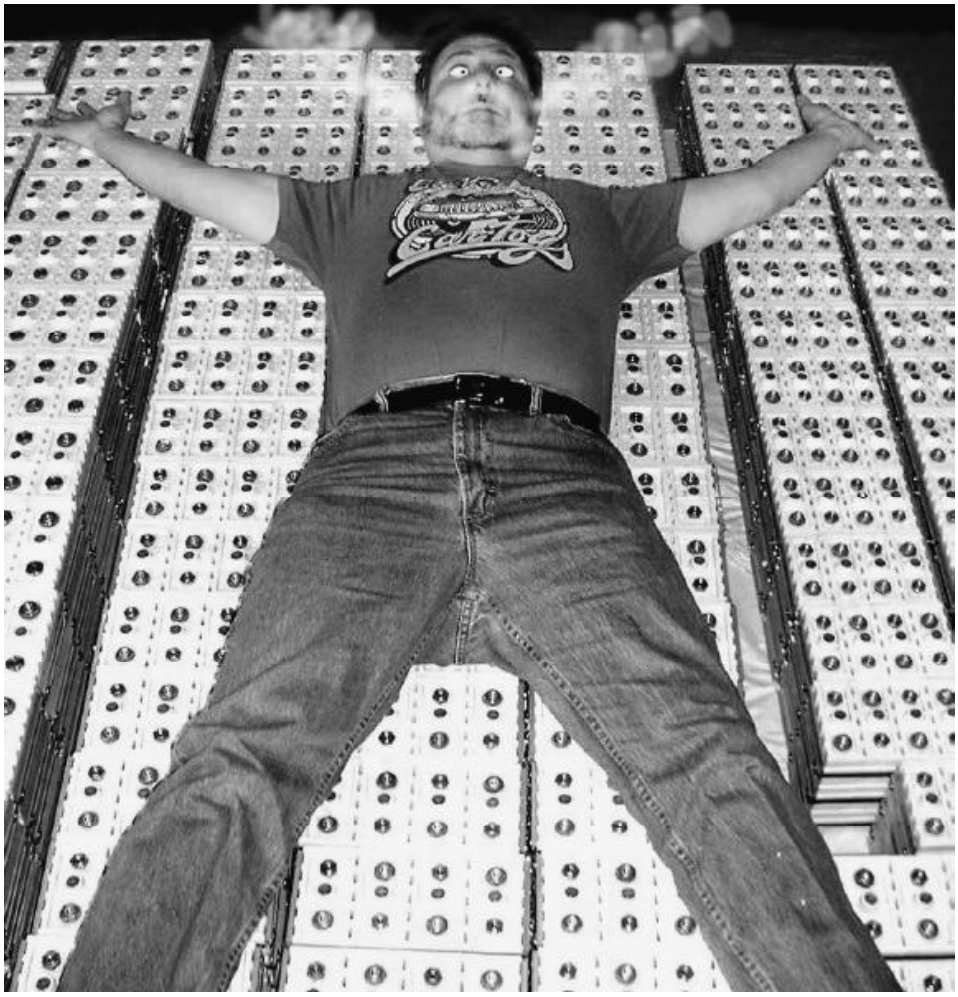
As I drove towards Victor's place, I thought about the impact that these new Li-Ion batteries would have on the EV conversions to come. If they could do what their makers' claim, finally, here was a battery we could get our hands on, that although pricey, would change the range per charge thing, the way Optimas changed the acceleration-top speed thing. If one were headed towards a 300+ volt type of EV, strong acceleration performance could also be had at the same time, too!

I was enjoying the ride in my trusty EV friend of 23+ years, and every once in a while, I'd nail it just to feel the thrust that comes from 1000+ amps out of a 156V stack of Optimas and fed through a powerful motor controller into a torquey 9 inch ADC series-wound motor....300 ft. lbs. of torque and 135 HP is FUN in a light weight, little Datsun 1200 econobox! Still, I was also wishing for all this fun 'and' the extended range that is the promise of Li-ion. Ahead of me, was a sea of batteries Victor was excited to show me. I knew that feeling. I used to do the same thing to EVers, as when they'd come for a visit back in the days where Optimas were considered 'the exotic' EV battery, they'd want to go see 100+ bright yellow Optimas strewn in my EV shop.

I rolled to Victor's place, with 8.7 ahrs having been extracted from the Optima pack. These days, the pack is doing quite well and can deliver up to 30 ahrs (up from the last pack's 25 max usable ahrs), though I try to keep most daily discharges to 22 ahrs or under so as to not cycle the pack to death. I wasn't planning on recharging at his house, as quite frankly, with our downtown destination about 13 miles from his house, I didn't really need to. Victor arrived home from work a moment later, got out of his car, and greeted me...any thoughts of plugging in to recharge went out the window, knowing that behind that garage door, lurked a bunch of white, exotic batteries! Inside, there they all were, covering his garage floor. I had brought my digital camera, but Victor soon had it in his hands and was commanding me to lay down on top of the batteries.....oh—kayyy. Hmmm, better take off my watch, and make sure the belt buckle stays put. Before I knew it, I had assumed the crucifixion pose as Victor starting catching the scene. I believe he's got the picture on some web site. We had a fun time talking about the batteries, and I was allowed to play around with them. I picked them up and felt the light







weight modules in my hands as I was in awe of how many EV style ahrs they could dish out...amazing!

I find the current thread about all the theoretical problems there might be with Li-Ion, interesting, and all the grave predictions of explosions, over charges, and failed batteries, remind me of the flack I heard about the Optimas years ago. For a while Optimas got quite a bad rap, especially when some not-too savvy EVer, simply replaced an aging 1200 lb. pack of 20, 6V flooded cells with ten Optimas...after all he had replaced a 120V pack with a 120v pack, right? After punishing a small 450 lb. pack of Optimas to death trying to make them go the same distance as 1200 lbs. of wet cells, he proclaimed Optimas as crap, saying they had no range and horrible cycle life. Of course, we all know that this was an unfair comparo, but this is how it went back then...people did all sorts of weird things with the new Optimas, and the results were presented as testaments proving these new-fangled Optimas were junk. A few of us took on the naysayers, tried our best to educate them, and continued on building fun, exciting electric machines using the new Optimas. Today, a lot more is known about how these AGM style batteries can make EVs muscle machines with a neatness and tidiness never before possible. These are lead acid batteries, so range per charge isn't any better (or worse) than with other types of lead acid batteries, but they can provide a fun factor that was before, not possible, and at very aggressive EV currents, they do actually improve range a little bit over more conventional wet cell batteries.

It is my hope, that the newly available Li-Ion batteries (thanks, Victor) will not suffer from the same scenario as did Optimas. Let's give the folks stepping up to the plate credit for trying something new, for putting their money where their mouth is, and for taking a stand against the EV's last bugaboo, lack of range.

Back to my story.....It was entertaining being inside Victor's laboratory, and looking around was like gazing into Victor's brain....scary thought! I asked about some strange boards covering the center of Vctor's garage...that's when his alter ego 'Mole Man' began to appear, and with a demented look, he began to move metal pieces, wires, batteries, semiconductors, circuit boards, and the like, out of the way, as he cleared off the mysterious slats of wood to reveal a sunken recess, with a dark, dank, and descending stair step that lead down into a casket like sunken well with water oozing from its concrete walls...Moleman sort of grunted and hobbled down into his hole as any semblance of Victor was gone, and there was now only this earthen creature before me....I was frightened. It motioned for me to bend down and descend into its burrow, but I was a creature of the light, not the humid darkness of the Mole hole. Finally, after great protests, Moleman ascended into the garage to find a tripod equipped with powerful quartz lights, then he disappeared to connect them to power outlets deep below the surface. With live-giving light pouring up through the slats, I nervously went down to join Mole Man.

After experiencing Victor's 'pit', we were chatting away when he offered me a charge fromhis nearby NEMA 1450 240 vac outlet...sure, why not, however, the Meanie was on charge a whole 5 minutes or so before it was time for us to leave for the OEVA meeting. The Emeter had backed down a couple of ahrs and was indicating -6.6 ahrs when Victor and I left together in Blue Meanie, his first ride in my EV. We glided away and down the steep hill towards the freeway, then took a 70 mph cruise to the downtown meeting 13 miles away. I was a good boy and never smoked the tires...OK, OK, I did do a minor tire spinning bit on our way towards the freeway on-ramp...I think Victor enjoyed the ride.

We pulled up to the downtown EV charging station, down 22 ahrs and only to find another EV in one of the two slots, and in the remaining slot, a damn stink'n gas car! 'She' had pulled into the spot, and 'he' was rounding the corner to get in the passenger side, when I asked them, "Is this as electric car?" He nervously tried to explain that they were 'just' meeting for her to pick him up, while I fired back with, "Gas cars do not

continued on page 11

CONVERSION WORKSHOP, STEP 17
FABRICATING BATTERY AND COMPONENT INTERCONNECTS

By Michael P. Brown, © 2003

The first step of the interconnection process must be taken before you order the batteries. This is deciding which type of terminal you want. There are three types of terminals available for the golf cart batteries we use: the automotive terminal, the universal terminal, and the 'L' terminal.

Getting to Know the Candidates

The automotive terminal is the one most of us are familiar with, a round tapered post sticking out of the top of the battery. When used with the automotive style cable end, its large contact surface combined with an almost 360-degree clamping action makes for a good reliable connection.

The drawback of the automotive post is the cable end itself. The cable ends for 2/0 cable are large and bulky, which makes it difficult to build an interconnect for two batteries with the terminals close together. The other problem with automotive style cable end is expense: $4.00-$5.00 each times twice the number of batteries in your pack.

The second choice - the universal terminal - is an automotive terminal with a 5/16" stud sticking vertically out the top of the post. The theory is that a cable can be attached to the battery with an automotive style cable end (see above) or with a 5/16" cable lug over the stud. The cable-lug-over-stud method works well in golf carts, where low amp draws permit lightweight #2 cable interconnects, which is why ninety percent of the golf cart batteries sold have universal terminals.

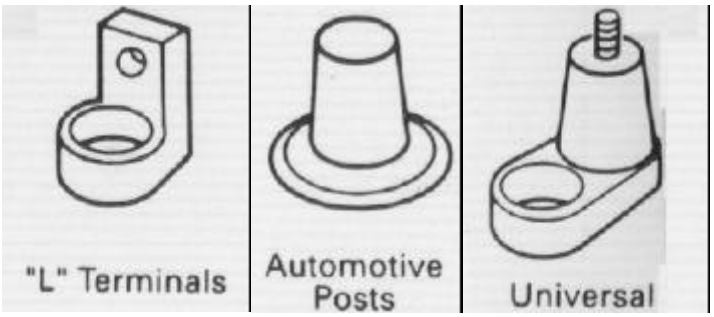
However, in the road-going EV, where 400-500 amp momentary draws are common and heavy 2/0 welding cable is used for interconnects, problems arise. The lead post is subject to "cold creep". This is a process by which lead will flow at room temperature while under pressure. This process is accelerated by the heavy cable interconnect, small contact patch (less than one half square inch), heat from the high amp draws, and the severe lock washer used to try and keep the assembly tight.

Crimping a lug onto a cable using a proper crimping tool.

All of this leads to the stud working its way up out of the post and a loose connection. If you tighten the nut, the stud pulls out a little more, and things get loose again. When a battery connection is left loose, resistance develops which causes heat. Under a high amp draw, a lot of heat is generated. The battery post melts, the series string is broken, and the car stops, hopefully without catching fire.

In addition to the loose connection problems, the 5/16" stud adds ¼" to the over all height of the battery, which could become critical in a tight battery layout.

The third choice is the "L" terminal. On this terminal the 1- 1/8" square base is soldered to the battery post that comes from the inside of the battery. The vertical arm of the L is the same size as the base, ¼" thick and has a 5/16" hole through its center.



Common battery post terminals.

This is the type of terminal that I recommend. Its large flat surface allows the entire flat end of the cable lug to make contact with the terminal, which leads to less resistance. The 5/16" hole, when used with the nuts and bolts provided with the batteries and some additional washers, makes for battery connections that don't loosen up on their own and cause problems.

Hands On at Last

Now we move to a point further along in the conversion. You have bought the batteries, with "L" terminals, and installed them according to your paper layout, as we discussed in the last issue. Now you have to build and install the interconnects.

