Electric Auto Association

CURRENT EVENTS

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THE LATEST IN HYBRIDS - HONDA CIVIC CVT

EAA HONDA CIVIC HYBRID 2003

"One small charge for man, one huge leap for manufacturers"

Jim Stack, Phoenix EAA (article & photos)

Recently I purchased a new Honda CIVIC Hybrid. My other vehicle is a 1994 S10 Electricar pick-up truck that hadn't been on the road for over 2 years when I got it and now I drive it every week. Why would an EAA EV driver purchase this kind of car? How is it compatible with electric vehicles?

First, I realize the limits of existing all-electric vehicles. Second, there are very few available. Like most EAA members I know the best EV is a converted ICE car, but we can't make them for the entire world. Even if we could, most new car buyers want one with all the features, backed by nationwide service. If only we could get big carmakers to realize people want EV's. Also, the batteries are still the weakest link in the EV because of availability, durability and expense. My new hybrid helps with all of these issues.

I chose a Honda for many reasons. First, they have been a leader in emission control since 1975 when the CVCC engine in produced cleaner exhaust without a catalytic converter and got better mileage. They also built the all-electric Honda EV PLUS (but that never made it to full time production). Then they came out with the Insight hybrid with a 70-mpg EPA rating, and Toyota followed with the Prius Hybrid. The CIVIC is the first popular mainstream car to be offered with a hybrid option. If it is successful, I feel the next version could be a plug in hybrid or 100% EV option on a mainstream car.

Hybrid Gauge - charge/assist & battery

The new hybrids use batteries, an electric motor, low rolling resistance tires, and a controller, all common EV components. By making a lot of them and improving the technology, all of us will benefit. My CIVIC has a 144V DC battery pack in a walled divider between the backseat and trunk. It also has a 10-Kw brushless DC motor, low-rolling resistance tires, a PCU Power Control Unit (controller), regenerative braking and electric power steering.

The model I chose is a Honda CIVIC 4 door hybrid with an automatic CVT (Continuously Variable Transmission), NiMH (Nickel Metal Hydride) batteries and regenerative braking. Our car drives and looks just like an all-gas CIVIC. There are a few differences. When you start the car there is no whine from a starter motor, the engine comes to life and idles immediately. When you stop, the engine goes into auto-stop mode just as you reach a standstill, then there is silence. As soon as you lift your foot off the brake the motor idles as if it was running all the time. On the down side, the back seats don't fold forward because of the battery pack is behind the seat, so you don't get trunk access for those longer items.

The instrument panel displays the most differences. There is a circular bar gauge with 4 sections, to let you know if the car is charging while coasting and braking, or assisting while accelerating. At the top of this gauge a smaller indicator shows the amount of charge or motor assist occurring. To the right is a battery meter for the 144V pack SOC (State Of Charge). There is a multi-featured performance gauge showing the average mpg and a more immediate bar graph that shows 0-120 mpg, along with a miles-traveled readout. On the left is the gas fuel gauge. The air conditioner has an economy button to save energy and the cabin temperature can be set from 60-85 F. Fan speeds can also be controlled automatically, or set manually. It all seems very well done without being too distracting, and it lets you know what's happening.

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COVER STORY

Photos by Jim Stack, Phoenix EAA Chapter

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PASSING OF A PIONEER (Correction)

The previous issue of CE featured a major tribute to Bob Wing, a true EV pioneer, who passed away on March 17, 2002 at his home in Inverness, California.

The tribute/ reflection to Bob EV involvement was erroneously attributed to the wrong author. The correct author/writer is Bob's good friend **Don McGrath**, secretary of the North Bay EAA Chapter. Don wanted it to be known as one of Bob's best friends, and he wrote in Bob's memory.

Bob Wing, EV Pioneer

OPINIONS & EDITORIALS

What do you think about EVs and the EAA? Give us your opinions, and we will publish them in this, our editorial column.

Reflections on Evision Conference (EAA All-Chapter's Meeting)

At the recent 1st EVer EAA Chapters Conference in Washington, we raised the question about our past, and where we are heading in the future. Here are some views reflected by long-time supporters of the EAA.

Dave Goldstein (President, EVA/DC):
"What has EAA *truly accomplished* in the past 30-35 years, and where are we going?" "What are we going to do to help EVs achieve the broad public acceptance that they deserve and which, we believe, is vital to the future of our country?"

Is the "Burden of History" (Professor David Kirsch's thought-provoking book) *too great* or can we truly effect meaningful change? Or are we simply "stirring the pot" and waiting for the right confluence of timing and opportunity?

KEEPING EV HOPE ALIVE

Charlie Garlow responded with:
"The EV movement has accomplished a number of things, most important of which is to keep alive the hope that EVs will someday be the most frequent way to transport people and cargo. We have educated a lot of Americans and others overseas. We have encouraged state governments, including California, to stand fast and keep the pressure on. Without that public support, California would never have passed the good ZEV requirements, and the state of the technology would never have advanced as far as it has."

"We haven't gone down this road as quickly as we would have liked because some very powerful forces have been blocking the road, but I think our progress has been remarkable, given the Goliaths we are up against. Where are we going? We are going to do more of the same, continuing to build a citizens movement to change the climate and garner greater support for clean transportation."

"Can we effect change? Yes. Citizen demands for change have been the only reason we have all sorts of good things happening in this country, from child labor laws to the Clean Air Act to the EPACT. Citizen demands are the only means by which change will ever be effected. We must continue to stir the pot and add more fire under that pot, until the timing and opportunities improve."

"I guess you could call me an optimist."

EVS PROTECT OUR ENVIRONMENT

Scott Cornell responded with:
Americans are mostly selfish by nature. We want to have the biggest, best, most comfortable of everything, and not to give up anything (except maybe for a few extra bucks) to get just what we want. We have not been taught (or encouraged to think much about) how our "conspicuous consumption" habits will affect future generations of all forms of life. Even when we know how we are affecting future generations, we still revert back to the selfish attitude of "it's not affecting me right now, I don't care".

We are now at an environmental crossroads - we are beginning to see just how we are affecting our environment (most folks in developed countries at least know about global warming and the problems with the ozone layer and what causes these problems). One of our missions at the EAA is to offer people who know and care an alternative, and to help educate those who may not know but who have open minds. We've been doing this pretty well for the past 3+ decades (especially considering our relatively small numbers).

We are equipped with the tools we need to prove that EVs can help our environment (some of us have been using them for 20+ years). We just need to continue to be quietly persistent, without being too pushy, about spreading the word about EVs. For those who already drive EVs, drive them proudly, patiently offer factual information whenever it is requested. For those with and without EVs, offer encouragement and assistance to those who are interested, and wherever possible, help to open minds.

By Ron Freund, San Jose EAA

So you've done the basics in selecting the "ideal' vehicle for your conversion. You pulled the engine, removed the exhaust system and gas tank and laboriously cleaned the engine compartment. You have the electric motor, the controller, the battery racks, the batteries and charger installed and wired. You've taken that first test drive around the block and your family and friends saw your beaming "EV grin"! It works! It's quite an accomplishment, something that makes one of those lasting impressions. But were you working "in a vacuum", without consulting a savvy mentor, perhaps someone who's walked this path before you?

I recently assisted an EAA member who had done a mid-1980's pick-up truck conversion generally following Mike Brown's "Convert It" book as a guide. Yet it just didn't seem to get more than 14 miles on a charge. Flabbergasted, as I learned more about his setup, I promised him together we'd get to the bottom of this, to the root cause.

His truck had rear-wheel drive, 120-volts of 6-volt flooded batteries, an ADC (Advanced DC) 9" series motor, a Curtis 1231B controller and a Russco charger installed. There was a large battery box under the hood, and three separate boxes under his beautifully hinged truck bed. His round trip commute was about 28 miles and since he couldn't manage that on a single charge, he was paying a local restaurant owner near his employer a monthly fee to offset the electricity he was consuming there while at his job.

When I arrived he was charging. Five hours later we had created a list of action items, all of which were "musts", in order to maximize the range. I present them here in hopes that one or more will help others to do the same, since building an EV isn't simply a matter of slapping the necessary components into a ready chassis.

1) Battery Interconnects:

The Russco was delivering 8 amps into the pack as measured with my clamp-on Tenma ammeter. I used a 3 and a half-digit digital voltmeter to measure the voltage drops from battery terminal to battery terminal. I did the measuring; my friend recorded the data, which will also be for future comparison. We looked at the voltage drops at twenty one interconnects on twenty batteries, all the way to the controller. Measuring typically 1.5 to 3 millivolts (nearly the lowest voltage my meter could repeatably read), we used a calculator to assess the quality of the connection. Ohms law provided that 3 millivolts divided by 8 amps equals 375 micro-ohms. (NOTE: That was far smaller than we could measure without a sophisticated 4 wire, six and a half-digit laboratory grade micro-ohmmeter. Always with power off, the resistance is near the limit of the meter's resolution. Direct resistance measurements are not the way to do this. We determined it indirectly, calculating R=V/I.)

That kind of connection would dissipate about 15 watts when driving conditions draw 200 battery amps. This was the upper limit of what I considered acceptable. I strive for half this number when making connections. After measuring all connections we reviewed the data, picking the top offenders. One was really gross, dissipating 192 watts at 200 amps, plus dropping 0.96 volts at that current thereby acting as a weak cell. Ouch!

2) Interconnect sizing:

This vehicle employed 3/32-inch strips of straight copper between battery posts on a majority of the connections, with occasional #00 AWG welding cable as well. Straight heat shrink covered strips were simply bolted on. We made a calculation of their effective cross sectional area (versus that of the welding cable: 3/32-inch by 1.25-inch strap equals 0.117-square inches area. The 2/0 cable's conductor diameter was .368-inches, 0.106-square inches area. Hmmm. Perhaps there was a misunderstanding; 3/16-inch copper strips were better on paper!

3) Using solid bus bar interconnects:

In high vibration environments solid bus bars between batteries has been known to rupture the seal between the lead post and the plastic cover on flooded batteries. A suggestion was made to use an in-line "zigzag" while bending the material so that shocks could be better absorbed. Or better yet, simply use #00 welding cable throughout. In fact, on the battery interconnects, using Belleville washers, with no stainless steel hardware in the path of the connection helps maintain solid connections since lead creeps when stressed! (Stainless is not a great conductor!)

4) Wheel bearings:

Having internalized this horrific 14-mile range number, my mind immediately searched for culprits. After breaking lug nuts loose, using a rolling floor jack we lifted the front left wheel. This was safer than using a bottle jack, since it rolled with the vehicle movement. I stated that my index finger at 12 o'clock pushing the wheel vigorously should produce 3-5 rotations. My full palm barely produced 1 turn! Off with the cotter pin and loosen the bearing so it's sloppy. Then with no axial endplay tighten to finger tight, and back off one flat on the hex head nut. Replace cotter pin. Now the index finger test let it roll smoothly for many turns.

5) Wheel cylinders:

Moving to the right-hand front wheel the bearing there was fine, except the disc brake caliper was dragging. Seized wheel cylinder? I left my friend to investigate - after all, the vehicle was 110K+ miles old.

6) Differential:

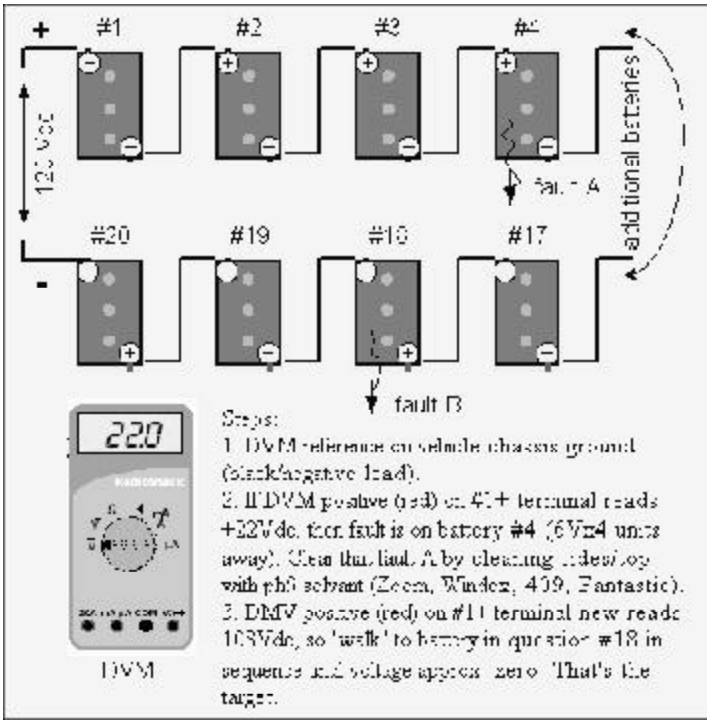
Moving to the rear of the vehicle, I asked if the rear end still had the SAE 140 weight gear oil. It was untouched. What I suggested meant a lot of work (due to placement of one of the battery boxes). Action: remove the faceplate, clean out the casing, and use synthetic lightweight oil and a new gasket.

7) Fuse links:

There were multiple fuse links in this vehicle, one in the front, one in the back, in addition to the large breaker (vertically mounted). One link produced a large voltage drop at 8 amps while charging, I suggested renewing this connections.

8) Battery top conduction (electrical safety issue):

Since the post/top interface had been breeched due to vibrations on the solid interconnects, acid had leaked onto the top surface. Serious leakage was apparent.



Putting the DVM (digital voltmeter) negative lead on ground, we walked down the series of traction battery connections until we found something close to zero volts. We started at one end with +62 volts and at the tenth battery the reading reversed and started climbing in a negative direction (see diagram). Battery number ten was oozing and filthy. Once that battery was removed, cleaned along with the surrounding area, and reinstalled, the procedure was repeated. The cleaning removed the grounding leak.

A second different dirty battery with a conductive electrolyte path was discovered. Conducting measured only a few microamps (millionths), which was enough for a voltmeter to register. Finally, after much cleaning, there was no more voltage registering when measured from any battery to ground. This is the way the battery pack was intended to be. Any shorts could become a serious shocking situation.

9) Batteries:

For this step, we labeled the tops of the batteries with a felt tip marker so we could easily identify them. Shortly after removing the pack from charging, we measured the voltage on each and logged the results. Right away we spotted battery number 1 at 4.1 volts. This meant the 6-volt battery had a dead cell. A dead cell is a time bomb waiting for a trigger. Three others batteries were also looking suspicious so soon after a charge. While most read 6.60-volts, these were at 6.1-volts. Hmmm. Since the pack was used, (abused) and aged, actions to be taken follow below.

10) Charger:

A properly functioning PbA (lead-acid) battery charger should take a battery from the depleted state to 2.35-volts per cell (vpc). This vehicle's configuration consisted of 20 batteries, each with 3 cells, for a total of 60 times 2.35-volts. Full charge should be 141 volts. Periodically (once per week with daily driving), an equalization charge should be run to bring each cell to 2.55-volts. In this case that is 153-volts total.

This charger was clearly defective, since the owner claimed never to have seen more than 133-volts on the pack under charge. Double ouch! The pack was neither being fully nor properly charged. I brought in an old Zivan K-2 and we quickly saw the pack voltage reach it's highest levels ever! 137, 138 and more… replacement is in order.

11) Wheel alignment

In an effort to minimize rolling resistance, make sure the toe-in is set at nearly zero-degrees. If the vehicle is taken to a shop for a full four-wheel thrust alignment, both front and rear specs can be set to nearly zero. Toe-in helps hold the road, given the pavement crown. It works against EVers so you might ask to tweak settings. Today's computerized alignment rigs are sophisticated, so custom settings shouldn't be unmanageable. Bring home the print out too, for reference next time!

12) Tire inflation:

Keep all tires inflated near their maximum. Parking with my hood facing east, I notice that my right side tires lose air faster over the summer. Repeated heating and cooling in the sun perhaps? Check this monthly at a minimum.

Battery swap programs

The San Jose EAA chapter has a battery exchange program, which allows local EAA members to get no charge replacements of like kind. Those used batteries probably have similar capacity to those being left behind in the vehicle. (EVers know that new and old batteries don't "share" the load well). The program allows drivers to stretch their investment until such time as a new pack can be ordered. Other chapters are encouraged to establish similar programs working in conjunction with local battery dealers who agree to pick up those "shot" cores for recycling. Contact the EAA for details on implementing your own.

Conclusions:

A dozen pointers are presented here for consideration to help drivers get the most from their investment. Safety is critical so don't take any shortcuts. A minimum set of tools to work with would include:

- 3-½ digit DVM (with at least 1-2% basic accuracy)
- a rolling 2 ton floor jack
- pencil / logbook for data logging
- 4-function calculator.

Optional tools might include (budget permitting) a 2 % accuracy DC/ true RMS AC clamp on ammeter. Inexpensive analog meters called volt ohm meters (VOM) look like traditional gauges, yet may only have 5-7% accuracy and don't provide very repeatable measurements. A 2.000-volt source may read 2.1 the first time, and upon re-measuring just two seconds later might read 1.9 volts, especially near the low end of the scale. Save your money, but plan on spending over $30 dollars for a reasonable DVM. Features like auto ranging (meaning one setting reads all inputs up to the max.) are nice but not necessary, and "talking tools" can be expensive frills.

Plug-in vs. Fill up: An EV position

By Scott Hull

I was driving my Citicar yesterday. A gentleman walked up:

Gentleman: Is that car battery powered? Did you see the commercial with the Toyota [ed: actually a Honda Hybrid] and a guy was looking for a place to plug it in and it said, "You don't have to plug it in".

Me: No, I didn't see the commercial. But my other car is a Cadillac and I never have to plug it in either. Do you have to plug your car in?

Gentleman: What? (looks puzzled, then sudden realization) - Oh, you're right, I don't.

Me: That's why I like this car. I have to plug it in but I never have to put gas in it.

Hybrid vs. Battery Electric

By John Wayland

Here's the reverse scenario. As most know, I own and drive both EVs and a Honda Insight Hybrid, and I still prefer a pure EV, hands down. Both Toyota and Honda are guilty of this distasteful and goofy "you don't have to plug it in" mantra. I almost passed on buying my Honda because of the bad feelings I had about Honda's anti-EV sentiment in regard to this nonsense. Perpetuating the myth that "having to plug in an EV is a bad thing" is counter productive, and I hope someday it will come back and bite them! I even sent a letter to Honda America about this. Anyway....

I too, get asked the dumb "don't ya' have to plug it in?" question when I drive my EV... been getting it for 22 years, but it's almost more fun now, when the same thing happens with my Honda Insight... my gas car. In spite of what Bruce Parmenter may have implied, I never, ever, have thought of it as an EV, never call it an electric car, and always correct the misinformed when they call it an electric car. It's a hybrid that runs on gas as it's original fuel source, period.

Onlooker: Hey, is that Honda's new eee-lek-trick car?

Me: No, they stopped making the good cars when they discontinued their EV Plus, all-electric car, and only make this one that needs gas now.

Onlooker: Well, it's that Insight thingy, ain't it? Ain't it eee-lek-trick?

Me: It's actually a hybrid car...half gas, half electric. It's got cool electric car stuff inside, including a powerful electric motor, but all of its energy has to come from burning gas.

Onlooker: Yeah, so it never needs to be plugged in....cool!

Me: No, not cool. It still needs to go to the gas station, but at up to 90+ mpg, not very often thanks to the advanced electric car stuff inside. Its pollution is far lower than regular cars, too, but I wish I COULD plug it in... it'd be a much better car if I could do that, and it would be far less hassle to be able to plug it in for most of my driving needs instead of having to rely on gasoline.

Onlooker: I don't wanna plug-it-in, that's too much trouble. I'd rather put gas in it and get lektrissity for free!

Me: It's not free. You still have to drive out of your way to pay someone for gas that pollutes the air. Yeah, it's way cool that this car is so advanced that it captures most all of the normally wasted energy from decelerating or using the brakes to generate electricity, energy that regular gas cars simply throw away in heat and worn out brake pads, and it's cool that it burns gas so much cleaner, but it still can't take advantage of clean electricity from hydro-electric dams, wind generators, and solar panels like a real electric can, because I can't plug it in. I REALLY want to plug my car in!

Onlooker: I don't wanna have to plug-it-in!

Me: (got this one from my friend Geoff Shepherd) Do you have a cell phone? Is it gas powered, or is it battery powered and charged by clean electricity? You have to plug your cell phone in; are you saying you'd rather not be able to do that in the privacy and convenience of your own home, and instead, have to take your phone to a gas station all the time and pour smelly gas inside to make it run? Would you like to use it near your mouth with gas fumes wafting out of it?

Onlooker: No, that'd be awful, no, I don't want that!

Me: Know what? I also own a few pure electric, battery-powered cars. They can't go as far as this car can, but they're faster, more comfortable, totally silent, and never, ever have to go to a gas station, never ever need antifreeze, exhaust pipe repairs, belts, hoses, oil changes...none of that. More important for me, is that my electrics don't make any pollution and are good for helping to keep the air clean. I like that. I can plug those cars in, and I really like that part, too, because it's so easy to just plug it in, go to bed, and in the morning, (got this one from Geoff, too) magic fairies have come in the night and filled the batteries up with electricity.

Onlooker: Ya mean, it's all ready to go again, and you can just unplug it and drive away?

Me: Exactly, just like your cell phone.

As to the Honda Civic Hybrid commercial that Scott hasn't seen yet but evidently, his gentleman friend had seen... un-for-tunately... I, sadly, finally saw it last night... ARGHH!!! It is worse than the mantra Honda used with the Insight in its limited magazine ads and brochures. Gawd, it's a terrible commercial! It would be bad enough with just the geeky guy in his garage holding the *female* end of an extension cord as he looks fruitlessly to find a place to insert the female end to have AC wall current flow "into" his car, but the dolts who produced the commercial, evidently, are as much electrical idiots as the guy featured in the commercial, without a clue about the everyday use of a common extension cord.

Yes, I'm not kidding. As the commercial's voice-over constantly rants, "You don't have to plug it in," they show this idiot holding the wrong end of an extension cord as he

tries to plug the male end of the cord into the car! This of course, to anyone with a brain, would suggest that he is trying to extract 120 VAC from his car for some reason. But the whole point of the commercial is that the Civic hybrid does not need to be plugged into an external source of electricity (in the case of this lame commercial, 120 VAC, I guess).

It's bad enough to keep beating the "You-don't-have-to-plug-it-in" bit to death, but to have an idiot not even grasping how an extension cord works is going too far. It portrays those who may want to purchase a Honda as complete fools... is that really how Honda wants the world to perceive its customers? This commercial is a disgrace, and should be an absolute embarrassment for Honda.

See Ya.....John Wayland

Honda Civic Hybrid - cont. from page 1

With the feed back from the instruments I have been able to reach 70 mpg on 10-mile trips and average 55 mpg on commutes. My best city driving performance has been 67 mpg, a round trip of about 40 miles with level terrain in Phoenix. My overall mpg after about 2,000 miles was 56.

Since the mpg bar graph gives instant feedback you can see how being light on the accelerator and coasting in anticipation of the next stop help with mpg. This is perfect training for getting the most out of an EV battery pack. These similarities help the general public learn the lessons of EAA member driving without getting stranded and giving up on EV's. The improvements to battery packs and controllers can be passed on to future EV's.

To compare emissions you can look at www.fueleconomy.gov and see that the CIVIC matches the Toyota Prius (ULEV): an EPA rating of 7 (with 10 being the best. In the future they should improve. There are only 3 hybrids available in the US from major manufacturers at this time, two from Honda and one from Toyota. Honda expects to sell about 2,000 a month in the US and can expand this since they are made on the same assembly line in Japan as the normal CIVIC.

Since electric motors give off EMF (Electric Magnetic Field) radiation, I checked my car with a hand held EMF meter (EF22) from Fry's Electronics. There was almost no measurement, only 0.1- milligause (mG) in the center console under the dash. This compares well to a Saturn EV1 on which I measured 5 to 20-mG. According to the US ANSI standard and the Swedish MPR and TCO, EMF has been associated with cancer and other problems. The Swedish limit is 5.1 mG.

A nice plus is the Federal Income Tax rebate of $1,500 on hybrids this year, dropping to $1,000 next year, $500 in 2004, and zero after that. (See the April 2002 EV NEWS, pg. 15)

New Hybrids are coming soon. Ford is planning an Escape hybrid, Chevrolet a Silverado, and Daimler-Chrysler a Ram pick up. Honda has a show car called the Dual Note that has 400 HP and still gets 42 mpg. There are even hybrid buses with battery power for the motor and LCG (clean gas) for the engine.

There will likely be many more versions in the next few years. The good thing is the many improvements they will bring to components for electric vehicles. The only problem is that many of the hybrid components are smaller in size and capacity than the requirements for battery electric vehicles.

Features

MSRP: $20,010 manual, $21,010 automatic (about $2,000 less than the all-gas Civic)
Efficiency: City 46mpg, Freeway 51mpg (City 33 mpg, Freeway 37 mpg for all-gas)
Range: about 700 miles per tank-full (about 500 miles per tank-full for all-gas Civic)
Acceleration: 0-60mph in about 11 sec.
Emissions: ULEV (same as all-gas Civic)
Smog index: (same as gas Civic)
Transmission: 5-speed manual or CVT automatic
Warranty: 8 yr batteries
 # Passengers: 5 (2 front, 3 back)
Gas Engine: 1.3 liter, 4-cylinder, 85 hp @ 5,700 rpm, 87 lbs.-ft. torque@ 3,300 rpm (1.7 to 2.0 liter, 127 hp for all-gas Civic)
Gas tank: 14 gal
Electric Motor: 10-kw, 13 hp @ 3,000 rpm, 46 lbs.-ft. torque @ 1,000 rpm
Batteries: 144v (120-1.2v NiMH)
Weight: roughly 2,700 pounds
Standard Features: Anti-lock brakes, side-impact air bags for front occupants; automatic climate control; AM/FM/CD stereo; power steering, brakes, windows, locks, mirrors; remote-control locks; fuel-economy computer and display; adjustable steering column; interval windshield wipers; rear-window defroster; rear-seat heater ducts; alloy wheels; P185/70R-14 low-rolling-resistance tires.
Hybrid manual will carry 959 pounds of people and cargo, CVT, 888 pounds.