2/0 welding cable is normally used for the high current, high voltage traction battery interconnects. The cable is fastened to the battery or component terminals with copper lugs on the ends of the cable. It is critical that these lugs are firmly attached to the cable and protected from corrosion.

Heat Isn't Neat

When I was discussing fastening connectors to small gauge wires in the March/April issue, I gave several reasons why soldering the connectors to the wire wasn't a good Idea. The difference in size between 16 ga. wire and 2/0 cable multiplies the problems caused by soldering a connector on a small wire.

Applying the amount of heat necessary to heat the large cable and heavy lug to the temperature needed to melt the solder and make a good soldered joint is hard to do

under home shop conditions. This difficulty makes the chances of burnt insulation, solder wicking up the cable, or getting a cold joint very good, to say nothing about third degree burns.

If I Had a Hammer

The best way to attach a lug to a piece of cable is crimping. This is done by compressing the barrel of the lug over the cable, forming a mechanical joint. There are two types of tools that will give you the amount of force necessary to make a good crimp.

The first one looks like a large bolt cutter with a set of crimping dies where the cutting edges would have been. This tool works well but can be awkward to control, and requires some upper body strength. It also requires a separate set of dies for each cable size. The price of the tool and dies you might need make it a little expensive for the hobbyist converter, who should only need it while building his EV.

The crimper that I use is a cradle and punch type. The cradle holds the cable lug assembly in place underneath the moveable punch that rides in a sleeve that keeps it aimed at the cradle. The crimping force is supplied by hitting the punch with a suitable hammer. The side of the punch is marked to indicate the place at which the crimp is made for the size of cable you are using. I just hammer it until it quits moving which usually works out to be the same place.

How to Achieve a Perfect Crimp

Strip 5/8" of the insulation off the end of the cable. Be careful not to cut any of small copper wires that make up the cable, or disturb the shape of the bare cable. Fill the barrel of the lug half full of an anti-corrosion compound such as Noalox.

Carefully slide the bare copper into the lug. When the cable is fully seated, turn the lug around on the cable once to help spread the Noalox. Wipe off any of the compound that is forced out of the lug.

With the crimper on a flat, stable, hard surface, lift the punch and place the lug/cable assembly on the cradle, flat side down and centered under the punch. Hit the top of the punch with the hammer until it stops moving. If you like, test the crimp by clamping the flat end of the lug in a vice and giving it a sharp tug. You should be able to lean your weight against the cable and not loosen the crimp.

Wipe off any excess Noalox forced out by the crimping. Finish the crimp by heat shrinking a short piece of shrink tube over the lug/cable joint.

I have cut open lugs crimped this way after many years of service and found no corrosion inside at all. I have never had a failure from this type of crimp.

2/0 cable with copper lugs properly crimped to it is very safe and reliable. Its only drawbacks are bulk (with its insulation it is 5/8"-3/4" in diameter), lack of flexibility in short lengths, and the expense of the cable and lugs necessary to hook up a large number of batteries.

A Modest Proposal

For most of time I have been building EVs, I have used copper strap to interconnect the batteries in my cars. This strap is 1" wide by 1/16" thick. I have a local sheet metal shop shear copper sheet into the amount of 1" strap I need. We have used this on 500-amp 120 volt EVs under racing conditions as well as daily drives in hilly terrain with no problems.

Attach the copper to an "L" terminal in the following sequence: a 5/16" flat washer under the head of the battery bolt, the terminal, the copper strap, a low pressure lock washer called a Belleville washer, and the battery nut. The result will be a connection with a one square inch contact area that will not loosen up on its own.

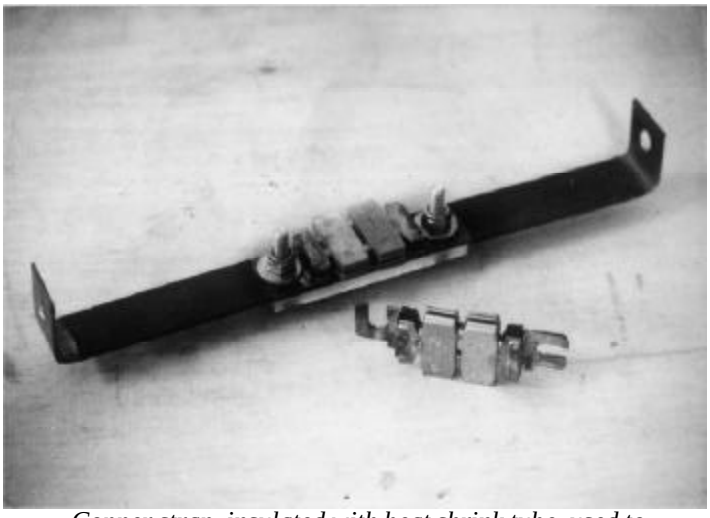
The only place I don't use the strap as an interconnect is where the batteries to be connected are at different levels in the Voltsrabbit's front pack. The narrow cross-section of the straps greatly reduces their interference with battery hold-downs fastened to the inside of the battery box lids, and gives the interconnect enough flexibility to eliminate strain on the battery terminals.

Working with the copper is relatively easy because of its softness. It is easily cut, drilled, and can be bent by hand in a bench vise. To make the interconnects, you first need to make a model out of thin cardboard. Bend the cardboard into the shape needed, and then use the unfolded model to size and mark the bend points on the copper strap.

Cut the copper strap to length, mark the bend points, and drill the 5/16" holes for the battery bolts. At the same time, cut a piece of ¾" shrink tube long enough to cover the entire copper strap except the ends where it makes contact with the battery terminal. I have found it easier to slip the shrink tube over the copper strap before making the final bend. Use a heat gun to shrink the shrink tube after the interconnect is bent to its finished shape.

You will find that you will use several of the same interconnects in each battery pack. Find out how many of each interconnect you need for the whole car and make them all in a production run.

While you are making interconnects, be sure to make 1 fused interconnect for each separate battery pack. I use a 500-amp time delay fuse mounted on a Bakelite block and fastened between two pieces of copper strap that go between two batteries in the series. This little precaution can save you from disaster in case of a short.



Copper strap, insulated with heat shrink tube, used to mount a fusible link between two batteries.

Making the Cut

Before you start to measure and cut the 2/0 cable, you should buy a pair of cable shears. These shears are built to cut welding cable and give you a clean straight cut every time. A word of warning: using this tool to cut anything but copper cable will ruin it, so use a pair of regular wire cutting pliers to cut that steel mechanic's wire and save your cable shears for cable.

How Long Does That Cable Need To Be?

Now we need to determine how long a piece of cable to cut to connect the batteries to each other or connect two components. You could just hold the loose end of your coil of cable to one component and string the cable to the component you want to connect to and cut it there, but cable is heavy and awkward, which is likely to lead to inaccuracy.

The Rope Trick

The way to avoid these problems involves a little paperwork and a piece of rope. Make a cut list of all the cables including, battery interconnects, that you need to make. Next buy a piece of rope 6 feet long with an outside diameter as close to the outside diameter of your cable as you can get.

Measure Once

Tape one end of the rope to mark it as the starting end. Take this short light piece of rope and clamp the starting end of it to one of the terminals of the component you need to connect. Run the rope along the path you want it to follow to the terminal of the second component that you want to connect to. Mark the rope at that place by wrapping a piece of masking tape with the outside edge of the tape at the place where the rope touches the terminal.

Measure Twice

Remove the rope from the car and take it to the workbench. Lay it out in a straight line and measure it. Add one inch to that measurement and record the total as the length of that cable on your list of cables. Repeat this process until you have the lengths for all the cables on your list

The cables that connect the rear battery pack to the front battery pack or other components in the front of the car are usually longer than six feet. To get the correct length for these cables, determine the path the cables will take under the vehicle. Make a mark at a place that is easy to reach from inside front and rear compartments at each end of that path. Try to make these marks an easy to remember whole number like seven feet apart.

Fasten the starting end of the rope at the front mark, measure the distance to its destination

as described above, and then repeat the process in the rear compartment. Adding the front and rear measurements to the seven feet will give you the length of cable needed. Add about four inches to your measured/ calculated length and record the new total on your cut list. Repeat the process for the length of the cable for the other side of the circuit.

Cut Once

Cut the cable as per the lengths given in your cut list. Immediately after cutting a cable use some masking tape and label it with its length and where it fits in the circuit. This close to the completion of a conversion, mistakes can creep in during the excitement.

Crimp Cautions

Now you are ready to finish the cable by crimping the lugs on each end, using the procedure given earlier. Before you reach for the hammer, there are some things to check. Make sure that holes in your lugs are the correct size to fit the fasteners on the terminals of the components you are attaching the cable to.

It is also important to orient the flat contact surfaces of the lugs to each other. The easiest way to do this is to crimp a lug on one end of the cable and fasten it to its component terminal. Then run the cable to its destination, and install the lug loosely on the cable. (Putting the Noalox in the barrel of the lug helps to hold the lug to the cable). Next, place the lug in its place on the second component's terminal and make reference marks on the barrel of the lug and the insulation of the cable to show the desired position of the lug on the cable. Take the cable back to the bench, be sure the reference marks line up, and crimp the lug to the cable. Using this procedure eliminates any twisting strain on the cable, lugs, or component terminals.

Secure Your Cables

Once all of the 2/0 cables have been made up and installed, they need a little more attention. These cables should be secured to each other and the chassis at regular intervals. They should not, however, be pulled tightly over a sharp edge or be allowed to move slightly against a flat piece of the body. Over time the insulation will wear through causing a problem.

The two cables that run from the rear battery pack of the car to the front pack should be held tightly together so that their electrical fields cancel each other out, eliminating a source of electrical noise that might cause problems with other parts of the car. We tape the two cables together with several small gauge wires that need to get from the back of the car to the front into one bundle.

Then, because the bundle has to run under the car, we run it through a piece of 1 ½" flexible PVC spa tube long enough to cover it where it is exposed to the road. The tube assembly is held to the chassis by brackets and hose clamps. If the spa tube is cut to a specific length and installed in the vehicle before the cables are cut, it can take the place of the front and rear marks we made to help determine the lengths of the two front-to-rear cables as described above.

The spa tube is not necessary if the cables and wires can be run through a protected space in the chassis of the car. Bundling them together is still a good idea for ease of handling and neatness.

We now have the battery interconnects made, the front-to-rear cables installed, and the components connected to each other. In the next article we will discuss installing the batteries, the final hookup, and the final testing necessary to put another conversion EV on the road.

Talk to you then.

photos by Shari Prange

*Mike Brown, Electro Automotive, PO Box 1113-HP, Felton, CA 95018-1113 * 831-429-1989 * Fax: 831-429-1907 * mike.brown@homepower.com * www.electroauto.com*

Copper straps between batteries, and cables connecting to the lower level of the pack.

LiIon Batteries *- continued from page 7*

belong here, this is for EVs only...please move so we can use the charging stand." With that, they pulled out as we pulled in, plugged in, saw 29.3 amps flowing into the pack, and left for meeting up with the other EVers for cheap happy hour dinner selections at the local hang out 'The Lotus Bar and Grill'. By the time our brief dinner was over, the Meanie had been fully recharged and I moved the car over to join the other EVs and hybrids positioned in the courtyard at the OEVA meeting place.

After a very good meeting with lots of attendees, Victor and I headed off into the night in Blue Meanie, and once again, cruised at freeway speeds all the way back to his place. The last leg of the return trip was a mile up the hill to his house, and after 12 freeway miles, the 13 Optimas still had the punch to eat the hill at speed...almost blasted right past Victor's road!

It was a fun night, and after taking a 15 minute top off charge, I left for my house. If Victor has anything to say about things, future EV encounters will be in cars powered by little white bricks of energy...no top-off charges needed!

See Ya.....John' Plasma Boy' Wayland

By Eric Ryan, Director, EV Challenge (www.evchallenge.org)

It was a gray and very chilly Friday morning in April as students, parents, teachers and volunteers gathered at Progress Energy's Harris Environmental Center in New Hill, just south of Raleigh, North Carolina, for the culminating event of the yearlong EV Challenge educational program. Some teens stood sleepy-eyed and somber while others joked and laughed, confident about their team's efforts over the next two days. Young men and women were dressed in everything from t-shirts and jeans, shorts and droopy pants to smart looking suits. On this first day of the event, students would further realize the efforts of all of their hard work.