Honda Civic IMA hybrid drive

CONVERSION WORKSHOP, STEP 11
INSTALLING EV COMPONENTS

By Michael P. Brown, © 2002

Now that we have the battery racks and boxes designed, built, and installed it's time to find homes for the rest of the EV components. In this issue, we will cover installing the controller, main contactor, shunt, and potbox. At this time, the battery boxes should just be sitting in their racks, holding their places in the vehicle.

Location, Brackets, & Hardware

We will start our component installation under the hood. With the battery box or boxes occupying their "prime real estate" in the center of the former engine compartment, we look at the remaining space available for the rest of the components. Usually, the space on either side of the engine compartment has remained available, and sometimes there is room across the front of the car where the radiator went. In the case of the front wheel drive cars, there is some additional room in front of the transmission where there isn't enough space to put batteries, but might be room for a smaller component.

While surveying the potential mounting spaces, look for any built-in mounting brackets or threaded holes that the manufacturer put there to mount parts of the original IC drive system. Also take a look at any of the removable brackets that held the IC part to the cars body. Any existing bracket that can be used as-is or modified to suit a new use will save you the four hours that it would take you to build a custom bracket.

Use good quality bolts and nylock nuts to mount the components or brackets. If you cannot drill a through hole to use a nut and bolt, don't use a sheetmetal screw to fasten a heavy component or its mount to the car's chassis. Under heavy load, a sheetmetal screw will loosen up from vibration or pull out from the strain placed on it and the body sheetmetal.

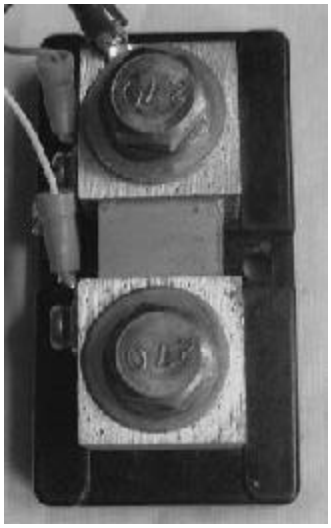
If you have to use a blind hole as a mounting point, use a pop rivet of a suitable size and material for the load. If you want the security of a pop rivet but not the permanence, use a rivnut. A rivnut is locked into a blind hole like a pop rivet, but uses a threaded mandrel to do the locking. When the mandrel is removed you are left with a captive nut ready to receive your mounting bolt.

Controller, Contactor, & Shunt

The first component that we will find a home for is the controller. Note: the controllers I will be talking about here are the Curtis-PMC models 1221C and 1231C, as they are the most widely used controllers. There are other controllers available and their sizes and shapes are similar, so what I am saying here should still apply. If in doubt, follow the installation instructions that came with your controller.

Curtis PMC controllers and pot

The footprint of the two controllers is not that big. What adds to the size of the footprint is the requirement (special need) for a heat sink as a part of the mount system. According to the factory the controller must be mounted on a piece of



typical shunt for scaling amps

¼" thick aluminum plate with a minimum size of 12" x 12". However, as long as you have an equal amount of surface area, the mount plate can be any size and shape you can fit into the vehicle.

This leads to the component mount plate concept. Which means, as long as you have this piece of aluminum plate, why not fill up the space left over after the controller is mounted with two components that support it? One of the two components is the main contactor, the big electrically operated switch that connects the battery pack most positive cable to the B+ terminal of the controller.

The other related component is the ammeter shunt. The shunt is a clever device that converts the amount of amperage that is flowing through a cable to a millivolt (mv) signal at a ratio of 50 mv equals 400 or 500 amps, depending on the current limit of the controller being used. This signal is read by a millivolt meter whose face is calibrated from 0 to 400 or 500 amps, depending on the calibration of the shunt. Since we want to read motor current, the shunt is placed between the M- terminal of the controller and the appropriate terminal of the motor.

Using a component mount plate with related components installed on it allows you to keep the cable lengths between the various components short. It also lets you make these cable connections on the bench instead of

inside a crowded former engine compartment.

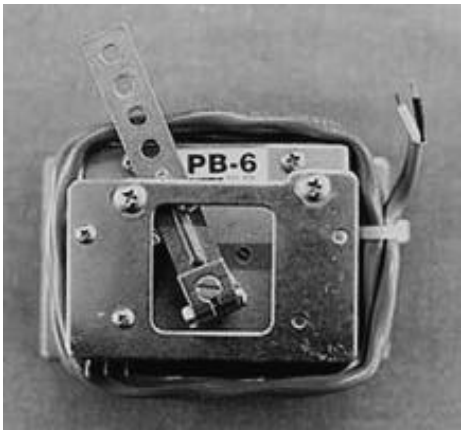
Installation of the components on the mount plate is kind of put-it-where-it-fits-best in terms of accessibility and ease of cable routing. The one exception to this is the controller, which should be mounted with its terminals as close to the motor terminals as possible. In addition, the long side of the controller should be horizontal to protect it from moisture in the air.

The moisture problem usually occurs if the controller is mounted with the terminals pointing straight up. In this position moisture collects on the end of the controller, which is closed off with potting material. If the seal gets cracked around the terminals for some reason, the moisture will enter the controller and cause corrosion, which is the leading reason for controller failure. So if you have to mount the controller vertically due to space constraints or some other reason, point the terminals down.

Since the other (and primary) purpose of the component mount plate is being a heat sink for the controller, some thought should be given to positioning the plate so that there is airflow across its backside to aid in cooling the plate and thus the controller. One trick that has been used to do this is to install the component mount plate where the radiator was mounted if there is room for it. This position gives the most direct exposure to cooling air, and at the same time serves as a block off plate to keep air out of the former engine compartment. This cuts down on "included air drag" that costs you range. If the only place that the mount plate and components will fit is in a dead air pocket with little or no air flow, ducting some air to the back of the plate might keep things cooler.

installed ontroller, contactor, shunt

Once you have determined the layout of the components on the plate and found a place for it under the hood, it's time to do the final installation of the components and connect them with cables. Before you bolt the controller to the plate be sure to coat the bottom of the controller completely and evenly with heat sink grease to aid in heat transfer from the controller to the plate. Be careful with the heat sink grease. It's not harmful, but it is messy and will get all over



things if you don't watch out.

Potbox

The next component we have to find a home for is the potbox. The arm on the pot box is mechanically attached to the car's original accelerator, or "gas" pedal, and connected electrically to the controller by two wires. Depending on the position of the arm, the potbox sends a 0 to 5K-ohm signal to the controller. This signal tells the controller how much voltage to send to the motor. Very simple.

Mounting the potbox to the vehicle's chassis and connecting the arm to the gas pedal requires some thought. To do its job, the potbox must be rigidly mounted to the chassis because any flexing of the mount will interfere with the operation of the arm.

Since most of the cars that are being converted now have throttle cables instead of rigid rod linkage, I will give the procedure for adjusting a cable linkage here. The process for a rigid rod linkage is similar. The cable system requires a rigid mount at the throttle plate end, which can often be taken from the IC engine and modified for our uses. The cable housing usually has a threaded end that fits in this mount. This allows some adjustment of the cable length by moving a nut against the mount.

The body of the potbox has the "full on" and "full off" stops built into it. If the mount flexes when the gas pedal is depressed, the arm may not go to the "full on" position, which takes away from the EV's performance. At the other end of the arm's travel (the "full off" position), the problems are usually caused by mis-adjustment of the cable between the gas pedal and the potbox arm.

This is the time to refer to your project notebook for the measurements you made of the throttle linkage travel distances before you removed the engine from the vehicle. These distances should have been measured at the pedal itself and at the other end where it moves the throttle butterfly in the carburetor or fuel injection throttle body.

Take the distance that the end of the cable under the hood moved and try to match it to the distance the potbox arm moves from stop to stop. The arm has four holes along its length. The top hole has the longest distance traveled between the stops and the length of travel decreases for each hole the closer they get to the pivot end of the arm. Pick the hole whose travel distance most closely matches your measured distance. It is better if the measured distance is a little longer than the stop to stop distance so there is a little slack in the cable with the arm at the "full off" stop.

Next have an assistant get into the vehicle and push the gas pedal to the floor while you see if the arm contacts the "full on" stop. If it doesn't, try taking the slack out of the cable with the adjusting nut. Be careful not to lift the arm off of the "full off" stop. If "full" on can't be achieved with cable adjustment, check if there is a full on pedal stop under the gas pedal itself. If there is such a stop, try adjusting it down until the potbox arm goes to the "full on" stop on the potbox. I have sometimes found it necessary to remove the pedal stop in order to get full throttle, and in one instance I had to bend the pedal up from the floor in order to get the travel I needed.

The importance of getting "full on" is obvious: more performance. The reasons for achieving "full off" are important for safety. When the microswitch is wired into the control circuit the way the Curtis-PMC instructions specify, it acts as a "dead man" switch. It does this by opening when the potbox arm contacts the "full off" stop. When the switch opens, it opens the main contactor, which shuts off the battery pack high voltage, high amperage current to the controller. At the same time, it opens the potbox relay, which removes the high voltage, low amperage current from the key switch input terminal of the controller, and shuts off the logic circuits inside the controller. The microswitch circuit must be wired this way because it is the first line of defense in case you experience a problem with the controller or motor.

The other reason to have a definite "full off" also involves safety. One of the features of the controller is called "high pedal disable" (HPD). This feature does not allow the controller to turn on with the potbox arm in anything but the
"full off" position. This is to prevent unintended acceleration when the key is turned on with throttle pedal partially depressed. If your throttle cable is so tight that it is holding the pot box arm away from the "full off" stop, your controller won't turn on.

The last thing to do in the pot box installation, after you have the throttle cable properly adjusted, is to add a second return spring to the assembly. The potbox's built-in return spring will return the arm to the off stop, but Curtis PMC wants a second spring as a backup. I find that using only the built in return spring gives you a gas pedal that is too soft, and thus hard to control. I use a carburetor return spring from a 1967 or later VW bug as my second spring, and the pedal feels just right.

This is all I have room for this issue. Next issue we will look what's involved in the installation of some of the other components.

See you next time.

Access
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Battery Maintenance

By Lee Hart

Let's anthromorphize a bit, and consider lead-acid batteries as alive; like the family dog.

1. They need exercise; it's good for them. You get the longest life when they are worked to about 50% of their capacity at moderate loads. After they have been loafing for weeks, you will notice a distinct improvement just from giving them moderate exercise.

2. But don't work 'em till they drop! If you drive an EV until it barely moves, the batteries are having a near-death experience! This is outright battricide, and a leading cause of early death.

3. They need to be be fed regularly (charged). Feed as soon as possible after a workout; they don't like to sit around starving after use. Batteries left sitting for days in an undercharged state develop a condition called sulfation.

4. Don't overfeed, or they get fat and have cumulative health problems and so die early. Chronic overcharging is a major cause of early death.

5. Don't underfeed, or they can starve to death. Chronic underfeeding also leads to a weak sickly battery and an early death.

6. Batteries can sit unused for months (hibernate) without needing to be fed. You don't need to put them on a trickle charger; just be sure to feed them occasionally so they stay near full charge.

7. They need fresh, clean water occasionally. Sealed batteries have a built-in watering system, but flooded batteries do not. Be sure to check water levels, and fill with distilled water as needed (dirty water poisons them!)

8. They need to be kept at reasonable temperatures, that you would find comfortable. Not too hot, and not too cold. Lead-acid batteries are "cold-blooded", so the lower the temperature, the slower they get. Likewise, they can't "sweat", so high temperatures cook 'em to death.

9. Batteries can't talk. They won't whine when they're hungry, or cry when you hurt them. You have to check their state of health with instruments, like voltmeters ammeters and (on flooded cells) hydrometers.

10. There are different "breeds" of batteries, each with its own good and bad points. Slow plodding workhorse floodeds are long lived. Racehorse AGMs are fast and powerful, but shorter lived. Using the wrong breed of battery for the application, or unrealistic expectations lead to disappointing results.

11. And some is just the "luck of the draw". For no obvious reason, after installing a set of identical batteries in a vehicle, some die young, and some seem to live forever.

The usual reason you see used EVs that say "needs batteries" is because the previous owner treated the batteries cruelly. Whether by ignorance or laziness, some or all of the above guidelines were violated. But batteries are replaceable, and it usually means you can get the EV "cheap".