With over 1000 attendees and 110 school groups represented – 26 high schools and 84 middle schools – this event is the largest EV education event in the nation. While the last several years have seen its share of EV education events come and go, the EV Challenge has continued to grow and become stronger. This is based, in part, to the fact that the EV Challenge is not simply a two-day event – it is a yearlong educational program that culminates in a two-day finale – the Final Event.

Although the EV Challenge features electric vehicle construction as its central learning experience – model solar cars for middle schoolers and full-size electric conversions for high schoolers – the program's strength comes from the diversity of "challenges" that emanate from this core project. Beginning in the fall of each school year, students from multiple classes begin to learn and apply the math and physics skills needed for the mechanical and electrical engineering tasks that await them. They learn drafting, construction skills and design principles. They learn how emissions from gasoline-powered vehicles pollute the environment and what they can do about it. They study public speaking and become savvy public relations specialists. During the Final Event, participants are judged not only on how well their vehicle performs, but also on community initiative and fundraising abilities, creativity, technical innovation, troubleshooting skills, oral presentations, and web site design.

"The EV Challenge is a program that integrates skills, imagination, learning, and a tremendous amount of initiative," says Ralph Goodwin, the president of the Carolina EV Coalition – the nonprofit organization of which the EV Challenge is a part. "One of the students' goals is to get the community involved as a way to leverage their school's own resources." Students accomplish this by securing business sponsorships, marketing their efforts and progress to the local media, and giving presentations to local community groups. "In this way, students not only gain the support they need, but educate people about

South Brunswick Middle School won the EV Challenge's Junior Solar Sprint race.

the benefits of clean, efficient electric transportation."

In addition to coordinating a yearlong competition, the EV Challenge provides schools with funding assistance through grants, prize money, and product discounts; ongoing technical support and teacher training; and an in-depth curriculum manual to help schools integrate EV Challenge activities into their school's educational program. The program also features a Mobile Classroom – a 25-foot enclosed trailer housing EV Challenge educational exhibits including a Junior Solar Sprint car and a student-converted convertible Triumph Spitfire. The Classroom is towed by a 3/4 – ton bi-fuel natural gas pickup.

During the Final Event, high school vehicles pass through a garage for an initial technical inspection and then line up next to one another, hoods open for the design judging. There were a diversity of vehicles in this year's lineup, ranging from a white 2-door 1971 Datsun 240-Z to a red, white and blue 1989 GMC S-15 pickup truck to a marroon Volkswagen Jetta. With names like "Crimson Shocker," "Voltsdragon," and "Blue Thunder," nearly all advertise sponsor logos, and are decorated with leaping yellow and orange flames painted on door panels or shiny electric blue racing stripes. Judges walk up and down the rows of cars, as students excitedly explain their design features.

The EV Challenge's high school program features three separate vehicle classes – cars, trucks, and modifieds. While the design goal for all three classes is to build a stock looking, street legal vehicle, the modified class allows veteran schools to build vehicles with more high performance components. All schools must utilized lead-acid batteries, a DC-powered system, and keep the vehicle's weight under the manufacturer's gross vehicle weight rating.

The students take different approaches to their vehicle design. One school, for instance, has converted a Toyota MR2 into a lightweight speed-demon autocross racer that regularly places in the top-five of local sports car autocrosses – against the gas burners! Another school decided, instead, to go for range with over 1700 pounds of lead-acid batteries in their Ford Probe, somehow still keeping their vehicle's weight under the manufacturer's gross vehicle weight rating.

In the middle school program, the students build their vehicles according to nationally recognized Junior Solar Sprint (JSS) guidelines. All of the vehicles must use identical solar panels and motors, be within a certain size limit, and utilize a "hook" of some sort to guide the vehicle along a guide wire. In addition, the EV Challenge version of the JSS program requires that the vehicles also carry an empty soda can as a payload and design challenge. In addition to competing in a 20-meter race, the students and their vehicles are also judged for creativity and technical innovation.

Like the high schoolers, the younger students' vehicles represent a diversity of design approaches. While some student's apply compact discs for wheels and straws for axle sleeves, others use small wheels with spokes and high performance bearings. The vehicle's names – "The Unidentified Flying Cake," "The Intimidator," and "Hammerz" – give a hint at the student's design style.

The middle school program doubled in size this year and also became a part of the Department of Energy's National Middle School Science Bowl. As such, in addition to building slick solar cars, the students gained additional science knowledge by participating in a science quiz bowl. The winners of the middle school race – South

continued on page 22

CAREFUL WHAT YOU SAY - HOW REPORTS WRITE

By Dean Grannes

[Editor note: This article is a reflection on how newspaper reporters can be interviews EVers to get facts and insights and first-hand experiences, but what comes out the other side, after the reporter, editor and others get done, may not have the same message nor slant. Unfortunately, reporters aren't obligated to provide a rough draft for review to their sources, so mis-quoting is common in the industry. Still, we need to continue to speak up about EVs and inform environmental groups that the EAA and EVers know the facts about EVs. We build, repair and drive them as far as they will take us, even if the automakers consider them a "failure".]

I was disappointed in this article [printed two columns over]. It seems that the reporter brings up the negatives first (the first line says it all), and with each successive car, he tells about its shortcomings before telling about its advantages, if he tells it at all.

Disadvantage 1 (Frost's Porsche): 40 miles range. Driver gets stuck. In a residential area?!?!? Residential areas have probably the one of the highest densities of electrical outlets per square block of any type of area (except office buildings). Can't he ask for a charge? I don't get it.

And he doesn't mention the advantages: no gas, oil changes, exhaust, reliable, etc. Depending on the conversion (I couldn't find it in the photo album), it might have good acceleration and be great in those Des Moines winters (if batteries properly heated/ insulated).

Disadvantage 2 (Pullen's accord): can't tow a trailer. (?!?!?!) Ummm, why is this even an issue? Why dwell on this point (how many times does the average person expect to tow a trailer, and with an Accord to boot, anyway?) instead of the point that he's using some advanced batteries that, if they pan out, could revolutionize the conversion EV segment? Again, why not talk about acceleration, or never getting stuck like Mr. Frost?

Disadvantage 3 (Lussmyer's Sparrow): handles poorly at high speeds. This may be true, although I regularly see one or two Sparrows here in the Bay Area zipping along in the HOV lanes at a pretty good clip. Again, the reporter emphasized the negative over the positive.

He then talks about servicing the vehicles. He implies that it costs more to drive an EV because he tosses out the $2000 for a new battery pack figure, but only roughly alludes to the reduced costs associated with oil changes, radiator/coolant work, alternator, starter, exhaust systems, tune-ups, etc., not to mention the actual cost of "fuel" (electricity being way cheaper than gasoline). I doubt anyone showed him an actual comparison of the prices. In many if not most cases, EVs are cheaper to operate. And where does he get the line, "the electrical systems need regular attention"? If done right (good charger and BMS), it shouldn't need much, if any attention.

He then parrots the auto manufacturer's claims that there wasn't enough interest in EVs to keep them going. I do wish someday a reporter would actually check his facts first.

He talks about conversions as expensive and limiting the car in range. Here, the facts are right, but again, he doesn't talk at all about the advantages. Why do people do this? If there are all these disadvantages, which he is quick to point out, why convert a car to electric? He doesn't seem to even care to investigate this obvious question.

Finally, he talks about the Tango, a car being built in-state and with numbers that would impress anyone: out-accelerate a Viper for under $20,000. Good range, great handling. The article ends implying that the Tango is just a concept—no mention that there are prototypes out there that have done what Rick claims.

It seems like the reporter hadn't actually ridden in an EV when he wrote the article. Nor had he seen cost-to-run comparisons. I have to hand it to him that he did talk to several EV drivers and got a good variety there, but seemed always to focus on the negative rather than the positive. If I were a naive reader, I would walk away thinking "why bother?"

Drivers get a charge out of getting by without gas

SEATTLE POST-INTELLIGENCER
http://seattlepi.nwsource.com/local/121732_electric13.html

Drivers get a charge out of getting by without gas
Tuesday, May 13, 2003
By LARRY LANGE
SEATTLE POST-INTELLIGENCER REPORTER

The first thing John Frost has to remember is that he can drive his car no more than 40 miles before plugging it into an electrical socket. Jon Pullen notices the difference towing a trailer, when the rear of his car can pitch during a lane change. But John Lussmyer says an electric car can be a great conversation-starter.

"I had one guy swing into the right-turn lane next to me and ask, 'Can I take a picture?' " said Lussmyer, a computer programmer who drives a single-seat electric car. "They're odd-looking, and they're so tiny. When a Honda Civic dwarfs you, you're small."

In a nation where gasoline-powered vehicles have ruled the road, electric cars occupy a tiny fraction of the fleet. Some major automakers have shunned them, and it's been harder recently to find new ones to buy. Most buyers are skeptical because the vehicles have limited range, and some are small and light enough to raise safety questions.

But battery-operated electric cars refuse to die, and owners think recent gasoline price increases have raised interest in them. State legislatures, including Washington's, have moved to make golf-cart-sized electric vehicles legal on neighborhood streets.

Those already driving them say they're fun, and an adventure.

"For me, it was not just being green, as they would have you believe," said Frost, a maintenance technician who lives in Des Moines. "It was an experiment. It was a learning experience."

Frost, 46, drives a 914 Porsche fitted with

an electric motor. He quickly learned its limit of 40 miles on each charge of the 16 batteries that power the motor.

"I've been stuck," he said. "It's either call the wife and have her bring another car to tow you home, or bring the gas generator to charge the (Porsche) up, which is a waste of gasoline."

The worst problem, he said, is "getting lost and running out of juice looking for somebody's address out in a residential area. You make too many turns, and you say, 'I'm running low, and I've gotta go home.' "

Pullen, 27, a Seattle computer systems developer, extended the range of his converted Honda Accord by using nickel-zinc batteries. He says he can drive up to 120 miles between charges and the batteries last longer.

But the car's batteries added about 500 pounds of weight to the vehicle, much of it in the rear, and he's learned not to tow trailers.

"For most driving, it handles almost exactly the same," he said. "It's just that its edges have been moved some, because of decisions I made about the weight."

Lussmyer, 42, also learned the limits of his yellow Sparrow electric one-seater on a freeway. He tried pushing it to 75 mph but slowed because "it's a little nerve-racking. ... A little twitch (of the steering wheel), and I'd be from one side of the lane to the other. Between the tight steering and the small wheelbase, you've got to be careful."

The Sparrow has a closed body, a windshield and one door but is licensed as a motorcycle because it has three wheels. That lets Lussmyer slip to the front of the ferry line when he commutes to his Mill Creek job from Whidbey Island.

Since buying the car a year ago, "I'm no longer bored sitting on the ferry," he said. "Usually by the time I'm getting out of the car, there are people coming up, asking questions."

Another Sparrow driver, attorney Steve Bernheim, said drivers of conventional cars roll down their windows at stoplights to ask about his tiny vehicle "and I'll hand them a brochure."

Owners seem to be a committed bunch, devoted to the cars as well as to the idea of a quiet, non-polluting vehicle.

"People who drive big, low-mileage cars, using lots of gas, are contributing to national security instability ... by using more oil than they need," Bernheim said.

Commitment is required, because there are few places to get service and many owners must do it themselves. They avoid trips to the gas station and normal car tuneups, but they must limit driving and need to know where they can plug a car in (Frost keeps a list of friends with usable plug-ins). Batteries may last two years or so before needing replacement at a cost of perhaps $2,000, and the electrical systems need regular attention.

But owners say interest in electric vehicles has grown, reflected in attendance at monthly meetings of the Seattle Electric Vehicle Association..

Not enough, however, to impress most big automakers. To the chagrin of many now leasing the car, General Motors is gradually withdrawing its electrically powered EV1 coupe from the California and Arizona test markets, citing lack of interest and the cost of maintaining the 1,000 already produced. GM doesn't plan any more attempts at making electric vehicles; the company is now shifting to "hybrid" vehicles, using a combination of gasoline and electric power.

"Much as (EV1 owners) loved their vehicles, and we love them for it, there just weren't enough of them," GM spokesman David Barthmuss said.

Ford discontinued sales of its Th!nk electrically powered car last year, and the producer of the single-seat Sparrow, the type driven by Lussmyer and Bernheim, has filed for bankruptcy.

Finding new electric cars is "not getting any easier, with the major manufacturers backing away from it," said Steven Lough, president of the Electric Vehicle Association. "They come and they seem to go."

An alternative is to convert standard vehicles to electric power by swapping out the gasoline engines for electric motors, as David Cloud, an experienced electric-car builder, has done. But that can cost $10,000 to $12,000 and limits driving ranges to 30 to 130 miles, depending on the car and the number and type of batteries used. Those factors make the cars a hobby for many.

Lough thinks the recent Bush administration talk of developing cars powered by hydrogen fuel cells may be luring some potential electric-car producers away, in hopes of getting government research assistance. That upsets him and other electric car owners, who think they also have a niche.A few manufacturers agree. Three years ago, Daimler Chrysler bought a North Dakota-based golf-cart producer, Global Electric MotorCars and has made the little vehicles part of the company's alternative-fuels program, according to spokesman Sam Loricchio.

Chrysler thinks the vehicles — now equipped with optional doors, 10-inch diameter wheels and holding up to four passengers — might be sold as short-commute cars; prices at the factory range from $7,000 to almost $9,000.

With Ford and GM momentarily out of the picture, "we really see it as a very untapped market," said Loricchio. Sales of the GEM cars are growing, he said.

Another prospective manufacturer: Spokane-based Commuter Cars Corp., whose owner, Rick Woodbury, is searching for financing to produce an electric two-seat car he claims can accelerate faster than a Dodge Viper and will make in-city parking easier with its 39-inch width. The cost: an estimated $25 million to begin production of the 8-foot-long "Tango," to sell for $18,700, at 10,000 per year."It's going to take off," Woodbury said. "But I just have to get it started."

Vermont Senate Overturns Former Governor's ZEV Mandate

The Vermont Senate recently approved a measure that would regulate the use of battery-powered neighborhood electric vehicles (NEVs) in the state, as well as repeal a regulation enacted by former governor Howard Dean requiring a certain percentage of the models offered by automakers in the state to be zero-emission vehicles (ZEVs).

Vermont Agency of Natural Resources (ANR) Air Pollution Control Division mobile sources program chief Thomas Moye said although the ZEV mandate would have required automakers to sell nearly 300 ZEVs in the state, the agency did not have plans to enforce the rule. Additionally, ANR secretary Elizabeth McLain said the repeal will have a "minimal" effect because the agency had already begun updating the state's vehicle pollution rules. "What this is for is to allay the fears of auto manufacturers and dealers that they were going to have to sell a vehicle that doesn't work particularly well in Vermont," said McLain.

State officials said the bill will now be submitted to the Vermont House of Representatives for consideration. (MONTPELIER ARGUS: 4/5)

EVCT to Host 'EV Drive Technology' Summer Workshops

The Electric Vehicle Center of Technology (EVCT) in Oklahoma City, OK recently announced it will be hosting a "summer special" for automotive and science teachers, technicians and "other interested individuals."

The "Basic EV Drive Technology Course" will be held May 27 through 30 and repeated on June 10 through 13, at a cost of $550. During the course, instruction will focus on basic electrical theory; EV drive components and system integration; hybrid systems; diagnosis and troubleshooting; and an introduction to fuel cell technology.

The nonprofit EVCT, which is part of the Oklahoma Department of Career and Technology System, is currently the nation's only Continuing Automotive Service Education (CASE)-certified EV training facility.

Nevada State Senate Approves Use of HTs on Sidewalks

The Nevada state senate recently approved a measure that allows use of Segway LLC's two-wheel, battery-powered Human Transporters (HTs) on "public pathways," including sidewalks and bicycle paths. The legislation, known as S.B. 363, also establishes a maximum speed for the HTs of 15 miles per hour. Additionally, the bill, which will now be considered in the state assembly, allows city and county officials to regulate the HT scooters. Under S.B. 363, the Segway HT is defined as "equivalent to a person on foot." (RENO GAZETTE-JOURNAL: 4/14)

Ninth Clean Cities Conference to be Held in CA

The 9th National Clean Cities Conference and Exposition was held May 18 through 21 at the Wyndham Palm Springs in Palm Springs, CA. The conference, the theme of which is "Turn Up the Heat for Alternative Fuels," featured a "special emphasis on building strong partnerships between federal, state, local, international and private sector fleet professionals and the rest of the [alternative fuel vehicle (AFV)] community."

On May 18, officials from the College of the Desert and West Virginia University presented an "AFV 101" course, followed by tours of the city's SunLine Transit Agency and Waste Management of the Desert AFV facilities. May 20 was designated "Fleet Day," with all programming focused on "issues and decisions especially relevant to fleet personnel."

Local NY Car Dealership Begins Offering GEM NEVs

The Doan Dodge automobile dealership in Greece, NY, now offers neighborhood electric vehicles (NEVs) manufactured by DaimlerChrysler's Global Electric Motorcars (GEM) division. "We've already sold 10 of them, and we've only had the franchise for about three weeks," said Mike Daeschner, general sales manager of the dealership.

A two-seat version of the GEM currently retails for approximately $5,000, while a four-seat model sells for about $6,000. That the state provides tax breaks to those purchasing the NEVs, which are capable of traveling up to 35 miles per charge. (DEMOCRAT AND CHRONICLE: 4/16)

Indiana High School Students Honored at EV Competition

An electric vehicle (EV) designed by two students at Richmond High School in Richmond, IN – juniors Eric Killion and Ben Tincher — won third place in the autocross car competition at the Electric Vehicle Challenge Program in Raleigh, NC, as well as earned the students recognition as "rookie of the year." Killion and Tincher spent approximately 300 hours converting a Ford Escort donated by Richmond Power and Light into an EV by installing a 96-volt electric motor, eight brakes and a vacuum booster pump for the brakes. The classmates competed in the event against students from 44 schools across the country. (PALLADIUM-ITEM: 4/20)

B.I.G. MAN EV Selected for Memorial Marathon in OK

The Oklahoma City Memorial Marathon has selected the low-speed electric vehicle (EV) manufactured by Alva, OK-based Barton Investment Group Manufacturing, LLC (B.I.G. MAN) to be one of the official pace cars for this year's race. The company said the five-passenger Barton Low-Speed Vehicle (LSV), which is allowed to travel at speeds up to 25 miles per hour, features a single-charge range of 75 miles.

The company said the Barton LSV was displayed at the Cox Convention Center in Oklahoma City for two days prior to the marathon, which was held on April 27.

CARB Approves Modified ZEV Regulations

The California Air Resources Board (CARB) recently approved a revised version of the state's zero-emission vehicle (ZEV) regulations that offers automakers "a choice of two options for meeting their ZEV requirements."

Automobile manufacturers can either meet "standards that are similar to the ZEV rule as it existed in 2001," which includes a "vehicle mix" of two percent ZEVs, two percent advanced technology vehicles that have earned partial ZEV (AT-PZEV) credits, and six percent "extremely clean conventional vehicles," or PZEVs.

Under the new modified rules, automakers can achieve part of the ZEV requirement by "producing their sales-weighted market share of approximately 250 fuel cell vehicles [(FCVs)] by 2008," with the remainder of the requirement to be met by offering four percent AT-PZEVs and six percent PZEVs. The agency noted that the FCV requirement would rise incrementally to 50,000 vehicles by 2017.

Although one CARB official described the revised ZEV mandate as a "bait-and-switch strategy," CARB chairman Alan Lloyd defended the plan, saying it is "not backsliding" and will achieve "clean air faster."

Milwaukee Officials Considering Electric Bus Line

Milwaukee, WI's Milwaukee Connector study program is considering plans to use an electric-powered bus to link the city's downtown area to several other "popular city destinations." The committee leading the study, which includes representatives from the Metro Milwaukee Association of Commerce (MMAC), the city of Milwaukee and the Wisconsin Center District, first considered building a light-rail system, but determined that the project would be too "disruptive."

Study officials will now begin gathering data on the "potential costs, routes, and necessary technology to install an electric bus transit system. A final decision on the project is not expected until late next year. The state government could potentially cover up to 80 percent of the cost of the $300-million project.

Merced, CA to Make New EVs Available to Local Tourists

The Greater Merced Chamber of Commerce in Merced, CA, recently announced that the city's California Welcome Center is scheduled to begin offering public use of five new electric vehicles (EVs) received from the Yosemite Area Regional Transportation System (YARTS) through a grant from Yosemite National Park later this month.

The two-seat DaimlerChrysler EVs will be available for rent for $15 per day or $2 per hour. (MODESTO BEE: 5/2)

TX Inventor Develops New 'Solar-Electric' Vehicle

Kent Farmer, the owner of a Bexar County, TX solar specialty products and renewable energy devices company, the Power Store, has converted an electric vehicle (EV) developed by Ford into a new "solar-electric" concept car.

In addition to modifying the original EV "to increase its speed and range," Farmer designed a portable solar array mounted above the vehicle's roof that allows the car "to charge up while driving and while parked," as well as a stationary solar array that serves as "a 'base camp' fast charger."

Electrovaya Showcases MAYA 100 ZEV at Tour de Sol

Electrovaya, Inc. and its MAYA 100 zero-emission vehicle (ZEV), powered by the company's patented lithium ion SuperPolymer technology, was featured at the 2003 Tour de Sol, a "green" transportation event comprising three festivals, an open house and a road-rally competition that began in Burlington, New Jersey and ended in Washington, D.C.

The MAYA 100 is a "fully featured [sport-utility vehicle (SUV)]" powered by a 35-kilowatt-hour battery package that is capable of traveling approximately 120 to 160 miles per charge. The ZEV seats five and is available in both two-wheel-drive and four-wheel-drive configurations.

Electrovaya chief executive officer Sankar Das Gupta said "We feel that our lithium ion SuperPolymer-powered MAYA 100 is fundamentally a more advanced technology than hydrogen-powered fuel cell cars and can be brought to market on a more timely and cost-effective basis."

Albany Officials Take Delivery of 10 NEVs

The city of Albany, NY recently has taken delivery of 10 battery-powered neighborhood electric vehicles (NEVs) manufactured by DaimlerChrysler AG. The new NEVs, which were donated by Armory Garage, were featured at the city's recent Tulip Festival.

Albany mayor Jerry Jennings noted that the NEVs have been registered with the New York Department of Motor Vehicles and can be operated legally on the city's streets. (CAPITAL NEWS: 5/8)

Extreme Machine 2000 to Offer Six-Wheel Electric Vehicles

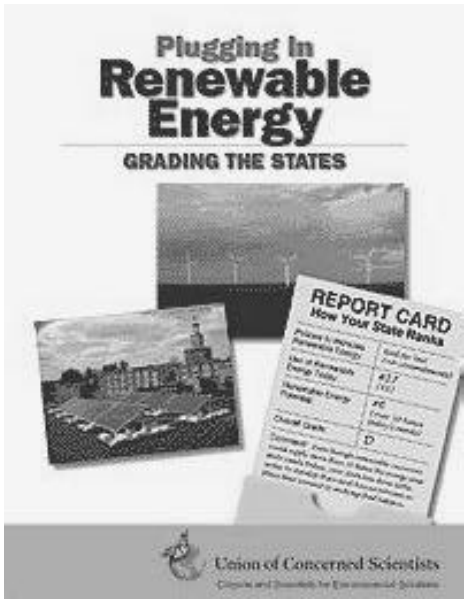
Spokane, WA-based Extreme Machine 2000, Inc. will soon begin production of its all-electric and hybrid-electric, six-wheeled amphibious vehicles at a new 28,000-square foot facility in the Spokane Industrial Park. The company plans to produce approximately 30,000 vehicles per year for "outdoor enthusiasts, the military, law enforcement agencies, resorts, state governments and outfitters."

The amphibious vehicles, which will cost about $9,500 apiece, were designed by Extreme Machine CEO Dick Ewing and "several associates" during the course of "more than five years." According to the company, parts for the vehicles will be produced by "area contract manufacturers" and shipped to the Spokane facility for assembly. (SPOKANE SPOKESMAN-REVIEW: 5/12)

Plugging In Renewable Energy: Grading the States

This is an excerpt from the executive summary of the May 2003 UCS report Plugging In Renewable Energy: Grading the States. Reprinted with permission from the Union of Concerned Scientists.