But such problems can be cured. A little detective work to fix the problems, and then some tender loving care will go a long way toward getting the longest life possible on the next set of batteries.

Lee Hart's insights are gleaned from interaction with various issues interacted on the Electric Vehicle Discussion List.

SPARROWS - ANSWER TO UK DRIVING NEEDS

By David Bock, E2V, UK

THE future is here - and it's electric.
This lean, green, eco-friendly machine, one of only four in the country, could help stressed-out motorists beat the gridlock and get streets ahead. With a top speed of 80 mph, cheap running costs and easy parking, the Corbin Sparrow electric car could be that answer to drivers' prayers.

That's according to husband and wife team David and Barbara Bock, who run St Mellion-based E2V imports and build electric cars and scooters. Speaking at the Celebration of Innovation, at the University of Plymouth, Mrs. Bock, the company secretary, said the car could revolutionize jams on the country's roads.

"They are a lot cheaper to run, they are very green and from April the road fund tax is free of charge," she said. "They are easy to drive - it's just like driving an automatic."

The lime green mean machine, which has covered more than 2,000 miles, works off 13 batteries, which generate 156 volts. Because of Devon and Cornwall's hilly roads, the car's batteries need recharging every 35 miles, but Mrs. Bock said it was much cheaper than its petrol-guzzling cousins. She has calculated that the energy costs of the car's first 1,000 miles were just Pounds 5 [$7.60] - or 1/2p [$.007] per mile. To achieve the same results, an internal combustion engine car would have to cover 800 miles to the gallon.

The car retails at Pounds 8,500 [~$13,000], but the road fund tax is free, energy is cheap and it would never need an oil change, plugs, or antifreeze, although the batteries would need replacing every four years. In America, high-powered electric cars have reached speeds of 220 mph, but the UK speed record stands at 138mph.

left 1200amp Sparrow Hawke (no #), middle hand controlls (#007), right Mr. Blobby (#017), not shown Blue Bird (#010)

Mrs. Bock believes E2V is the only company in the country to import the cars and uses her own Sparrow to commute the 16 miles between St Mellion and Plymouth. So far, there are just four of the pioneering models in the UK and only about 300 in the world.

(The rest of this article is based off of email discussions on the yahoo sparrow group, http://groups.yahoo.com/group/sparrow_ev and direct interview with David.)

Review of the UK Sparrows:

The UK fleet of Sparrows consists of some very different configurations (vins xx, 007, 010, 017 and 018). All of them are the original tall-profile wheel jellybean-shaped models.

Mr. Blobby is the Red car, vin. #017 and is fitted with the new Curtis controller (runs a treat!). But the Curtis has caused the E-Meter to give a voltage rise under load of around 10-15 volts. Also, the speed now reads 'light-speed' when the accelerator is depressed. We now have a GPS fitted on the dash just to read speed, excessive or what. However the GPS does show max speed, average speed etc, so is useful for data gathering.

The next one is Blue Bird (Blue) car #010, fitted with a failing DCP600 but about to receive a new Curtis when we de-bug the problems the Curtis has caused to Mr. Blobby. 010 is running a DCP 600 amp controller. It's not the original unit, but is the controller from 018; the original had to be replaced due to blowing its capacitors.

010 is 2 years old and has been used nearly every day. The lady who owns her calls her blue-bird (as the car's electric blue) and loves it to bits. As with 018, it was supplied with the old 140-tooth rubber belt drive. We made adaptors to fit the larger pulley sets and made our own belt guards. A testament to the guard is both cars are running original belts that are as clean today as when they were first fitted. We did extensive work to manage the Sparrow leaks ducting the water into the lower battery bay and expelling it there.

Support from Corbin has been non existent after JJ left. The original dealer was no better except that we did manage to negotiate compensation for 010 that will see the owner need not worry about servicing cost for the car for the foreseeable future.

The final Sparrow is vin 018 was my company car. It was supplied with the controller sat on the seat, not installed! Due to another oversight it was also missing its dc-dc. The problem was basically that the UK dealer was a bike guy, not an EV guy. He had no understanding of the workings of EVs. It was also quickly apparent that the battery pack was damaged, it had been shipped plugged in BRB up and the dc-dc

originally installed had killed the pack. The company car 018 had logged around 4500 miles. Then it was donated to the European Green Energy Centre last year as their centerpiece. It runs the pack fitted at 80 miles range per charge (YT's). This Sparrow is still serviceable, but is on static display, sad to say.

The fast one is the Peter Sekowskey's Sparrow Hawke; (Green) no vin plate on this car so I'm not sure of it's #. Fitted with a "stonking" DCP1200 amp unit, awesome rear wheel smoking fun car, but also a belt eater, well the belt is only rated to 20KW not 180KW! The motor mount is positioned differently than the standard Sparrow, about 2" lower and 2" further back. The front wheels are wider spaced, I guess to give the car better high-speed tracking.

The last one is my company car, vin. 007. It has had a chequered history. Ecovec, who was setup as the UK Sparrow dealer, originally brought this car into the UK. They brought 12 cars in initially but had to return most of them immediately due to the controllers. 007 has a H2-400 Zapi regen controller. It is a micro based unit and is set to give 10% reverse speed, this makes reversing easier. Car 007 has factory and test miles only 54 to be exact. No extensive tests have been done on the car for range but the amps were no higher.

Car 007 was sold to a disabled chap with no controller fitted, the car was sent to us 'to get it working'. We had 'in stock' Zapi H2 controllers so we made the necessary mods and fitted one. I have in bits, car 007's original motor shipped wrongly timed and destroyed on delivery! The regen with the H2 is good and it's good to see the amps going back down hill. Regen is set to feel like light engine compression on high pedal so the car feels very natural. Range was never explored as it was also supplied with a dead battery pack. We have cycled the batteries up enough to do 10 miles but they need replacing.

Comments about controllers and problems with Mr. Blobby:

I have just fitted the new Curtis unit to 'Mr. Blobby ' and have noted that when the motor is driven, no load, the voltage appears to go up! This can't be right. Before I go spending a day looking for the reason I would be open to any ideas. On a separate note, the radio now works when the motor is driven, no load. The reason for the no load testing is that 'Mr. Blobby' is using a temporary rear swing arm that has a miss-formed bearing housing.

I have replaced the bearings but as they are in a poor housing they are not running freely. Also on a rolling road test the speedo seems to have now got a mind of its own. I've checked the sender is clean, I've reamed out the debris from the disc holes, but to no avail. I saw in the archives that someone fitted a suppressor capacitor and magnetic HF suppressor. I will try this unless there are any other ideas. The belt is running silently, thanks for the anodizing tip.

Comments about brakes:

The cars we have in Cornwall, England have

continued on page 19

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

It was a gray, chilly Friday morning (April 26, 2002) with the promise of sunshine as students, parents, teachers, school officials and volunteers gathered at the Harris Environmental Center in New Hill, just south of Raleigh, North Carolina, for the Final Event of the year-long EV Challenge program. Some teens stood sleepy-eyed and somber, others joked, laughed, and moved about – full of adrenaline – all waiting in line to sign release forms that would allow them to participate in the two-day activity. Young men and women dressed in everything from tee shirts and jeans, shorts and droopy pants to smart looking suits, hair coifed. On this first day of the Final Event, students would further realize the efforts of all of their hard work.

1st Place Overall - Northern Vance HS

With 85 school groups represented – 33 High Schools and 52 Middle Schools – this event is the largest of its type in the nation. While the 1990's saw its share of high school-based EV 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 year-long educational program that culminates and the Final Event finale.

Most noticeably, the EV Challenge features electric vehicle construction as its core learning experience. Whether it is Middle School students building model Junior Solar Sprint cars or High School students converting gasoline vehicles to electric, 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 they learn to do something about it. They study public speaking, English, and drama and become savvy public relations specialists. During the Final Event, participants are judged not only on how well their electric vehicle performs, but also on initiative and fundraising abilities, creativity, technical innovation, troubleshooting skills and knowledge, oral presentations, and design of a Web site devoted to their program.

"The EV Challenge is a program that integrates skills, imagination, learning, and a tremendous amount of initiative," says Harold Miller, the EV Challenge's assistant director. "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 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

North Vance HS EV entries

to help schools integrate EV Challenge activities into their school's educational program. The program also feature's 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 are a diversity of vehicles in this year's lineup, ranging from a white 2-door hatchback 1971 Datsun 240-Z to a red, white and blue 1989 GMC S-15 pickup truck to a sleek, black 1995 Ford Probe. 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 mechanics.

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 their Ford Escort. The result? It traveled 113 miles and finally stopped because the driver became tired! The car had plenty of juice left – enough to leave 15 feet of rubberized-pavement upon departing for its trailer. And, perhaps most impressive, one school built their Ford EXP for both range and speed – and took first place in the car class of both events!

In the Middle School program, the student's 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 student's 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 – "Wooden Wheel," "The Wedge," and "Lift-off" – give a hint at the student's design style.

Glamour of the vehicles 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.

Special thank you to Andrea Gabriel of the State Energy Office, North Carolina Department of Administration, for providing information for this article.

This article is a new feature called the "Education Corner." Information is geared toward those involved in EV education programs and written and edited by Eric Ryan. Eric has been in the EV education field for nine years as a teacher, consultant, and director of the EV Challenge.

lineup of solar sprint entries

Junior Solar Sprint Races

By Charlie Garlow

Junior Solar Sprint races fire the imagination "Watch these suckers zing!" said Joe Teach, middle school science teacher from an inner city Washington, D.C. School. Joe has been leading championship teams to the Junior Solar Sprint races for years now. His students build the shoebox sized solar/electric cars and race them down the 20-meter track. In the process, they learn about materials science [light but strong materials], aerodynamic streamlining, low-rolling resistance, gear ratios, solar photovoltaic effect and other science and math principles. Usually a little atmospheric chemistry gets thrown in as he talks about air pollution and global warming that come from gasoline cars. His students also have fun competing, jumping up and down with excitement. They win trophies and other prizes. They see the full size electric/hybrid/fuel cell cars on display at the NESEA Tour de Sol. Lots of learning going on here.

The Junior Solar Sprint contests are sponsored by local organizations all around the country. I recommend that our EAA chapters adopt this teaching module as a way to get students interested/excited about math and science, something that will benefit them for the rest of their lives. It is also a good way to get students and their parents/teachers interested in the electric vehicle movement and EAA. This is a low cost entry into the world of EVs. The solar panels cost $30 and the little electric motors cost less than $2. That makes this available to a lot more students than if they are trying to build an electric bicycle, motorcycle or car.

Visit http://www.nrel.gov/education/student/natjss.html and see who is running races in your state. If no one, call some one nearby and ask them how they got started. I got started by attending a race. The next year I was in charge. The helpful hints and instruction manuals on this web site make it an easy to adopt project. Finding students who want to compete was my major job. I wrote to the science teachers at the local middle schools and asked if they liked the idea. I volunteered to come to their school [taking time off from work] to get them started, bringing along one of the easy to build kits from Pitsco or Sun World. I also show off my electric pickup truck. I have a video from DOE about the Sunrayce which always gets "oohs" and "aahs" from the crowd because the vehicles look like space ships. Then I have a video on JSS races in Colorado [a real hotbed for JSS] so they can see other kids' cars and how the races work.

So, what are you waiting for? Adopt JSS as your local chapter's next project. Call or email me with your questions.

Charlie Garlow garlow.charlie@epa.gov
202-564-1088 ph

Ed: Charlie Garlow was recently appointed as EAA Committee Chair for JSS (Junior Solar Sprint) at a national level. He'll be leading the effort to expand JSS to other areas in order to reach middle school students nationwide for the EAA.

EVCO ELECTRATHON

By Darryl McMahon
Past Chair, EVCO Electrathon

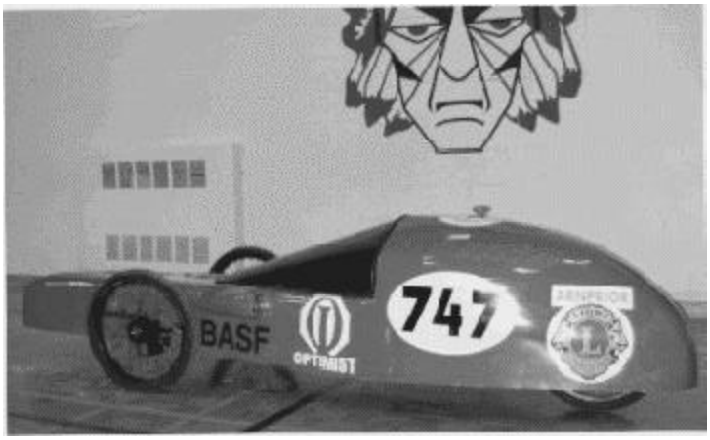
Well, it's not a VEVA report, but I thought this might be of interest to some anyway. On Saturday, June 8, the Electric Vehicle Council of Ottawa hosted its 5th annual EVCO Electrathon, at the Ottodrome International Speedway (3/8's mile paved oval track).

Thirteen Electrathon vehicles participated. Best vehicles covered close to 40 km in the hour. The fastest lap time recorded provided a speed of approximately 55 km/h.

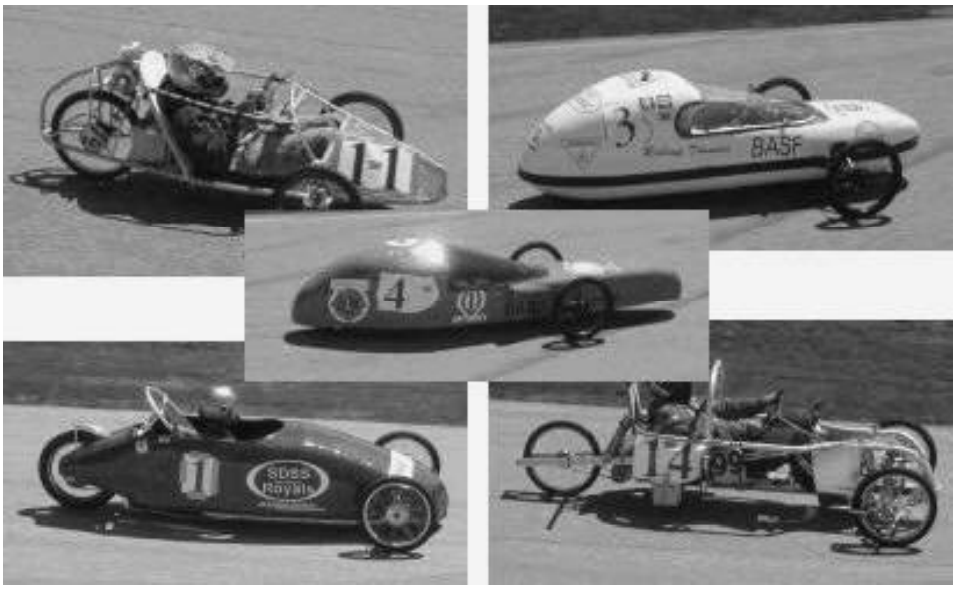
Sponsors and supporters included Hydro Ottawa, Ontario Power Generation, Econogics, Kiwanis (Riverside) Club, Exide of Canada, Co-operators Insurance, Motorsport Club of Ottawa (track officials), Institution of Electrical Engineers (tech inspection), St. John Ambulance, Radio Amateurs, Rideau Nautical Modelers (radio control model boat demonstration) and many, many volunteers, working both to stage the event and with the teams.

I think was the best Electrathon yet. Top five finishers were within 5 completed laps of each other. Driving strategy was evident throughout the hour (pacing, drafting, use of banked curves, timing passes), and several vehicles had enough juice left near the end of the hour that they were actually going faster at the end than at the beginning of the competition.

In addition to the Electrathon vehicles, we had a number of on-road and other EVs present, including the following from EVCO members: trailerable sailboat with electric auxiliary drive built into rudder, ElecTrak E15 electric tractor, Auranthetic electric motorcycle, Mazda RX-7 conversion, 2 x VW Jetta conversions, Ford Ranger conversion, Pontiac Fiero conversion (I hope I remembered them all), and (courtesy Transport Canada): Ford Ranger EV, Honda Insight hybrid, Toyota Estima hybrid, and (in my opinion the piece de resistance), a Nissan HyperMini.



All the on-road electrics were also demonstrated on the track after the competition was completed. Spectator turnout was pretty good (low hundreds) given the overcast conditions and short showers experienced during the day and the distance to the track from town main population. The facility is being upgraded significantly, and I am told the area being cleared to the east of the existing track is for an drag strip being built to satisfy NHRA rules. Hmmm, I wonder if NEDRA would like to have an event in Canada one of these days? (Slap, slap, stop that, I already have too many projects on the go.)



Results of the Electrathon highlights:

High School Electrathon Class Placings

1st Place (Trophy plus $100)
Arnprior District High School "Red Lightning" [#747] 64.75 laps (39 km)

2nd Place (Trophy plus $75)
Arnprior District High School "Rolling Thunder" [#01] 63.2 laps (38 km)

3rd Place (Trophy plus $50)
Courtice Secondary School [#38]
61.2 laps (37 km)

Open Class Placings

1st Place (Trophy plus $100)
"Propultron" [#46]
65.4 laps (39 km)

2nd Place (Trophy plus $75)
Giraph Protective Technologies [#G1] 60.0 laps (36 km)

3rd Place (Trophy plus $50)
Équipe Court-Circuit [#72]
54.1 laps (32 km)

Additional information on the race results can be found at http://www.econogics.com/ev/result02.htm. The official 2002 EVCO Electrathon web page is http://www.econogics.com/ev/otthon02.htm.

Mobile, AL MTS to Fast-Charge Electric Buses

The Metro Transit System (MTS) of Mobile, AL recently announced it has purchased two PosiCharger fast-charging units from Alabama Power to recharge four electric shuttle buses that service a route in downtown Mobile. MTS said the buses are able to return to service after a 10-minute break for recharging and then receive a full recharge at the end of the day.

"We've just begun to use the rapid charging and are still in the testing stage," said MTS general manager Bob Williams. "After operating a 10:30 a.m to 2:00 p.m. lunch hour service for the first four months of service, we recently started to use the rapid-charging units when our electric bus service moved to a full day (7 a.m. to 6 p.m.)"

Williams said MTS originally planned to test the rechargers for two months, but "initial equipment problems" have led to concurrent use and testing of the units.

MTS also said it is developing a bus recharge schedule and a back-up plan in case of technical problems with help from the Electric Transit Vehicle Institute. Williams said MTS hopes the PosiChargers will help reduce the number of buses in service from three to two until further testing has been completed.

MTS purchased the electric buses from Ebus with the help of a 20-percent local match from Alabama Power. [EVS IN TRANSIT: SPRING 2002, Mobile, AL]

Modesto, CA to Consider EV, Hybrid Use

Modesto, CA city councilman Bruce Frohman recently proposed that city legislators consider investing in alternative vehicles for future fleet needs. Frohman has recommended that one half of the new non-emergency vehicle purchases made by the city be electric or hybrid electric vehicles.

Modesto currently owns a hybrid electric Toyota Prius and has plans to purchase a diesel-electric bus. Additionally, Frohman purchased his own Prius in March.

"If we show leadership, people won't be afraid to follow," said Frohman. "When I bought my electric car [Ed: typical public misunderstanding of the electric-assisted gas-powered hybrid], I wasn't afraid to try something different."

Although Modesto is taking Frohman's suggestion into consideration, city operations and maintenance director Peter Cowles expressed concern about the cost and availability issues related to the proposal.

In a recent letter, Cowles told Frohman that Modesto "would feel comfortable" considering the purchase of 10 hybrid electric vehicles in the next five years. However, Frohman defended the recommended investment, citing the "social value of cleaning the air." [MODESTO BEE: 5/6, Modesto, CA]

Future Car Congress to Feature Ride and Drive

ESD The Engineering Society (www.esd.org) recently hosted the 2002

Future Car Congress, held June 3 to 5 at the Hyatt Regency Crystal City in Arlington, VA, which featured a ride and drive demonstration of advanced technology vehicles. The ride and drive toke place at the Turner-Fairbank Highway Research Center in McLean, VA.

According to ESD, congress attendees will have the opportunity to test-drive the newest advanced technology vehicles on a closed-circuit course.

Among the vehicles to be featured at the ride and drive are the hybrid-electric Toyota Prius, the Toyota RAV4 all-electric sport-utility vehicle, the Toyota Highlander fuel cell vehicle (FCV), the hydrogen-fueled, internal combustion engine Ford H2 ICE, the Ford Hydrogen Focus FCV, the Ford Focus diesel vehicle, the Hyundai FCV, the Honda FCX-V4 FCV, the Mercedes-Benz hydrogen-fueled A-class Necar 4 compact car and Sprinter light van, and the Mercedes-Benz methanol-fueled A-class Necar 5.

ESD said the ride and drive will begin with a media and government preview on June 2 from 12:00 p.m to 4:00 p.m. The ride and drive will be available from 1:00 p.m. to 3:00 p.m. on June 3 and 4. [EIN PUBLISHING, Alexandria, VA]

Cree Readies Launch of Three-Wheeled EV

Swiss designer Creation Research Engineering and Ecology (Cree - www.cree.ch) recently announced it is developing a three-wheeled electric vehicle (EV) for introduction in Europe next year. Cree said the 3.1-meter long by 1.5-meter wide "Sam" EV is ideal for city driving because it combines the usefulness of a small car with the convenience of a scooter. Tthe Sam can achieve a a maximum speed of 85 kilometers (km) per hour, and has a range of up to 70 km on a full six-hour charge.

According to Cree, the Sam motor gathers most of its power from the kinetic energy generated by such standard vehicle activities as braking and downhill driving. The company said Sam's lightweight polyethylene and aluminum construction also help reduce energy use.

Cree chairman Daniel Ryhnier said the Sam is also 90-percent recyclable, but stressed that the environmentally friendly features of the vehicle are not its only selling points. "We know that if you want to create a product that is a commercial success, then issues of price and the way it fits into people's lifestyles are just as important," said Ryhnier.

Cree said it is currently incorporating feedback from Swiss drivers of Sam prototypes and hopes to begin mass production of the vehicle in 2003. Ryhnier said the company aims to sell "tens of thousands" of the Sam in Europe at a cost of approximately 4,300 pounds (about $6,270). [THE ENGINEER: 5/15]

Electrovaya, CAMI Partner to Develop ZEVs

Electrovaya, Inc. recently announced it has signed a memorandum of understanding (MOU) with CAMI Automotive, Inc. to develop zero-emission vehicles (ZEVs) utilizing Electrovaya's power and control technology in CAMI's sport-utility vehicles (SUVs).

"Each party provides its expertise in the development of [ZEVs]," said Electrovaya CEO Sankar Gupta. "Together, we will drive the pace at which this technology can become a commercial reality." Electrovaya said vehicles powered by its lithium-ion SuperPolymer battery achieve "unsurpassed" range as well as reduced operating and maintenance costs.

"CAMI is a leading producer of small SUVs, and we are delighted to have a CAMI-built vehicle used by Electrovaya to develop clean, green SUVs for our global customers and to respond to existing global environmental needs," said CAMI president Simon Boag.

Electrovaya develops, manufactures and sells products using its SuperPolymer battery technology. CAMI, a joint venture between General Motors of Canada, Ltd. and Suzuki Motor Corporation, builds the Chevrolet Tracker and the Suzuki Vitara. [PRNEWSWIRE: 5/22]

EV Rental Weathers Attacks, Looks to Future

Following the terrorist attacks on September 11, 2001, many rental car companies experienced a significant drop in rentals, placing some businesses close to bankruptcy. However, officials with environmental rental car firm EV Rental Cars (www.evrental.com) said the company has weathered the drop in business and is considering plans to expand.

The company, which rents a variety of all-electric, hybrid electric and natural gas-powered vehicles, said it plans to add 100 low-emission vehicles to its fleet later this year. O'Day said the company will purchase a number of Toyota Prius hybrid electric vehicles (HEVs) and Honda Civic HEVs. In addition, the company said it is considering buying low-speed neighborhood electric vehicles (NEVs) for use in urban areas. O'Day said EV Rental is currently discussing the NEV purchase with officials from DaimlerChrysler and Ford.

However, the company noted it does not expect to purchase many highway-capable, battery-powered electric vehicles (EV), citing limited EV production from major automakers and inadequate public charging facilities. [EV NEWS: APRIL 2002]

continued from page 13

all required a rebuild of the brakes. This started as car # 017 park brake was not reliably releasing. On inspection the actuation piston (a bullet shaped push rod) in both fwd and rear caliper had been installed incorrectly, the wrong way around. Whilst we had the brakes apart we took the opportunity to service them and removed a rubbery backing from the hydraulic brake pads backs. This was melting when the brakes got hot and caused the brake piston to become stuck. The rubber was also absorbing the release movement in the piston. I am informed the rubber backing is used to stop the brakes squealing. This can also be achieved by using a copper grease (heat proof grease) on the rear of the brake pad, important, do not get grease near brake surface parts, if in doubt seek professional help.

The park brake calipers are 'floating' calipers and as such they should move freely, dirt and oxide (rust) would cause the 'floating' mount to stick and will contribute to a sticky brake! The rear brake assembly is subject to much derby punishment and will require regular servicing. Luckily this is reasonably easy as with the rear wheel off all the part are to hand.

We have also had a problem with the park brake cable being too short. This was compounded when we fitted the new reduction gear as the swing arm needed extending. With the rubber compound removed and the brakes serviced the cars should roll freely, note should! car # 017 has a seized rear wheel bearing. Whilst the bearing is a stock item (we have the new bearings sat on a shelf) the bearing seized due to being fitted in a warped housing and with excessive heat (we suspect during assembly the bearing was fitted then components welded, high heat, melted grease). Just need a replacement swing arm to get #017 back in action, well apart from.....