Text from http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=1180



in publications

- *Plugging In Renewable Energy (1.4 MB PDF) (full report)*

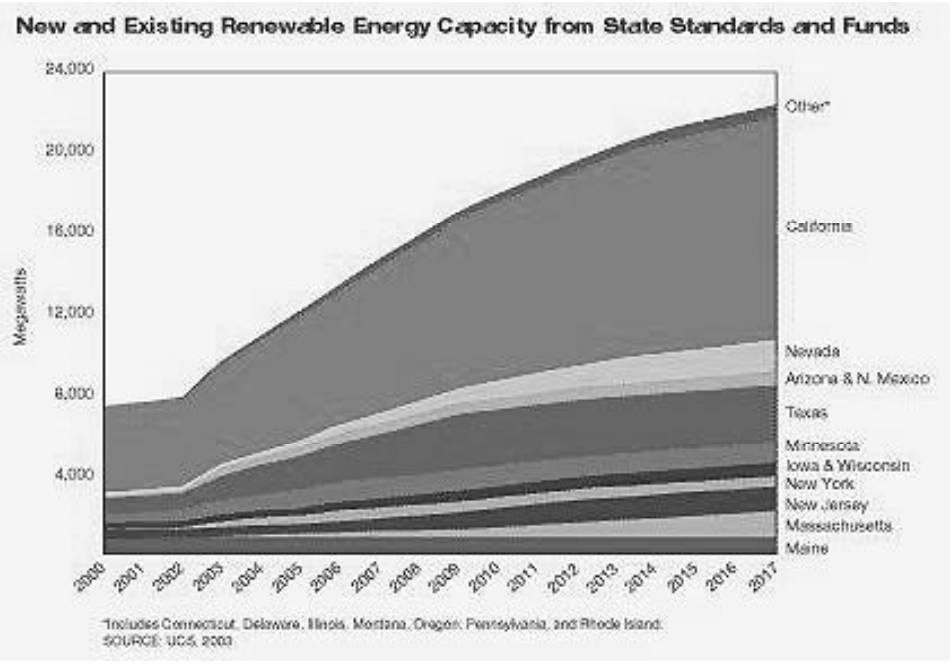
http://www.ucsusa.org/publication.cfm?publicationID=631

- *Plugging In Renewable Energy (PDF) (fact sheet)*

http://www.ucsusa.org/publication.cfm?publicationID=632

America's electricity system is dominated by fossil fuels. The result is a system that lacks diversity and security, threatens the health of our citizens, jeopardizes the stability of Earth's climate, and robs future generations of clean air, clean water, and energy independence.

This report assigns grades to each of the 50 states based on their commitment to supporting wind, solar, and other renewable energy sources. We measure commitment by the projected results of renewable electricity standards for electric companies and dedicated renewable electricity



funds. Current state renewable energy generation is also considered. State renewable energy purchases, voluntary programs, and unenforceable goals are discussed but not considered in the grading. We also compare the total development realized from state commitments with federal legislative proposals and each state's renewable energy potential. Our analysis shows that 19 states have stepped in to fill a leadership vacuum at the federal level by taking important first steps toward developing a clean energy system. Among our findings:

- A mere handful of states are responsible for most of the projected gains in renewable energy (see graph above). California accounts for 44 percent of all projected new development; California and Texas together account for nearly 60 percent; and the top five states account for more than 80 percent.

- Only California and Nevada received A-grades for enacting standards that increase renewable electricity sales by one percentage point per year for at least 10 years, while covering most state utilities (see map to right).

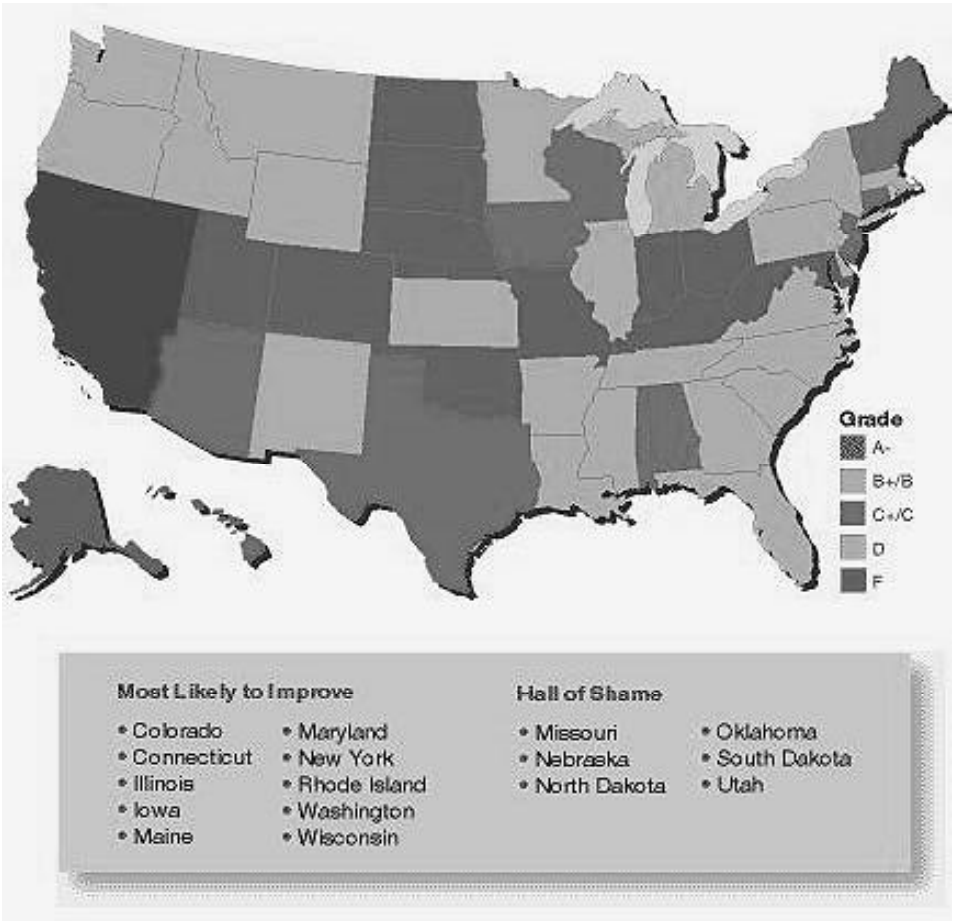
- Thirty-four states received failing grades of D or F for their lack of commitment to renewable electricity, with six qualifying for our Hall of Shame.

- Most states have only begun to tap their abundant renewable electricity potential.

- Renewable energy generated through state standards and funds will significantly exceed voluntary purchases of renewable (or "green") electricity, but fall far short of what a fair, cost-effective national standard could produce.

The tremendous disparity in state programs and failing grades for 34 states illustrates the need for a national renewable electricity standard. By setting a minimum requirement on which state standards and voluntary programs could build, a national standard would prove more equitable and lead to much higher, cost-effective levels of renewable electricity generation. Studies by the federal government and UCS have shown that a national standard of 20 percent by 2020 is feasible and affordable.

For more information go to the Union of Concerned Scientists website at www.ucsusa.org.



WHAT: **2003 Challenge Bibendum**
WHEN: **Sept. 23-25** WHERE: **Infineon Raceway**

PitReport

BACKGROUND: Challenge Bibendum was conceived by Groupe Michelin as an objective way to bring together and test the best available technologies for environmentally positive vehicles. The event is open to all energy sources.

Challenge Bibendum Comes to Infineon Raceway in 2003

MICHELIN CHALLENGE BIBENDUM

Infineon Raceway has been selected as the host site in 2003 for one of the annual premier global events for advanced technology vehicles: Michelin's Challenge Bibendum.

The three-day event will take place Sept. 23-25 and Infineon Raceway will serve as the host site, with other events planned for San Francisco and Sacramento. This will mark the second Challenge Bibendum in North America.

Challenge Bibendum was conceived by Groupe Michelin as an objective way to bring together and test the best available technologies for environmentally positive vehicles. The event is open to all energy sources. It features vehicles from virtually every major vehicle manufacturer and brings together all facets of the automotive world: vehicle manufacturers, designers, energy suppliers, technical and industrial partners.

Some of the companies that signed up for 2002 Challenge Bibendum included: Toyota, Daimler-Chrysler, Opel, Citroen, Peugeot, Ford, Honda, Mercedes, BMW, Fiat, Nissan, Renault, Audi and Volvo, among others. Energy sources included bio-ethanol, electric, bio-fuel and hybrid electric, to name just a few.

"Challenge Bibendum has become the key international showcase for these new technologies that will govern how we move about our planet in the coming years," said Steve Page, president and general manager at Infineon Raceway. "We are very honored that Groupe Michelin has selected Infineon Raceway and the Sonoma Valley to host this important event."

The 2001 Challenge Bibendum tested new technologies during a rally from Los Angeles to Las Vegas. It featured the largest collection of fuel cell vehicles in the world – 10 vehicles from seven manufacturers. The 2002 event began in Heidelberg, Germany and concluded in Paris for the opening of the Paris International Motorshow.

"We are excited to have the event return to North America," said Michael Fanning, vice president, public relations and government affairs, Michelin North America. "The North American market already has several choices of hybrid and electrical vehicles – with more coming every day. Challenge Bibendum is the perfect place to showcase vehicles consumers can choose today to make our planet a better place to live."

Plans for the 2003 event have already begun.

"The support from Sonoma and San Francisco has been extraordinary," said Michelin's North American Project Leader Ron Musgnug. "We considered many locations for the 2003 event, but the work being done today in the Bay Area to promote advanced technology vehicles is a wonderful model to showcase to the world. The beauty of the wine country and the forward thinking of the city and county of San Francisco will be the perfect backdrop to the 5th Challenge Bibendum."

Vehicle testing, information booths and media seminars will be based at the newly renovated Infineon Raceway in Sonoma. Vehicles will then rally across the Golden Gate Bridge to conclude the event in San Francisco. More than 200 international journalists are expected for the 2003 event.

Although some Americans may be unfamiliar with the name "Bibendum," it is well known elsewhere in the world. "Bibendum" is the original name of the Michelin Man– the ever-pleasant man of tires that has symbolized Michelin for more than 100 years. The first Challenge Bibendum was held in 1998 to help celebrate his 100th birthday.

Updates for 2003 Challenge Bibendum can be found at www.challengebibendum.com.

Buckeye Bullet and e=motion to Challenge Fastest Speed Record

Engineering students at The Ohio State University have spent two years designing and building it. Now it's time to test the Buckeye Bullet, an electric racecar that the students think can earn the record of fastest speed by an electric vehicle.

Ohio State's Buckeye Bullet electric car is traveling to the Bonneville Salt Flats in Utah to attempt to break the record for the fastest speed achieved in an electric car. The current record stands at 245 miles per hour (394 kmph), but Buckeye Bullet team leader Todd Rodrick hopes to surpass 300 mph (483 kmph) when the vehicle is tested October 16-19, 2003 at Bonneville.

OSU's Buckeye Bullet prepares for a speed run.

The streamlined vehicle is 30 feet (9.14 m) long, 2 feet (0.6 m) wide and stands less than 3 feet (0.9 m) tall. More than 12,000 nickel-metal hydride batteries power the 500-horsepower electric motor.

Meanwhile, a British team says it intends to smash the World Electric Land Speed Record towards the end of 2003. The Primetime Electric Land Speed Team has already started successfully testing the new vehicle – called e=motion – in preparation for a run on the Chott-el-Jerid salt flats in the Tunisian Sahara.

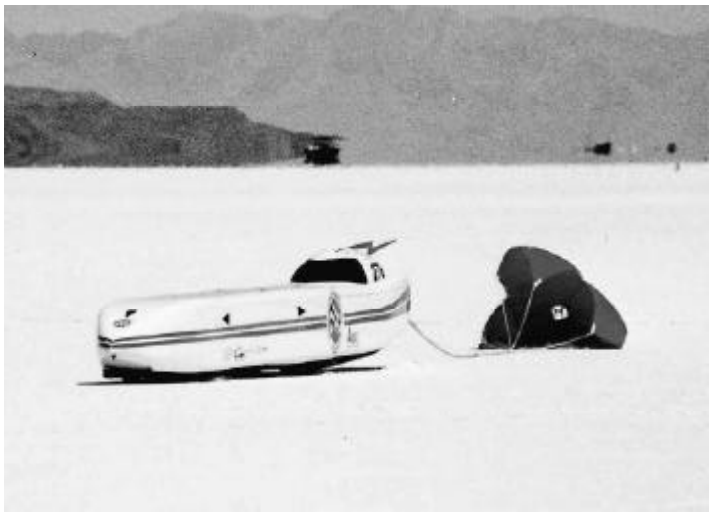
The e=motion has been designed and engineered by Colin Fallows, an engineer with 30 years' aeronautical design and engineering expertise, and is driven by Mark Newby, a trained pilot. As well as a series of other British Land Speed Records, Mark and Colin's team hold the outright British Land Speed Record of 300.3 mph (483.3 kmph), which they achieved in July 2000 in a jet-powered dragster, eclipsing Richard Noble's previous best of 258 mph (415 kmph).

The British E=Motion also prepares to break the speed record.

At the same time as attempting to break the electric vehicle record of 245 mph (394 kmph), Mark and Colin will try to become first in the world to exceed 300 mph (483 kmph) on battery power. This standing FIA (Federation Internationale de l'Automobile) record of 245.523 mph (395.131 kmph) was set October 22, 1999 by the American White Lightning team, with driver Pat Rummerfield. This same team established a BNI (Bonneville Nationals, Inc.) speed record with the same driver and vehicle of 251.322 mph (404.464 kmph) during that same month. During the Bonneville World Finals of 1999, the White Lightning set the fastest qualifying mile with a speed of 254.229 mph (409.142 kmph).

There are three classes for electric vehicles - based on weight. DWRA's "White Lightning" currently competes in Class III for vehicles in excess of 1,000 kilograms. The previous world record for Class III vehicles of 215.3 mph in the two-way flying mile, established in 1997 at Bonneville Salts Flats, Utah, was shattered by DWRA's "White Lightning" during the 1999 World Finals.

World records in land speed competition are recognized by the Federation Internationale de l'Automobile (FIA) only if they meet rigid international standards. To certify a record setting course, extreme care is taken to measure distances for the speed traps, usually one mile and one kilometer in length, so that each run taken will time the vehicle at each distance. To establish a record it is required that a competitor make two passes - up and down the course - within a one hour period. The record is an average of the two directions.



The White Lightning in 1999, after exceeding 245 mph (394 kmph)

EV BOOK REVIEW

By Terry Wilson, SJEAA member and EAA Historian

This is the first in what is planned to be, examples of the books in the EAA Historical Collection. It is not a review, but more of a sampling of content, information on the Author and the Authors intent. If you have read any of the books and wish to write a review of it, please do. Send any reviews to: ceeditor@eaaev.org

HISTORY of the ELECTRIC AUTOMOBILE: Hybrid Electric Vehicle
Author: Dr. Ernest Henry Wakefield
Publisher: SAE International
SAE Order No. R-187
ISBN 0-7680-0125-0
Copyright: 1998

Dr. Ernest Henry Wakefield has been involved with electric vehicles for nearly 40 years. He published his first book, The Consumer's Electric Car, in 1977. He has a Ph.D in Electrical Engineering, and has worked for General Electric and Westinghouse. He also taught electrical engineering at the University of Tennessee. In 1994 he published, History of the Electric Automobile: Battery-Only Powered Cars.

In History of Electric Automobile: Hybrid Electric Vehicles, the Author begins with the, Background for the Hybrid Electric Horseless Carriage. Flywheels, Fuelcells, Capacitors, Solar Cells, Inductive Charging, and Engines (Otto, Stirling, and Turbine) are among the topics the Author addresses in this book.

The book may be divided into four sections. The first section seeks to explain how knowledge needed to create electric vehicles was learned though earlier centuries. The second section is intended to discuss methods to overcome what the Author refers to as the "limited-range pariah" of the electric car. The third section addresses pollution and solar powered automobiles. The fourth section covers the Hughes inductive charger and the employment of the capacitor with regenerative braking.

The earliest example of a Hybrid was in Italy in 1894, where Count Felix Carli created a battery-spring tricycle! This was a parallel hybrid using one battery and an "impulsion box". The battery was of the Verdi type. This battery was chosen because it possesses a great specific capacity and could best resist road shock. The battery weight was 11 lbs; it had 5 plates and was rated at 2kWh. The battery could suppy enough power for a 4 or 5-hour trip, for a range of 20 to 30 miles. Both gearing and a rheostat were used during operation.

The impulsion box was used for reserve power. This system is described as a system of rubber tension springs that are stretched by revolving a small wheel, even during the running of the carriage. When power is needed, the springs are relaxed by foot pedal and energy equal to double the power of the motor is available to turn the axle. That energy alone could propel the Tricycle 160 feet.

In 1897, Justus B. Entz, chief engineer of the Electric Storage Battery Company of Philadelphia began construction of the first gasoline-electric car. Entz design used a generator with a revolving field as well as a revolving armature (to act as a clutch). When the armature of the generator was short-circuited, its armature and revolving field became electrically locked together, and the engine drove the carriage through this locked clutch in what would be high gear. If more torque was needed, for example to climb uphill, the short-circuit could be backed off to slip the clutch. The current created by the slipping was then supplied to the motor. In 1898 the car was tested. Percy Maxim (designer of both gasoline and EV's) went along for the ride. When Maxim exited the vehicle his foot caught on a wire to the ammeter, which caused an arc that pierced the copper gas tank, creating a stream of gasoline, which ignited, and the resulting fire destroyed the car!

Terry Wilson
historian@eaaev.org

Interesting EV Facts

The first EV was built in 1834 by Thomas Davenport.

The first rechargeable EV was built in 1881 by frenchman M. Gustave Trouve.

The first pedestrian fatality was by a New York City electric taxi cab in 1899.

The first American car race was won by an electric in 1899.

In 1899 "La Jamais Contente" set a 68 mph world record.

The first car to appear on a postage stamp was a Baker Brougham in 1901.

The first speeding ticket was issued to an EV in Chicago in 1903.

The Milburn Co. sold over 7000 EVs between 1914 and 1927.

In 1975, CitiCar was the 6th largest US car manufacturer.

In 1996 a Solectria Sunrise using NiMH batteries set a record range of 373 miles.

EV Education: continued from page 13

Brunswick Middle School – will travel to Colorado in June for the national championship.

Glamour of the vehicles and competition aside, the EV Challenge serves to teach our future engineers, designers, scientists, and mechanics that emission-free transportation is possible. Hopefully they'll learn to work cooperatively on a team, polish their communication skills by talking with business and community leaders, focus their creativity, apply their math and science in a real-world project, and have fun along the way.

For more information about the EV Challenge, or to get the results of this year's competition, visit the web site at: http://www.evchallenge.org.

ELECTRIC VEHICLE FACTS

Here's some EV trivial from the EVA/DC onthe opposite page. These EVent are provided by our EAA Historian.

Electric Autos were the range champions in the early 20th century, Gasoline powered vehicles had to stop about every 20 miles to take on water for cooling, and usually needed repair by then.

In 1899 a B.G.S. electric car established a one-charge range of 180 miles in France.

The World land speed record was held by Electric cars from 1898 to 1902 and lost out to a steamer, not gasoline!

A Ford executive once criticized the Baker Electric for having a top speed of only 35 Mph, forgetting that the Model-T was no faster and had to be backed up hills because of the gravity fed feul system!

The lunar roving vehicle (LRV) that transported astronauts on the lunar surface during the Apollo 15, 16, and 17 missions was a 4 wheel drive, 36 Volt electric vehicle that weighed 460 pounds on earth. The LRV carried over 1000 lbs of astronauts and equipment and was designed to operate for 78 hours.

Clara Ford, the wife of Henry Ford, never drove a Ford, instead she drove a 1914 Detroit Electric. She didn't care for "noisy, smelly", cars and stories indicate that she thought gasoline cars were too dangerous.

Battery operation is the only way a diesel submarine can submerge.

"Diesel Locomotives" are driven by electric motors. (The Diesel engines drive generators, rather than using batteries, to create the electricity necessary to drive the train).

The giant draglines used in strip mining use all electric power.

The World's Fastest Electric Car is powered by 6,040 "Sub-C" size batteries.

Sunpacer glides by on solar power in front of the [oil] capital.

View to the future was provided by GM with their Hi-wire

Viking 23 readies for inspection.

New EV entry from Asia - Heibao.

Various cars lining up for the start of the Tour de Sol.

Carl Vogel's Electric Hog readies for the race.

All Tour de Sol and Junior Solar Sprint photographs by Shiangtai Tuan.

Terry Wilson during his History talk, with Jerry Asher listening.

Meeting opening , Charlie Garlow, Dave Goldstein & Jerry Asher.

By Terry Wilson, SJEAA member

I want to thank all of the Members of the DC Chapter whom I had the opportunity to interact with during my visit for the 2nd EVer. I was pleased with the response to my, "History of the EAA" presentation.

No matter which Chapter I visit, I am always impressed with the kind of people I meet, in the EV community. Having participated in the 2nd EVer, rather than just observing as I did at the 1st EVer, I interacted with others and was rewarded with the friendship, camaraderie, helpfulness, and intelligence I have come to expect from EVers. I can assure you that if you got to know the EVers I have interacted with from all over country, and indeed from international communications, you would find the same spirit. So let's hope more of our Members will participate in inter-Chapter activities. Those of us who have, appreciated the value of these get togethers.

Jerry Asher has been my "conduit to the East". You sent him to the EAA National Meeting at the most opportune time. Jerry's impact was immediate. It was time for the EAA to become a truly National organization, so Jerry came up with the 1st EVer. We needed to build Chapters in the East, Jerry took on Chapter Relations East.

From finding local Members to provide guest housing, and transportation, to activities, and even group dinners, the EVA/DC Chapter can be proud of the efforts they made. The results of all these efforts are nothing but positives. The Luau and Lasagna provided great food and excellent socializing along with EV tech talk.

I hope we on the West coast continue to keep in close contact with those of you on the East coast. I am very proud to have the EVA/DC as a Member of the EAA.

Junior Solar Sprint entries zip down the track on solar power.

The Sprints attracted a lot of attention and school participation.

ELECTRIC AUTO ASSOCIATION CHAPTERS

CANADA

VANCOUVER EVA (VEVA)
Web Site: http://www.veva.bc.ca/
Contact: Haakon MacCallum,1-604-258-9005, info@veva.bc.ca
Mailings: P.O. Box 3456, Vancouver, BC V6B3Y4, Canada
Meetings: 3rd Wed./month, 7:30 pm
Location: 3750 Kitchener St., BC Transit

UNITED STATES

ARIZONA

PHOENIX EAA (PEAA)
Web Site: http://www.phoenixeaa.com/
Contact: Sam DiMarco, 1-480-948-0719, voltek_2000@yahoo.com
Mailing: PO Box 6465, Scottsdale, AZ 85258-6465, USA
Meetings: 4th Sat./month, 9:00 am
Location: Varies, see Web Site for details.

CALIFORNIA

CHICO EAA (CEAA)
Web Site: http://geocities.com/chicoeaa/
Contact: Chuck Alldrin, 1-530-899-1835, calldrin@sunset.net
Mailing: 39 Lakewood Way, Chico, CA 95926-1555, USA
Meetings: 2th Sat./month, 10:00 am.
Location: 1350 East 9th St, Chico, CA

EAST (SF) BAY EAA (EBEAA)
Web Site: http://geocities.com/ebeaa/
Contact: Ed Thorpe, 1-510-864-0662, eaa-contact@excite.com
Mailing: 2 Smith Ct., Alameda, CA 94502-7786, USA
Meetings: 4th Sat./month, 10:00 am.
Location: 1515 Santa Clara Ave, Alameda, CA

LOS ANGELES EAA (LAEAA)
Contact: Louis Weiss, 1-323-935-2690, warbucks@attbi.com
Mailing: 1811 Hi Point St., Los Angeles, CA 90035-4621, USA
Meetings: 1st Sat./month, 10:00 am
Location: 1200 E California Blvd, Pasadena, CA

NORTH BAY EAA (NBEAA)
Web Site: http://geocities.com/nbeaa/
Contact: Dr. Nick Carter, 1-707-573-9361, nick@npcimaging.com
Mailing: 2228 Magowan Drive, Santa Rosa, CA 95405-4924, USA
Meetings: 2nd Sat./month, 10:00 am.
Location: Call for meeting details.