DC Motor advancing:

As long as the motor is advanced in the correct direction it will be more efficient in that specific direction when running at speed, read over 2000rpm. However in reverse care must be taken to ensure you only apply low speed. The lead angle can be around 10-13 deg.; it's worth noting that the ADC motor is timed from stock for CCW rotation. They should be retimed 'from Corbin or ADC ' for CW rotation or neutral. Its easy to do but don't start if you're not sure!

You will know if the timing is wrong, the brushes will arc excessively and commutation will be noisy. You may even get a bang as the brushes try to arc over! If your motor is advanced timed correctly I'd be inclined to leave it, that is unless you plan some high speed reversing with the Sparrow.

EV collection, including Tiger Cat E1, second from the right.

Blue bird had this on delivery, we replaced the motor and examined the original (delivery miles only) to find a burnt brush set. It has been suggested that there was a timing problem with the motor but I cannot comment on that. The motor only did have the same symptoms however. We had stock of ADC motors and changed the motor, all has been well ever since.

We have a better belt guard that has ensured that the remaining UK cars, only 2 now in regular service, are still on original belts. They are cars 010 and 018, or Blue bird and Mr. Blobby. The key is to stop tyre debris spraying on to the belt. Our guards were fabricated from stainless steel, attached via the swing arm bolts and a swing arm strap and cover the wheel side, top and bottom of the belt from motor to rear sprocket (covering around 1/3rd of the rear sprocket.

They were a 2-part making installation possible with relative ease.

Going the distance:

what you need is a proper battery load tester. Ask your local battery company if they would let you hire one. The one we have clips to the battery and then switches in a 50 amp resistive load. It displays the battery voltage under load and it is quick to show up duffers as they show determination in battery voltage.

Another note, Mrs. G has just booked Blue Bird in for its 3000-mile service. The car is running very well and is on its original batteries and belt. She uses it daily for shopping and bowling and loves her a lot! Blue bird is one of the real early cars 010 from memory. The only thing she wants sorted is a sticking beam dipswitch. The carpet moving causes this. Hers can be removed so has a tendency to shift.

Any one around the UK who would like an early bird should visit our site as we have an early jellybean with 54 miles gathering dust.

Web page is www.e2v.co.uk and David can be reached at david@e2v.co.uk

Interview with Rob Wills, Tour de Sol Technical Director

By Michael H. Bianchi, copyright 2002

Every year I look forward to an interview with Rob Wills. I learn some details I missed and a few behind the scenes stories.

"It was a really great Tour. We did a lot of miles, saw a lot of cities, a lot of EVs. It was a small crew this time, but I think everyone came together and got to know each other more."

The Tour gave the Most Innovative Vehicle award to the turbine hybrid-electric bus from Advanced Vehicle Systems. How did that come about? "I think the AVS bus was great. It is a very clean, series hybrid with the micro-turbine generator running into the battery, and then the battery running the drive system. I think that's a model for lots drive trains for the future. The best thing about it is that it is running on conventional (diesel) fuel and could be widely adopted quickly. It has very good performance. It looks like it works very well. I could see that some people could complain about the turbine whine." Is it true noise level? Or is it that the bus is so quiet that relative to everything else it is noticeable? Traditional diesel buses are horribly noisy. "It's probably lower sound pressure, but it's around 3 kilohertz pitch which tends to go right through you if you are near it for a long time. You don't notice it when you are walking by." And since the bus has significant pure-electric range, the turbine would tend to be used on the highway more than in stop and go traffic.

Another noticeable entry was the "Electric Blue" from Team New Jersey. "Their fuel cell system was good to see. That was a very good demonstration. Let's hope we have more development on that front in the future. I think most people in the fuel cell industry agree that the fuel cell is not the hard part. The hydrogen infrastructure and storage is the hard part. Whether you do a reformer, high-pressure tank, or a Millennium Cell type of device, it's still a lot of extra work and equipment that's needed. When I started working with the hydrogen community 10 years ago John Bockris at Texas A&M and others who identified the benefits of the `Hydrogen Economy', it seemed like it would be 50 years in the future. But the government is saying that hydrogen looks like the answer. That is the quantum leap that we saw was needed but thought was unlikely to occur. With a little luck we will have systems like Millennium Cell and other methods of storage that are safe, eco-friendly, and earth friendly."

Rob was surprised that there were not more private entrants driving the commercial hybrids. "For most people it comes down to time and money. To take a week off and do this event is asking a lot. So something that I have been considering is to have a weekend drive-in for hybrid owners. That would be a really exciting thing." Maybe they could do an Autocross? An efficiency run with checkpoints and predefined leg times? Large groups can watch and it happens in one place. "Maybe have the cars come in on a Friday night, doing something mainly on Saturday and then have folks leave on Sunday to drive home. That would make it very practical for many people in the Northeast to do in, say, Washington or Annapolis. Most hybrid owners have a strong ecological ethic and might go out of their way to make their message known." They voted with their feet and wallets already. This would just be another step.

"Summing up."

"What makes a good Tour de Sol? The cars go from the beginning to the end and everyone comes in safely. For the first time in a Tour de Sol we had an accident where a vehicle was damaged, not due to the team. They were rear ended by someone else driving at considerable speed; purely operator error on the other person's part. The vehicle was not badly damaged. There was no acid leakage from the batteries. The folks driving the EV were OK. We can be thankful for that. In the end it showed the robustness of their vehicle. They had done a really good job in their design and construction."

"We also had good team spirit. A number of times I saw people pitch in. One case was when the rear-ended car came back to the charging area. There were about 10 people working on it until 1 o'clock in the morning. Another one like that was when the tent over the charging trailer blew away in Washington. There were 15 people, mainly the NHTI (New Hampshire Technical Institute) team, that just pitched in. The tent was reconstructed and up before you knew it."

"The West Philadelphia team was just brilliant and so much fun. And `Soljourner 1' beat out the `Solectria Super Force' in efficiency. Some were convinced that the Soljourner numbers were wrong and they could not be achieving less than 190 Watt-hours per mile. But the third day results, with 190 Wh/m again, clinched it." Is it possible the high-voltage pack has something to do with it? I-squared times R? "Yes. I think that is good for 5 to 10 percent, especially at higher loads. And the controller can be more efficient. It turns out that 400 Volt batteries can work ideally with 600 Volt IGBTs (Insulated Gate Bipolar transistors). If you go to lower voltages the chances are you have different technologies in the controller."

"Finally is the educational aspect. You only have to look at our stop in Philadelphia, which I think was the highlight from that viewpoint. Lots and lots of people learning about electric vehicles and a cleaner environment."

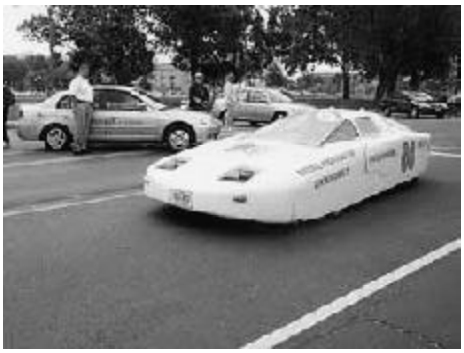
Complete reports can be found at: http://www.AutoAuditorium.com/TdS_Reports_2002

Vehicles displayed at stage in Trenton, NJ

The Soljourner 2 hybrid-electric

The Sungo with NiMH batteries

The Soljourner 1, W. Phil. High School
(photos by Eddie Calis)



The Viking 23, Western Washington Univ

The Super Force with battery trailer

The Solar Black Bear pickup with solar

The rEVolutionaryride VW vanagon

The E-Stream VW conversion

The SunPacer

NESEA Announces Tour de Sol Winners

The Northeast Sustainable Energy Association (NESEA) recently announced the winners from its annual Tour de Sol "green" transportation festival. The tour features a "real-world" road test on a 300-mile course stretching from Washington to New York.

NESEA awarded this year's prize for the greenest light-duty vehicle in the "production" division to both the Honda Insight entered by the Bedminster, NJ-"Drive to Work" team and the Toyota Prius entered by Tulsa, OK-based S&S Auto Sports. The association said both hybrid electric vehicles demonstrated an average of 55 miles per gallon (mpg) on the course and a 55-percent reduction in greenhouse gas (GHG) emissions compared to today's average new cars.

NESEA presented the award for greenest light-duty vehicle in the "prototype" division to a battery-electric Saturn entered by West Philadelphia High School, which achieved the equivalent of 180 mpg and a GHG reduction of almost 80 percent.

The award for the greenest vehicle overall went to the Climate Cooler II, an electric-powered motor scooter entered by a team from the United Nations Environment Program. NESEA said the scooter demonstrated the equivalent of 280 mpg and a GHG reduction of more than 85 percent.

While a number of the vehicles that participated in this year's tour are currently on the market, others were "one-of-a-kind" prototypes that offered a preview of the types of fuels and energy efficient vehicles that may be available in the future.

"The greatest news from the tour this year is that these cleaner vehicles are out there on the market and folks can buy them right away," said tour organizer Nancy Hazard.

Summary Trip Report

1st EVer EAA Chapters meeting in Washington DC/Philadelphia
By Ron Freund

May 14-15, 2002

During the last year, the EAA Board has searched for ways to unify the various chapters that are officially affiliated with the national organization. We concluded that in the past our organization has been viewed as "California-centric" since the founding chapter was located there and most of the active chapters are located in California, yet we needed to become more global. So, with significant help of the EVA/DC Chapter and coordination by Jerry Asher, the EAA organized and executed the first All-Chapters meeting on the East Coast of the USA. Four West Coast EAA members - Ron Freund, Ed Thorpe, Terry Wilson (all three Board members) and Lou McMillan - left the San Francisco Bay Area to meet with other EAA members in the East[1]. We met with the players, made face-to-face acquaintances and listened to what they had on their minds. Several new and rejuvenated Chapters were present or represented, and we learned a lot.

Day 1 – Tuesday, May 14

The activities were centered around the 2002 Tour de Sol (TdS) kick-off on the Capitol Mall, and the Department of Energy sanctioned Junior Solar Sprints (JSS). Each team illustrated the grand effort involved in creating the various TdS alternative fuel powered vehicles were on display at the Mall. In addition to the academic and community-based projects there were also some commercial hybrid electric cars entered. Vehicles ranged in size from buses to odd three-wheeled Twikes' and mopeds. Michael Bianchi summarized each teams entry beautifully and posted them to the Internet via the TdS website and EV Discussion List (EVDL). For as long as we can recall he has performed this role for the past TdS events[2].

The Junior Solar Sprints attracted scores of Middle School children, who shrieked with excitement and cheered on their teammates. The double elimination races of these hand-built model solar cars were held under mostly clear skies, but with very gusty winds. Nothing could interfere with the determined winners present, not even this cross wind.

The TdS event was launched with speeches presented by various government and industry representatives. The environmental leaders from the Northeast Sustainable Energy Agency (NESEA) congratulated and encouraged the participants of the Tour. Aside from Honda providing their new Civic Hybrid as the pace car, the only automaker represented for alternative fuels was Daimler/Chrysler.

All of these activities at the TdS kick-off and the Junior Solar Sprints illustrate the kind of early involvement that can make a significant difference in a child's life, providing a connection to a larger movement that the EAA would like to embrace. In the next few months, we would like to leverage from the experience and expertise of the EVA/DC members for deploying information kits to other Chapters. These kits will enable Chapter members to approach school science and physics teachers or PTAs to spread the word about Junior Solar Sprints nationwide. The EAA wants to appeal to our membership, asking them to help us reach out to encourage and stimulate a whole new generation to vision of electric vehicles.

After a light lunch (courtesy of the EVA/DC Chapter) we gathered with assorted EAA members strolled over to the Department of Energy (DOE), passed their security checks and gathered in one of their conference facilities. As part of the agenda, the meeting was 'web cast' (a live broadcast over the internet, with both video and sound) by Ed Thorpe, with tools provided by Bruce Parmenter, our Tech guru. This enabled remote EAA members with a computer and Internet connection could participate in this live Event. Beside over two-dozen members in the conference room we had participation by nearly a dozen members via this web cast from all corners of the country, watching, listening, and placing questions. A total of fourteen Chapters were represented throughout the activities. EAA Board and EVA/DC Chapter member Jerry Asher welcomed participants and moderated a "round-the-table" introduction of all attendees. We heard from Phil Patterson DOE who addressed the question Dave Goldstein presented to us all: what has the EAA and the EV movement accomplished and where are we headed. Ron Freund (EAA Chair and SJEAA Chapter member) spoke briefly giving a technology overview on the progress of the "state of the EV art" for the past 35 years, and where we should be heading. One goal was sited: "to increase membership to 2500 in 2005", in all fifty states and into Europe, Australia, Central America and elsewhere. Then we opened the floor, listening to various suggestions and ideas, wants and needs from Chapters and individual members. It was enlightening.