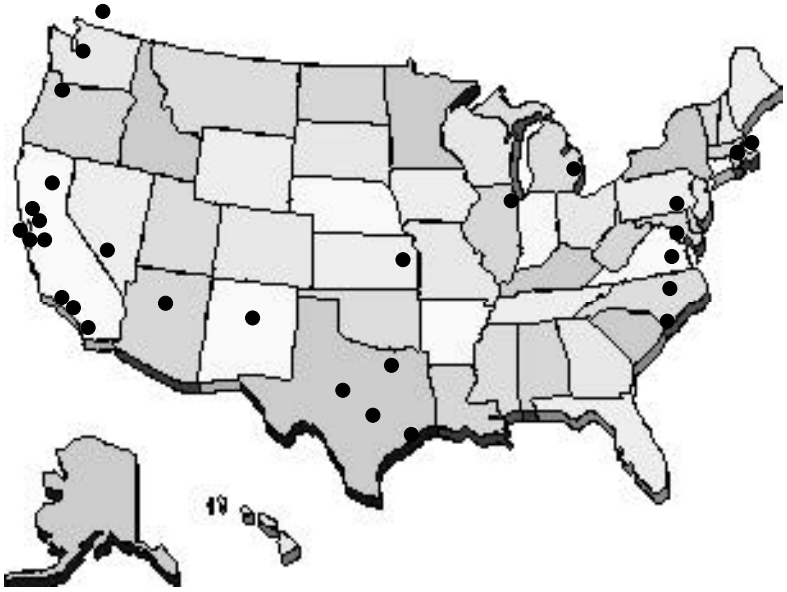
SAN DIEGO EVA (SDEVA)
Web Site: http://home.att.net/~NCSDCA/EVAoSD/
Contact: Chris Jones, 1-619-913-6030, NCSDCA@WorldNet.ATT.net
Mailing: 315 South Coast Highway 101, Encinitas, CA 92024-3543, USA
Meetings: 4th Tues./month, 7:00 pm
Location: 2080 Pan American Plaza, Balboa Park, San Diego

SF PENINSULA EAA (SFPEAA)
Web Site: http://geocities.com/sfpeaa/
Contact: Bill Carroll, 1-650-589-2491, billcarroll@eaaev.org
Mailing: 160 Ramona Ave., San Francisco, CA 94114-2736, USA
Meetings: 1st Sat./month, 10:00 am
Location: 601 Grand Ave, South SF, CA

SAN JOSE EAA (SJEAA)
Web Site: http://geocities.com/sjeaa/
Contact: Roy Paulson, 1-408-269-7937 dongillis@yahoo.com
Mailing: 1592 Jacob Ave., San Jose, CA 95118-1612, USA
Meetings: 2nd Sat./month, 10:00 am
Location: 2350 Cunningham Ave., San Jose, CA

SILICON VALLEY EAA (SVEAA)
Web Site: http://eaasv.org/
Contact: Will Beckett, 1-650-494-6922, will@becketts.ws
Mailing: 4189 Baker Ave., Palo Alto, CA 94306-3908, USA
Meetings: 3rd Sat./month, 10:00 am
Location: 3000 Hanover St., Palo Alto, CA

VENTURA COUNTY EAA (VCEAA)
Web Site: http://geocities.com/vceaa/
Contact: Bruce Trucker, 805-495-1026, tuckerb2@adelphia.net
Mailing: 283 Bethany Court, Thousand Oaks, CA 91360-2013 ,USA
Meetings: Call or email for location/meetings.



Listing updated, verified and current as of 07/01/03. Please check main web page for any changes in current listing. The Electric Auto Association is a 501 (c)(3) nonprofit organization.

KANSAS / MISSOURI

MID AMERICA EAA (MAEAA)
Web Site: http://maeaa.org/
Contact: Mike Chancey, 1-816-822-8079, eaa@maeaa.org
Mailing: 1700 E. 80th St., Kansas City, MO 64131-2361, USA
Meetings: 2nd Sat./month, 1:30 pm
Location: See web site for details.

ILLINOIS

FOX VALLEY EAA (FVEAA)
Web Site: http://www.fveaa.org/
Contact: Bill Shafer, 1-708-771-5202, assessorbill@cs.com
Mailing: 1522 Clinton Place River Forest, IL 60302-1208, USA
Meetings: 3rd Fri./month 7:30 pm
Location: 2000 Fifth Ave., River Grove, IL

MASSACHUSETTS

NEW ENGLAND EAA (NEEAA)
Web Site: http:/neeaa.org/
Contact: Tony Ascrizzi, 1-508-799-5977, tonyascrizzi@juno.com
Mailing: 34 Paine Street, Worcester, MA 01605-3315, USA
Meetings: 2nd Sat./month, 2:00 pm
Location: Call or email for meeting location.

PIONEER VALLEY EAA (PVEAA)
Web Site: http://geocities.com/pveaa/
Contact: Karen Jones, 1-413-367-9585, pveaa@hotmail.com
Mailing: P.O. Box 153, Amherst, MA 01004-0153 USA
Meetings: 3rd Sat./month, 2:00 pm
Location: 43 Amity Street, Amhurst, MA.

MICHIGAN

DMC-EAA DETROIT MOTORCITY CHAPTER (DEAA)

Web Site: http://geocities.com/detroit_eaa/
Contact: Richard Sands, 1-734-281-4087, rsands01@comcast.net
Mailing: 13162 Fordline St, Southgate, MI 48195-2435, USA
Meetings: Call or email for location/meetings.

NEVADA

LAS VEGAS EVA (LVEAA)

Web Site: http://www.lveva.org/
Contact: William Kuehl, 1-702-645-2132, bill2k2000@yahoo.com
Mailing: 4504 W. Alexander Rd., N. Las Vegas, NV 89115-2489, USA
Meetings: 2nd Sat./month, 10:00 am
Location: 1401 E. Flamingo Rd, Las Vegas, NV

NEW MEXICO

ALBUQUERQUE EAA (AEAA)

Web Site: http://abqev.org/
Contact: Tom Stockebrand, 1-505-856-1412, info@abqev.org
Mailing: 1013 Tramway Ln NE, Albuquerque, NM 87122-1316, USA
Meetings: 1st Tues./month, 7:00 pm
Location: 6810 Menaul NE, Albuquerque, NM

NORTH CAROLINA

COASTAL CAROLINAS (EAACC)

Contact: Jayne Howard, 1-910-457-4383, EAAofCC@aol.com
Mailing: 4805 E. Southport Supply Rd., Hwy 211, Southport, NC 28461-8741, USA
Meetings: Varies, call for details.
Location: 4805 E. Southport Supply Rd., Hwy 211, Southport, NC

TRIANGLE EAA (TEAA)

Web Site: http://www.rtpnet.org/teaa/
Contact: Ken Dulaney, 1-919-461-1241, teaa@rtpnet.org
Mailing: 202 Whitehall Way, Cary, NC 27511-4825, USA
Meetings: 3rd Tues./month, 5:30 pm
Location: Varies, call for details.

OREGON

OREGON EVA (OEVA)

Web Site: http://www.oeva.org/
Contact: Ralph Merwin, prizmev@yahoo.com
Mailing: 2905 NE 29th Ave., Portland, OR 97212-3558, USA
Meetings: 2nd Thur./month, 7:30 pm
Location: SW Salmon & 1st St, Portland, OR

PENNSYLVANIA

EASTERN EV CLUB (EEVC)

Web Site: http://members.aol.com/easternev/
Contact: Peter Cleaveland, 1-610-828-7630, easternev@aol.com
Mailing: P.O. Box 717, Valley Forge, PA, 19482-0717, USA
Meetings: 2nd Wed./month, 7:00 pm
Location: 201 E Germantown Pk, Plymouth, PA

TEXAS

AUSTIN AREA EAA (AAEAA)

Web Site: http://www.austinev.org/
Contact: Aaron Choate, 1-512-453-2890, info@austinev.org
Mailing: PO Box 49153, Austin, TX 78765, USA
Meetings: Call or email for location/meetings.

HOUSTON EAA (HEAA)

Web Site: http://www.heaa.org/
Contact: Dale Brooks, 1-713-729-8668, brooksdale@usa.net
Mailing: 8541 Hatton St., Houston, TX 77025-3807, USA
Meetings: 3rd Thurs./month, 6:30 pm
Location: 3015 Richmond Ave., Houston, TX

NORTH TEXAS EAA (NTEAA)

Web Site: http://www.geocities.com/nteaa/
Contact: Paul Schaffer, 1-972-437-1584, pshf@hotmail.com
Mailing: 430 Ridge Crest, Richardson, TX 75080-2532, USA
Meetings: Varies, call/email for details.

VIRGINIA

CENTRAL VIRGINIA EAA (CVEAA)

Contact: Ernest Moore, 1-804-271-6411, ernie_moore@yahoo.com
Mailing: 4600 Melody Ct., Richmond, VA 23234-3602, USA
Meetings: 3rd Wed./month, Call for details.
Location: Westwood Ave., Richmond, VA.

WASHINGTON

SEATTLE EVA (SEVA)

Web Site: http://slough1.home.mindspring.com/seva.html
Contact: Steven Lough, 1-206-524-1351, slough1@mindspring.com
Mailing: 6021 32nd Ave. NE, Seattle, WA 98115-7230, USA
Meetings: 2nd Tues./month, 7:00 pm
Location: See website, call for details.

WASHINGTON D.C.

EVA OF WASHINGTON DC (EVA/DC)

Web Site: http://www.evadc.org/
Contact: David Goldstein, 1-301-869-4954, goldie.ev1@juno.com
Mailing: 9140 Centerway Rd., Gaitherburg, MD 20879-1882, USA
Meetings: 2nd or 3rd Tues./month, 7:00 pm
Location: Building 31-C, 6th, Bethesda, MD.

Board of Directors 2003

Chairman
Ron Freund
chairman@eaaev.org

Membership Chapter Relations West
Will Beckett
membership@eaaev.org

Secretary
Scott Leavitt
secretary@eaaev.org

Treasurer
Gabrielle Adelman
treasurer@eaaev.org

Chapter Relations East
Jerry Asher
ChapterRelationsEast@eaaev.org

Elections Board Calendar
Bill Carroll
electionadmin@eaaev.org

Education Program Manager
Kim Rogers
education@eaaev.org

East Coast Coordinator
Karen Jones

Delegates:

Tom Dowling - *EV Charging*
charging@eaaev.org

Charlie Garlow - *Junior Solar Sprints*
juniorsolar@eaaev.org

Bruce Parmenter - *EAA Technology*
webmaster@eaaev.org

Ed Thorpe - *CE Publications*
ceeditor@eaaev.org

Terry Wilson - *Historian, Awards*
historian@eaaev.org

EAA Board contact:
board@eaaev.org 1-510-864-0662

Notice: IRS requires us to ask for a full disclosure by the donor for donations of $1000 or more. This should include Full Name, Complete Address, Phone Number, and Social Security or Tax ID Number.

Non-USA EV Groups:

EV Council Of Ottawa
Web Site: http://econogics.com/ev/evco.htm
Location: Ottawa, Canada
Focus: Canadian EV organization and resource

EV Charging stations San Francisco, CA

USA EV Organizations:

Electrathon America
Web Site: http://electrathonamerica.org/
Focus: Light-weight EV racing

EV Challenge
Web Site: http://www.evchallenge.org/
Focus: Educating Middle & High School children

National Electric Drag-Racing Association - NEDRA
Web Site: http://www.nedra.com/
Focus: EV racing

National Station Car Project
Web Site: http://www.stncar.com/
Focus: EVs to public Transportation

Electric Drive Transportation Association (EDTA)
Web Site: http://www.evaa.org/
Focus: EV industry organization

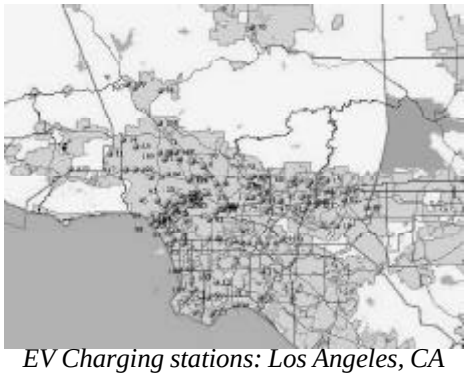
Northeast Sustainable Energy Association, - NESEA
Web Site: http://www.nesea.org/
Focus: Sponsers of the annual Tour de Sol

EV List Photo Album
Web site: http://www.evalbum.com/
Focus: Listing almost 400 electric vehicles from around the world - EVDL List owners

Union of Concerned Scientists
Web Site: http://www.ucsusa.org/
Focus: Citizens and Scientists for Environmental Solutions

Australian Electric Vehicle Association
Web Site: http://aeva.asn.au/
Focus: Australia national group

Japan Electric Vehicle Club
Web Site: http://www.asahi-net.or.jp/~MR5T-OKB/index.html
Focus: Japan national group
(Choose the english pages)



EV Charging stations: Los Angeles, CA

Sources - Used EVs-4-Sale:

EAA Main Links Page
http://www.eaaev.org/eaaevsforsale.html

Silicon Valley Chapter EAA
http://www.sveaa.org/

Innevations
http://www.innevations.com/used-evs.html

Eco-Motion Electric Cars
http://www.halcyon.com/slough/contributions.html

Phoenix Chapter EAA
http://phoenixeaa.com/

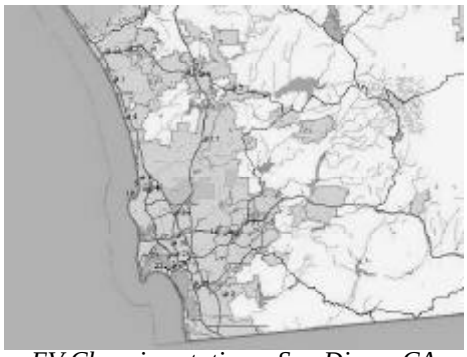
EVFinder
http://www.evfinder.com

EV Tradin' Post
http://www.austinev.org/evalbum/geobook.html

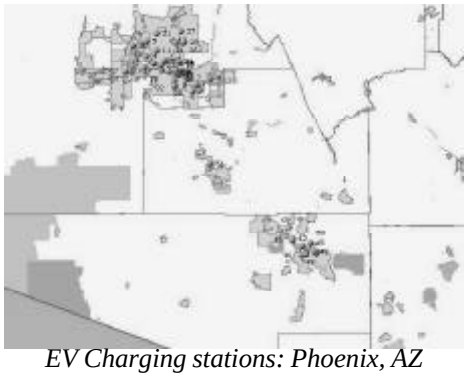
EVA/DC
http://www.evadc.org/forsale.html

Triangle EAA
http://www.rtpnet.org/~teaa/forsale.html

Check out these websites and the various EAA Chapter websites for new and used EV vehicles, production and conversions, and EV parts.



EV Charging stations: San Diego, CA



EV Charging stations: Phoenix, AZ

EV Charging Maps & Info:

EV Charger list
Covers Arizona, California and Georgia.
Web Site: http://evchargernews.com/

EV1-club inductive Charging
Sample maps displayed above.
Web Site: http://ev1-club.power.net/chglist.htm

AVCON Charging
Web Site: http://www.hondaev.org/chg.html

Arizona EV Public Charging Sites
Web Site: http://www.1opossum.com/chargers/

Ottawa Canada Charging Locations
Web Site: http://www.econogics.com/ev/chargloc.htm

Additional Canada Charging Locations
Web Site: http://www.ve-montreal2000.com/site/en/vebornes/Cartebornes.htm

How to Install Electric Vehicle Charging
Web Site: http://www.eaaev.org/eaaevcharging.html
Web Site: http://www.geocities.com/evcharging/

– General Items –

	*License Plate Holder, black plastic frame, white lettering on visible green.*	LICPH1	$10.00	
License Plate	*Motorcycle size, only in metal & black or chrome. (Special order, need additional 6 weeks.)*	Black: LICPH2-B Chrome: LICPH2-C	$14.00	
	*Embroidered Sew-On Patch, white. (Special order, allow an additional 3 weeks.)*	PATCH1	$ 9.00	
	*Embroidered Sew-On Patch, green. (Special order, allow an additional 3 weeks.)*	PATCH2	$ 9.00	
	*Embroidered Bucket Hat, comes in: small/medium & large/xlarge.*	S/M: DCP01-SM L/XL: DCP01-LXL	$25.00	
	*Ceramic Coffee Mug.*	MUG003	$ 5.50	
	*Insulated Car Coffee Mug.*	MUG02	$ 6.50	
	*Embroidered Polo Shirt (Forest or navy S,M,L,XL,XXL), 10 weeks for all colors other than Forest.*	SHIRT01-F-S SHIRT01-F-M SHIRT01-F-L SHIRT01-F-XL SHIRT01-F-XXL Same for SHIRT01-N-...	$40.00	
	*EAA Car Window Shade.*	SS001	$ 8.00	
	*EAA Bumper Sticker #1 (10.5"x3.75").*	BS800	$ 2.00	
	*EAA Bumper Sticker #2 "The Switch is on" (15"x3.75")*	BS002	$ 2.00	

– EV Buyers Guides –

	**Electrifying Times Preview 2004 *Electrifying Times Preview 2000 *1997 EV Buyers Guide *1996 EV Buyers Guide *1995 EV Buyers Guide*	ET2002 ET1999 BG1997 BG1996 BG1995	$ 5.95

– Literature –

	*Convert-It EV conversion Book*	CONV01	$24.95	
	*KTA Electric Vehicle Kits & Component Parts Catalog*	CATAL1	$5.00	
	Window Literature Holder (light plastic)	WL002	$15.00	
Indicate Month/Year and/or Vol #, back 20 yrs.	*Back issues of CE (Current EVents) magazine*	CE001	$ 3.00	

– Special –

	*AVCON to 14-50 adapter kit - sheet metal box, 14-50 outlet (2 hots and a ground, no neutral), for 220 VAC chargers, no 120 VAC (6weeks)*	ADAPT1	$255.00	
(fill out complete membership form on flip side of page)	***Electric Auto Association Membership ($10 rebates to local chapter.)***	***6 /year of Current EVents, member voting rights***	$39.00	

Shipping: USA 10%, Canada 15%, All Others 20% of subtotal
Handling $2.00 Send check (USA dollars) to:
EAA Merchandise, 582 Herma St, San Jose, CA 95123 USA

Electric Auto Association (EAA) Membership Application Form

Copy and fill out this form, attach a check or money order or use PayPal in US funds only for $39 ($42 Canada) ($45 International) payable to '**Electric Auto Association**'. You can fold this form as indicated and mail it with your payment enclosed. Use tape to seal the form before you mail it. Or send information in this form and pay through PayPal using http://eaaev.org/membership.htm.

New Member: ❑ Renewal: ❑ Country (if non-USA):_____ Date: _____

Name: _____ *email: _____

Mailing Street Address: _____ Home phone#: _____

Mailing City, State & ZIP: _____ *Work phone #: _____

*Do you ❑ own or ❑ lease an Electric Vehicle? ❑ Production ❑ Conversion ❑ Bicycle ❑ Other:_____ ❑ No

I support the _____ EAA Chapter, or please select an EAA Chapter closest to me. ❑

(*optional) All information in this application is for the exclusive use of the EAA and not be sold or given to any other organization.

(fold back ward, this will protect your personal information, placing it on the inside)

Please Identify your primary areas of interest relating to the EAA (check as many as you wish):

❑ Hobby/Builder ❑ Professional (income) ❑ Competition (Rallies, Races, Records) ❑ Owner/Driver
❑ Environmental/Gov. Regs. ❑ Social (Rallies, Shows, Dinners) ❑ New Technology & Research
❑ Promotion & Public Awareness of EVs ❑ Student or General Interest ❑ Electrathon/Bicycle/other

The Electric Auto Association www.eaaev.org

'Providing free Electric Vehicle information to the public since 1967'

The Electric Auto Association is a non-profit, 501(c)(3) for the promotion of electric vehicles. Membership includes the informative complementary EAA publication, "**Current EVents**". Donations are tax deductible. All information and statistics in this application are for the exclusive use of the EAA and is not sold or given to any other organization or company. From your membership dues, a percentage goes to the EAA Chapter you support for public Electric Vehicle promotion EVents like rallies, shows and EV rides.

(fold the bottom half under. This will now be the front of the letter. Be sure to seal it with tape)

Return address

_____
_____
_____

membership@eaaev.org

1st Class Postage Here

Electric Auto Association
Membership Renewals
4189 Baker Ave.
Palo Alto, CA 94306-3908 USA

June 30 - July 4, 2003

Fuel Cell 2003, Lucerne, SWITZERLAND
Phone: +41 56 496 7292
E-mail: info@efcf.com
Web Site: http://www.efcf.com

July 13 - 23, 2003

American Solar Challenge, USA
Twenty university teams racing their solar-powered cars across 2,300 miles of historic Route 66.
Web Site: http://www.americansolarchallenge.org/

July 16, 2003 - Mar 15, 2004

Eco Trekker, USA
An Australian TV crew filming a cross country trek using only eco-friendly sources of energy from cow pooh to food scraps, mostly to generate electricity.
E-mail: info@ecotrekker.com
Web Site: http://www.ecotrekker.com

July 23, 2003

OEVA Awareness Day 2003, Portland, OR, USA
Annual EV display in downtown Portland.
Web Site: http://www.oeva.org/

August 17 - 20, 2003

Energy 2003: Real World, Real Solutions, Orlando , Florida, USA
Sponsered by FSEC
Phone: +1-321-638-1014
E-mail: joann@fsec.ucf.edu
Web Site: http://www.energy2003.ee.doe.gov

August 23, 2003

EBEAA EV Distance Rally - part II, Hayward, California, USA
Second half of the Annual East Bay Chapter display and distance event.
Web Site: http://geocities.com/ebeaa

August 23 - 25, 2003

2003 Challenge Bibendum, San Francisco, California, USA
Challenge Bibendum was conceived by Groupe Michelin to bring together and test the best available technologies for environmentally positive vehicles. Open to all energy sources. It features vehicles from virtually major vehicle manufacturer and brings together vehicle manufacturers, designers, energy suppliers, technical and industrial partners.
Phone: +1-864-458-4698
E-mail: lynn.mann@us.michelin.com
Web Site: http://www.challengebibendum.com

August 31, 2003

NEDRA 2003 Nationals, Woodburn Drag Strip, Woodburn, Oregon, USA
Annual national electric drag races.
Web Site: http://www.nedra.com

September 9, 2003

19th Annual Mobile Sources/Clean Air Conference, Steamboat Springs, CO, USA
Organized by the National Center for Vehicle Emissions Control and Safety
Phone: +1-970-491-7354
E-mail: kuehl@cahs.colostate.edu
Web Site: http://ncvecs.colostate.edu

September 13 - 14, 2003

GASLESS AT THE CROSSROADS, Seattle, Washington, USA
Alt.Fuel Vehicle / and Electric Vehicle show, sponsored by the Seattle EVA, will be located at Bellevue's Crossroads Shopping Mall.
Web Site: http://slough1.home.mindspring.com/seva.html

September 20, 2003

SVEAA ANNUAL ELECTRIC CAR RALLY, Palo Alto, California, USA
31th annual Premere West-coast EV rally. This year the event will be held at Palo Alto High School, at El Camino Real and Embarcadro Road.
Web Site: http://eaasv.org/

September 24 - 26, 2003

8th Grove Fuel Cells Symposium 2003, Oxford, UK
Building Fuel Cell Industries conference and exhibition
Phone: +44-1322-663-006
E-mail: pamchattin@aol.com
Web Site: http://www.grovefuelcell.com

October 3 - 4, 2003

NORTHAMPTON ELECTRIC VEHICLE RALLY, Northampton, North Carolina, USA
Eighth Annual road rally and autocross, the kickoff event for the 2003-4 EV Challenge.
Telephone: +1-252-534-1258
Email: johnsond.east@ncs.schoollink.net
Web Site: http://www.evchallenge.org

November 15 - 19, 2003

EVS-20 The International Electric Vehicle Symposium and Exposition, Long Beach, California, USA
Powering Sustainable Transportation, the theme of EVS-20, highlights the important opportunity that electric drive technologies represent for addressing societal and economic issues shared across the globe.
Phone: +1-408-741-5870
E-mail: EVS20Symposium@aol.com
Web Site: http://www.evs20.org

November 2003

RICHMOND EV RALLY, Richmond, Virginia, USA
Seventh Annual rally at Richmond Technical Center
Phone: +1-804-780-6237
Email: basketbaul@aol.com
Web Site: http://www.evchallenge.org

December 9 - 11, 2003

POWER-GEN International 2003, Las Vegas , Nevada
Sponsered by the PennWell Corporation.
Phone: +44-1992-656600
E-mail: powergen@pennwell.com
Web Site: http://www.pennwell.com

Email information to <cenews@eaaev.org>.

EAA **Chapter** Event =

EV related **Event** =

EV related **Conference** =

ELECTRIC AUTO ASSOCIATION
2 Smith Ct, Alameda, CA 94502-7786

NON-PROFIT ORG.
U.S. POSTAGE PAID
HAYWARD, CA
PERMIT #546