What did we learn? Above all, there remains a strong need for more new talented and willing individuals to step up to assist in the Board with our cause. Communication between Chapters needs to be cultivated and encouraged. We have been solving the same problems repeatedly and independently all over the country, when we should simply leverage from best practices and the wisdom of others who have "been there and done that". To grow, we need funding. Perhaps we need to apply for Federal government grants. To do that, we need experienced grant proposal writers. An idea was hatched during our brief visit to encourage the Junior Solar Sprints to expand nationwide with the help of EAA Chapter volunteers. Someone needs to champion that effort to mobilize Chapter resources. Many other issues were discussed. Above all, we need to break down the walls that have separated different organizations in the past and join forces, walking in lockstep. Different EV clubs and user groups (such as the EV-1, Honda EV+, RAV4_EV owners, non-affiliated clubs) all need to band together to help educate the public and correct the various lingering misconceptions people have about EVs.

We adjourned and headed to the northern Washington area to the very beautiful Takoma Village common area, for an excellent supper and further break out sessions on selected areas of interest. Some of the topics were Junior Solar Sprints, EV components, battery and manufacturer development history, and various forms of EV racing. The "networking" began, and much more information was exchanged, and

Jerry, Terry, Lou and Ron enjoy the activities. (Ed Thorpe)

EAA Group pose with GM EV1 & Toyota RAV4 EV (Ed Thorpe)

Ed Thorpe introduces web casting at the DOC conference room. (Ron Neighbour)

this continued for well into the evening.

Exhausted, the four West Coast representatives retired, in preparation for the next day's activities. We were hosted to stay at the residences of generous East Coast members in the greater Capitol area.

Day 2 – Wednesday, May 15

The next day's activity was to travel up to northwestern Philadelphia. Ron and Terry were chauffeured in Dave Goldstein's car after picking up our guest speaker, Bob Beaumont, of CitiCar and Tropica fame. During the three-hour drive, we enjoyed hearing him recounting his early efforts as an EV pioneer. Dave provided his copy of Barbara Taylor's "The Lost Cord", which

EVA/DC Chapter tent at the Mall, and setup of solar slotcars. (Rob Neighbour)

Dave Goldstein reflects on the history of battery EVs. (Rob Neighbour)

Jerry Asher at the the Boyertown Museum.

Participants listen as Paul Hafer describes the Boyertown Museum. (Ed Thorpe)

chronicles his history, as reference. Since this book is now out of print, we expressed interest in a second printing, which Bob said he would consider. This book provides a candid snapshot of this EV giant, documenting wonderful insight into his character and his approach begun nearly 25 years ago. (A must read for EV enthusiasts).

Our destination was the Boyertown Historic Automobile Museum, where we received a complete tour, viewing what is purported to be the largest collection of turn of the (last) century electric automobiles in the world. We met with the 91-year-old son of the original Boyertown Bodyworks Company, Mr. Paul Hafer (now Chairman of the Museum) and listened to a wonderfully informative slide presentation by Museum Director Mr. Guy L. Davis, after a catered banquet dinner.

Finally we heard our featured guest speaker, Bob Beaumont. Again the EAA provided web casting, but the attendance now was sparser possibly due to our delay in getting started. After the most interesting and entertaining glimpse into the trials of competing with the big automakers, we loitered only briefly, said our good byes and shuttled Bob Beaumont back to his home. The next day we traveled back to the Bay Area, tired but enriched and more determined to make the EAA grow and prosper.

[1] Note: This team traveled at their own expense. No EAA funds were used. The organization provided EAA/DC with $500 as seed money to coordinate logistics for the two days of events.

[2] These reports can be accessed at http://www.FovealSystems.com/Tour_de_Sol_Reports.html. Some TdS reports and photos have been published in previous issues of Current EVents (CE).

We rode between the two museum sites in this Althouse electric truck!

1915 Althouse EV truck, converted to bus. (Ed Thorpe)

Bob Beaumont - creater of the CitiCar (aka Comuta-Car) and the Tropica, with "The Lost Cord". (Rob Neighbour)

CitiCar, among the extensive collection of EVs. (Ed Thorpe)

Tom Dowling – New Appointee to of EAA Board for position of Charging Infrastructure Liason

My interest in becoming an EAA Board member:

I've had a life-long interest in electric propulsion for vehicles, starting with a fascination with electric trolley buses and streetcars. In addition to my membership in the EAA, which goes back several years (former member of Sacramento group, SEVA), I am a member of the Bay Area Electric Railway Association. I am also a member of the EV Infrastructure Stakeholder Working Group for the California Air Resources Board (CARB).

My spouse and I have two GM EV1s, and our contractor son now has our Ford Ranger EV. We have a RAV4 EV on order. We love driving electric, and we've driven about 85,000 electric miles in the last four and a half years.

One of my other hobbies is electrical work. I'm quite familiar with electrical codes and practices, and I have done a fair amount of permitted and inspected residential work. I have a long career background in Information Technology (what used to be called Data Processing), and I maintain a Web page for EV charger information.

My goals and personal focus for EAA:

My personal goal and focus is to promote, develop, publicize and maintain public EV charging infrastructure. I'm a frequent user of EV charging infrastructure, and I have taken several long trips with my EVs, and plan to take more. I intend to do extensive further development of the EV Charger New Web site, although I wish to keep it independent of any organization. I will continue to work on initiatives in the following areas:

- Support the ZEV mandate.
- Provide drivers with up-to-date and accurate information on the location and status of charging stations.
- Promote and publicize charger-sharing protocol.
- Get more locations installed.
- Ensure that existing locations are properly maintained and signed.
- Reduce problems caused by parking of non-EVs at chargers (including support of pending legislation).
- Replace more large-paddle inductive chargers with small paddle.
- Support and promote the eventual conversion to the conductive standard.
- Promote methods of taking long-distance trips in EVs.
- Promote the EAA's Avcon inlet product.

Note: We are extremely pleased to appoint Tom and want to encourage other Chapters to "tap" his expertise. Though currently focused on California, his best practices can be leveraged elsewhere. Check our website for an email alias that will properly forward your messages to him. Welcome aboard!

EAA Board Elections

By Bill Carroll

Elections... something that is with us always. Each year it seems that there is an election held for our national board. This is easily explained... Our national board is set up so that there will always be a cadre of people who know what is in the works for our organization. Each seat on the board is for a three-year term and the terms are staggered meaning that at least one but no more than three seats are up for election at any one time.

This year there are three seats open, two three-year terms and one two-year term, so that the next thing for the membership to do is come up with some candidate nominations. Let me point out something that has bothered me in the past, "it seems that board members were elected because they had much experience in electric cars", owning an electric car is not a requirement to serve on the board. What is needed is willingness to serve. There are many jobs to be filled by board members, and delegates alike, (that is something else we still need delegates from the chapters, at the present time we have 1 (one) we need more. Being a delegate will insure that your chapter will be in on the know of what is happening nationally.

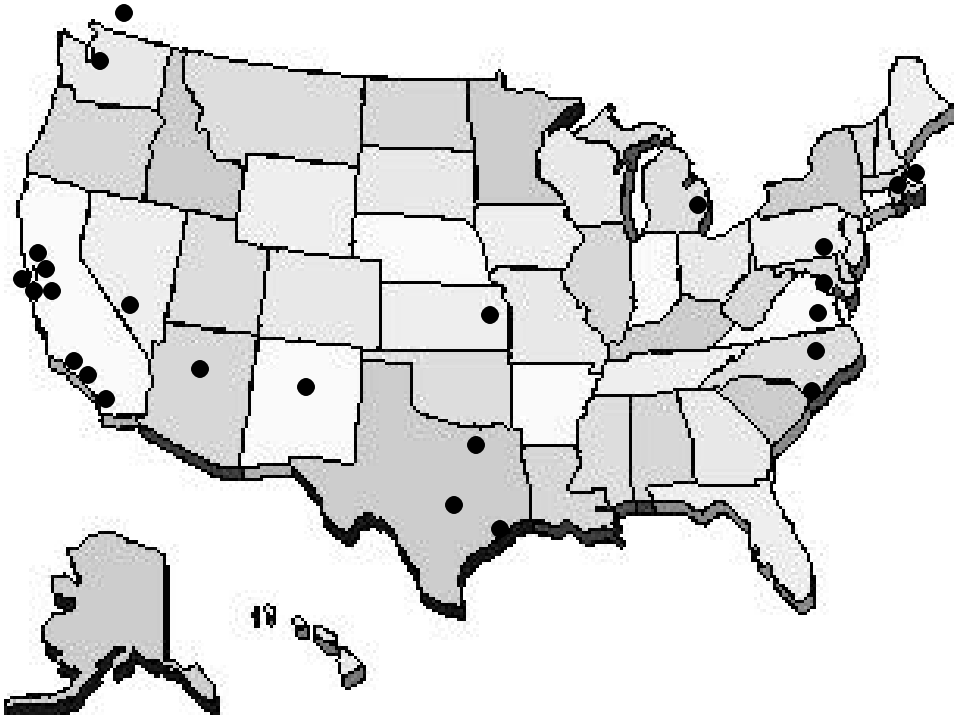
My request is this time is for candidate's statements to be placed in the CE so the membership will know a bit about the people who are willing to serve on the board.

Candidates can send statements to our membership chairman, Will Beckett use either e-mail or snail mail to his address as listed in Current Events.

Election Committee, chair
Bill Carroll
electionadmin@eaaev.org

View of a typical EAA Board meeting, one end of the table (Ed Thorpe)

25 ACTIVE CHAPTERS



CANADA

VANCOUVER EVA *(updated)*
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 Operator's Lounge

UNITED STATES

ARIZONA

PHOENIX EAA
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

EAST (SF) BAY EAA
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: Alameda First Baptist Church, 1515 Santa Clara Ave, Alameda, CA

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

NORTH BAY EAA *(updated)*
Web Site: http://geocities.com/nbeaa/
Contact: Dr. Nick Carter, 1-707-573 9361, nick@npcimaging.com
Mailing: 3000 Cleveland Avenue, Suite 209, Santa Rosa CA 95403-2117, USA
Meetings: 2nd Sat./month, 10:00 am.
Location: Call for meeting details.

SAN DIEGO ELECTRIC VEHICLE ASSOCIATION
Web Site: http://home.att.net/~NCSDCA/EVAoSD/
Contact: Chris Jones, 619-913-6030, NCSDCA@WorldNet.ATT.net
Mailing: 315 South Coast Highway 101, Suite U44, Encinitas, CA 92024-3543, USA
Meetings: 4th Tues./month, 7:00 pm
Location: San Diego Automotive Museum, 2080 Pan American Plaza, Balboa Park, SD

SAN FRANCISCO PENINSULA EAA
Web Site: http://geocities.com/sfpeaa/
Contact: Bill Carroll, 1-650-589-2491
Mailing: 160 Ramona Ave., San Francisco, CA 94114-2736, USA
Meetings: 1st Sat./month, 10:00 am
Location: San Bruno Public Library, 701 West Angus St., San Bruno, CA

SAN JOSE EAA
Web Site: http://geocities.com/sjeaa/
Contact: Mike Thompson, m.t.thompson@ieee.org
Contact: Roy Paulson, 1-408-997-2404
Mailing: 1592 Jacob Ave., San Jose, CA 95118-1612, USA
Meetings: 2nd Sat./month, 10:00 am
Location: Reid-Hillview Airport, 2350 Cunningham Ave., San Jose, CA

SILICON VALLEY EAA *(updated)*
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: Hewlett-Packard Corp., Lobby A Auditorium, 3000 Hanover St., Palo Alto, CA

VENTURA COUNTY EAA *(**new**)*
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 and meeting schedule

KANSAS / MISSOURI

MID AMERICA EAA *(updated)*
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.

MASSACHUSETTS

NEW ENGLAND EAA *(updated)*
Web Site: http:/neeaa.org/
Contact: Tony Ascrizzi, 1-508-799-5977, eaa@maeaa.org
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 *(update)*
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: Jones Library, 43 Amity Street, Amhurst, MA.

MICHIGAN

DMC-EAA Detroit MotorCity Chapter *(updated)*
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 and meeting schedule.

NEVADA

LAS VEGAS EVA *(updated)*
Web Site: http://geocities.com/lveva/
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: Clark County Library, 1401 E. Flamingo Rd, Las Vegas, NV

NEW MEXICO

ALBUQUERQUE EAA
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: Shoney's Restaurant, 6810 Menaul NE, Albuquerque, NM

NORTH CAROLINA

EAA OF COASTAL CAROLINAS
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 *(updated)*
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.

PENNSYLVANIA

EASTERN ELECTRIC VEHICLE CLUB *(updated)*
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
Meetings: 2nd Wed./month, 7:00 pm
Location: Plymouth Whitemarsh High, 201 E Germantown Pike, Plymouth, PA

TEXAS

AUSTIN AREA EAA *(new)*
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 and meeting schedule.

HOUSTON EAA *(updated)*
Web Site: http://www.bwsoft.com/eaa/
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: The Citizen Environmental Center, Rm 280, 3015 Richmond Ave., Houston, TX

NORTH TEXAS EAA *(updated)*
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
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: Richmond Technical Center, Westwood Ave., Richmond, VA

WASHINGTON

SEATTLE ELECTRIC VEHICLE ASSOCIATION
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
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: National Institute of Health (NIH), Building 31-C, 6th Floor, Bethesda, MD.

Listing updated, verified and current as of 06/15/02.

The Electric Auto Association 501 (c)(3) nonprofit

Board of Directors 2002

Chairman
Ron Freund
chairman@eaaev.org

Vice-Chairman EAA Membership
Will Beckett
membership@eaaev.org
1-650-494-6922

Secretary
Scott Leavitt
secretary@eaaev.org

Treasurer
Gabrielle Adelman
treasurer@eaaev.org

CE Publications
Ed Thorpe
contact@eaaev.org

EAA Historian EAA Awards
Terry Wilson
historian@eaaev.org

EAA Technology
Bruce Parmenter
webmaster@eaaev.org

EAA Chapter Relations East
Jerry Asher
ChapterRelationsEast@eaaev.org

Delegates:
Bill Carroll - *Board Elections*
electionadmin@eaaev.org

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

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

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

EAA Membership contact:
membership@eaaev.org 1-650-494-6922

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.

CALENDAR OF EVENTS

June 1, 2002

TANFORAN RALLY, San Bruno, CA, USA
Annual SFPEAA's Rally..
Web Site: http://geocities.com/sfpeaa/

June 8, 2002

REV!2002, Vancover, BC, Canada
Annual VEVA electric vehicle show and test-ride event.
Web Site: http://gwinfo.dhs.org/rev2002/

June 29, 2002

POWER OF DC - "AMERICAN AMPS", Mason Dixon Drag Way, Hagerstown, Maryland, USA
2nd annual electric vehicle drag races.
Web Site: www.powerofdc.com

July 4, 6 & 7, 2002

FESTIVAL FOR THE ENO, Durham, North Carolina, USA
TEAA EVs display.
Web Site: http://www.rtpnet.org/teaa/

July 4, 6 & 7, 2002

GASLESS AT THE CROSSROADS, Seattle, Washington, USA
SEVA EVs display.
Web Site: http://slough1.home.mindspring.com/seva.html

July 21, 2002

FEDFLEET2002, Kansas City, Missouri, USA
Annual workshop of the National Federal Fleet Managers. Forum for fleet professionals and private fleets.
Contact: FedFleet 2002
Phone: 202/501-1777
E-mail: vehicle.policy@gsa.gov.org

Aug 3, 2002

NEDRA NATIONALS, Woodburn Drag Strip, Woodburn, Oregon, USA
Annual national electric drag races.
Web Site: www.nedra.com

Aug 24, 2002

EVEAA ANNUAL DISTANCE RALLY, Concord, California, USA
25th+ annual EV distance and public awareness rally.
Web Site: www.geocities.com/ebeaa

Aug 24, 2002

OEVA'S EV AWARENESS DAY, Portland, Oregon, USA
Annual EV public awareness rally.
Web Site: www.oeva.org/

Sept 1, 2002

NEDRA NATIONALS, Woodburn Drag Strip, Woodburn, Oregon, USA
Annual national electric drag races.
Web Site: www.nedra.com

Sept 4-5, 2002

42 VOLT AUTOMOTIVE SYSTEMS: STRATEGIES FOR SUCCESSFUL IMPLEMENTATION AND COMMERCIALIZATION, Cleveland, Ohio, USA
Conference focused on the converging market and technical trends in automotive electrical system design as they relate to the transition of vehicles from 14 to 42 volt batteries.
Contact: Intertech
Phone: 1-207-781-9800
Fax: 1-207-781-2150
E-mail: info@intertechusa.com

Sept 21, 2002

SVEAA ANNUAL ELECTRIC CAR RALLY, Stanford, California, USA
30th annual Premere West-coast EV rally.
Web Site: www.becketts.ws/eaa/rallyinfo.htm

Sept 23-25, 2002

2ND MICHELIN CHALLENGE BIBENDUM, Paris, France
Second road challenge of clean fuel vehicles, from Hockenheim, Germany to Paris, France.
Contact: Ron Musgnug
Phone: 1-864-458-4588
Fax: 1-864-268-3374
E-mail: rcm324@aol.com
Web Site: www.challengebibendum.com

Oct 4-5, 2002

NORTHAMPTON ELECTRIC VEHICLE RALLY, Northampton, North Carolina, USA
7th Annual road rally and autocross, the kickoff event for the 2002-3 EV Challenge
Email: johnsond.east@ncs.schoollink.net
Telephone: 1-252-585-0627

Oct 8-10, 2002

NGV 2002: CLEAN TRANSPORTATION IN A LIVABLE WORLD, Washington, D.C., USA
8th national NGV Conference focusing on the latest in nature gas vehicle technologies.
Contact: NGV Coalition
Phone: 1-202-824-7360
Fax: 1-202-824-7367
Web Site: www.ngvc.org

Oct 19 - 23, 2002

EVS-19, Busan, Korea
The annual electric vehicle symposium.
Contact: Korean Society of Automotive Engineers
Phone: +82-2-564-3971
Fax: +82-2-564-3973
E-mail: evs19@evs19.org
Web Site: www.EVS19.org

Nov 2, 2002

"SILENT THUNDER", Sacramento Raceway, Sacramento, California, USA
Electric drag races.
Web Site: www.nedra.com

Nov 2002 *(Date TBD)*

RICHMOND EV RALLY, Richmond, Virginia, USA
6th Annual rally at Richmond Technical Center
Contact: William Baul
Email: basketbaul@aol.com
Phone: 1-804-780-6237
Web Site: www.evchallenge.org

Dec 10-12, 2002

ELECTRIC TRANSPORTATION INDUSTRY CONFERENCE, Hallandale, Florida, USA
Annual meeting of the Electric Vehicle Association of America.
Contact: Kara Elsden
Phone: 1-202-508-5039
Fax: 1-202-508-5924
E-mail: kelsden@evaa.org
Web Site: www.evaa.org

All EAA Chapter Events - please email <cenews@eaaev.org> to have Chapter EVents listed in this calendar. Events are also posted on the EAA's website at www.eaaev.org.

Other USA EV Groups:

Bay Area Action
Web Site: http://www.baaction.org/
Location: San Francisco Bay Area, CA

Fox Valley
Web Site: http://www.fveaa.org
Location: Chicago, IL

Denver EV Council - DEVC
Web Site: http://www.devc.org
Location: Denver, CO

Oregon Electric Vehicle Association - OEVA
Web Site: http://www.oeva.org/
Location: Portland, OR

National 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 Vehicle Association of the Americas - EVAA
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://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

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

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)

Additional EV Information:

The California Air Resources Board - CARB
Web Site: http://www.arb.ca.gov/
Focus: Setting standards for EV mandates.

Sources - Existing EV 4 Sale:

Silicon Valley Chapter EAA
http://home.pacbell.net/beckettw/forsale.htm#owned

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

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

Arcata Electric Car
http://www.tidepool.com/~ecar/list.html

EV Tradin' Post
http://members.nbci.com/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 Maps And Information:

Tom Dowling's EV Charger list
Covers Arizona, California and Georgia.
Web Site: http://evchargernews.home.attbi.com/

EV1-club inductive Charging
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/

Used EVs for Sale

FOR SALE: 1982 Jet Electrica (Series 1, Escort)

Contact: Ron
Phone: (408) 447-0607
Location: SF Bay Area, California

Specifications:
Motor: Prestolite 4001 (7 inch)
Batteries: 15 new US8VGC-HC 8 Volt Lead Acid, Flooded (120V pack)
Controller: Curtis 1221B (400A)
Fuel Guage: E-meter
Charger: Zivan NG5, 240V
Tires: Goodyear Invicta, Low Rolling Resistance

Includes new shocks, struts and strut bushings. New upholstery (a la original). Excellent introductory car, for daily driving. Serious inquiries only.

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. Do not use staples, instead use tape to seal the form before you mail it. Or send an e-version of this form, pay through PayPal using the link on http://www.eaaev.org/eaamembership.html.

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. ❑

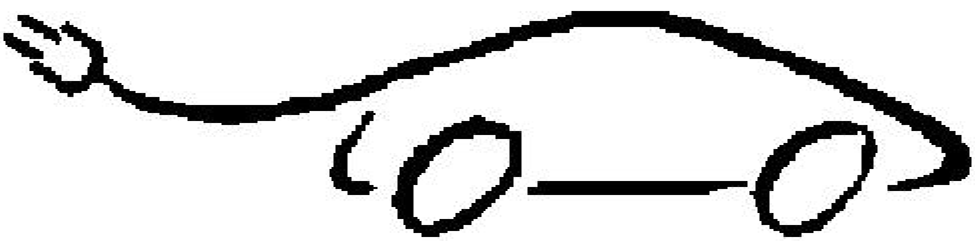
(*optional) All information in this application is for the exclusive use of the EAA and not be sold or given to any other organization.

(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 (EAA) is a non-profit organization (eaaev.org 501c3) for the promotion of Electric Vehicle use in and by the public. Your membership is Tax Deductible and you will receive the informative EAA publication, "**Current EVents**". 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 activities like EVents, 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

____

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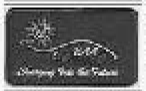
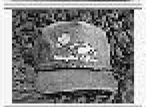
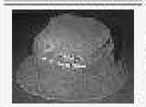
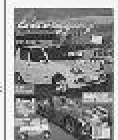
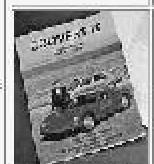
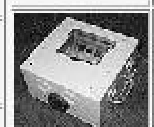
membership@eaaev.org

1st Class
Postage
Here

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

The Electric Auto Association (EAA) is a nonprofit organization for the promotion of public Electric Vehicle (EV) use / awareness as a viable choice. All proceeds are used to cover the costs of our nonprofit efforts in this cause. Please show your support with your purchases for a better, cleaner, quieter, and lower maintenance transportation option.

Image	Description	Item#	Price	#
	License Plate Holder, black plastic frame, white lettering on visible green.	LICPH1	$10.00	
	In motorcycle size, only comes in metal & in either black or chrome. special order. allow 6 weeks.	LICPH2-B LICPH2-C	$14.00	
	Embroidered Sew-On Patch, white This is a special order, please allow an additional three weeks.	PATCH1	$ 9.00	
	Embroidered Sew-On Patch, green This is a special order, please allow an additional three weeks.	PATCH2	$ 9.00	
	Embroidered Hat, adjustable fit.	CAP002	$15.00	
	Embroidered Bucket Hat, comes in: small/medium and large/xlarge.	DCP01-S/M DCP01-L/XL	$25.00	
	Long lasting metal "Electric Vehicle Parking Only" sign. Same materials used as a public no parking sign. Reflective white background with dark green lettering. Wall or pole mounting.	PARK02	$40.00	
	Blemished, Long lasting metal "Electric Vehicle Parking Only" sign. Same materials used as a public no parking sign. Reflective white background with dark green lettering. Wall or pole mounting.	PARK01	$25.00	
	Ceramic Coffee Mug	MUG003	$ 5.50	
	Insulated Car Coffee Mug	MUG02	$ 6.50	
	EAA Car Window Shade	SS001	$ 8.00	
	EAA Bumper Sticker #1 (10.5x3.75 inch)	DS000	$ 2.00	
	EAA Bumper Sticker #2 (The Switch is on) (15x3.75 inch)	BS002	$ 2.00	

	Embroidered Polo Shirt (Forest or Navy S,M,L,XL,XXL), 10 weeks for all colors other than the Forest.	SHIRT01-F	S M L XL XXL	$40.00	
		SHIRT01-N	S M L XL XXL		
	— EV Buyers Guides --				
	Electrifying Times Preview 2000 1997 EV Buyers Guide 1996 EV Buyers Guide 1995 EV Buyers Guide	BG1998 BG1997 BG1996 BG1995		$ 5.95	
	— Literature --				
	Convert-It EV conversion Book	CONV01		$24.95	
	KTA Electric Vehicle Kits & Component Parts Catalog	CATA11		$5.00	
	Window Literature Holder (light plastic)	WLU02		$10.00	
	Back issues of CE (Specify month/year)	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 * some assembly required - 6+ week delivery after payment deposited.	ADAPT1		$200.00	
	Electric Auto Association Membership	EAAM01		$30.00	
		SUBTOTAL		$____	
	US RATE - 10%, or CANADA =15%, or OTHER = 20% of the total	Shipping		$	
		Handling		$ 2.00	
		TOTAL		____	

To order:

- Check off which items and how many you want, total the amount.
Post / mail it with your payment for the amount plus shipping and handling to:

EAA Merchandise, 5820 Herma St., San Jose, CA. 95123 USA

Email, Tel# ______________________

Name: ______________________

Address:

City, State Zip: ______________________

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

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