Electric Auto Association

CURRENT EVENTS

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NEDRA - LAS VEGAS "WICKED WATTS" DRAG

By Rich Brown

By smashing, I mean NEDRA records were being smashed right and left!

Many of the EV faithful came to Wicked Watts. The racers that were there were:

Richard Furniss - with his 192V '86 RX-7
William Kuehl - with his 192V '85 Fiero
Robert Lange - with his 72V custom made motorcycle
Brian Hall - with his 72V custom made motorcycle
Hassan Hall - with his 48V custom-made "Milicycle" micro-sized motorcycle
Bill Dubé - with his custom made "Megacycle"
Otmar Ebenhoech - with his 240V 914 "CA POP E" Porsche
Bruce Meland - with his 144V '86 "Kawashocki III" motorcycle
Dennis Berube - with his "Current Eliminator" dragster

NEDRA
National Electric Drag Racing Association

NEDRA officials there, but not racing:

Roderick Wilde, (acting) NEDRA President
John Bryan, Video Director
Rich Brown, Marketing Director

The racers arrived at the Strip at Las Vegas Motor Speedway when the gates opened at 8 am Saturday morning. It was windy, but sunny. While racers were greeting friends they hadn't seen in a while, the track announced a delay in the opening of the track for runs. The winds were steady 15 to 20 mph with gusts to 28 mph. The flags were standing straight out. We were all worried that the event would have to be cancelled...BUT IT WASN'T!

The racing began and the first runs were predictably a little on the slow side while batteries and drivers warmed up to the season opener. Things heated up fast with Robert Lange being the first to strike down the NEDRA MT/H record that he himself set at Sacramento last year. Robert's best time of the day was 9.753 at 62.10 mph in the 1/8 mile. Robert drives a beautiful polished aluminum custom-made motorcycle that he recharges with solar cells. Robert is sponsored by Lakeport Chiropractic of Lakeport, CA.

Robert's joy was not to last long as Brian Hall (Thunder Struck Motors), on his black bike, painted with a skull and cross bones, raided Robert's new mark and smashed the MT/H record again with a fast 9.423 sec 67.43 mph 1/8 mile run. This new record was recorded when Brian ended the day in a head-to-head race with Robert.

Nobody expected Dennis Berube to be at Wicked Watts, so we were surprised to see his trailer there. His trailer is unmistakable, it is emblazoned with "The World's Quickest Electric Vehicle." To my surpise, Dennis wasn't driving the Current Eliminator. His Cousin, Wes Riopel was goig to drive. Wes is a MSgt. and crew chief in the US Air Force. He was serving over in Afghanistan. His crew loaded the bombs on to F-15 fighter jets. Wes wrote some messages on the bombs among which were: "Current Eliminator.com" and "Currently Eliminated". Dennis promised that he could drive the Current Eliminator when he got back from Afghanistan. Wes drove the dragster to a thrilling first run of 13.08 sec at 101.85 mph. With each run, Dennis programmed the dragster to go a little faster. Wes did 12.36 sec, 11.37 and ended with 11.070 at 121.54 mph.

The last race of the Current Eliminator was against Bill Dubé's Megacycle. The Megacycle has been refitted with new sealed lead batteries since the Bolder Cells it used before were no longer available. This was basically a testing day for Bill and Scott Pollacheck, the driver(pilot?) of the Megacycle. The Megacycle was turning 11.586

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Photos by Bruce Parmenter. Also new NEDRA logo, created by Chip Gribben.

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PASSING OF A PIONEER

By Bruce Parmenter

Bob Wing, a true EV pioneer, passed away Sunday morning, March 17 2002, at his home in Inverness, California.

Bob has served the EV cause and the EV community for many years, dating back to the early 1970's.

He was a hobbyist, a media correspondent, and an EV consultant, and after his retirement from his job as an executive at Stanford Research Institute, devoted much of his time to his consuming passion, electric vehicles and the environment.

In 1973, Bob acquired a 1959 MGA Roadster for $100. Two non-operational MGAs had been rebuilt into one semi-operational gas car. Over the course of the next 27 years, the car, which Bob converted in 1973, underwent many metamorphoses, including installation of Optima YTop batteries, various battery equalization devices, a ZAPI regen controller, and a Zivan Smoother.

In 1979 the Wings moved to Oregon, where Bob continued his crusade. Shortly after arriving in Oregon, Bob showed his MGA at the 1979 Seattle Environmental Faire for 6 days, also appearing on a half-hour radio interview.

Bob recharging his EV Ranger Pickup

He organized the Salem, OR chapter of EAA and later founded additional chapters in Portland, Albany-Corvallis, and Medford.

In 1982 the Wings returned to California, settling in Inverness, CA, at the Point Reyes National Seashore and adjacent to Tomales Bay State Park. They returned to California with three EVs.

Bob established the North Bay Chapter of the EAA, in which he was active for many years. The MGA was again displayed at the Silicon Valley EAA '96 Rally at Stanford University, where it garnered the award of "Best Classic Car." As a media correspondent, Bob attended many EV Conferences, including various EVS (International Electric Vehicle Symposium) meetings, and wrote many articles for journals such as EV News, Current EVents, and Electrifying Times.

The MGA in 1999 was sold to Dean Grannes, after which Bob leased an EV Ranger from Ford Motor Company.

The Ranger lease was recently transferred to Chuck Hammond of Santa Rosa when Bob no longer had the physical strength and energy to drive it.

Bob was a fine gentleman, and his leadership, dedication, and conviction was an inspiration to all that knew him.

His wife, Margot, survives Bob. Condolences may be addressed to her at P.O. Box 277, Inverness, CA 94937-0277.

ADDITIONAL REFLECTIONS

By John Wayland

Like many I'm sure, this saddens me. Bob and I were friends, and on many occasions spent time together on the road at various EV shows. The term 'EV Pioneer' is certainly applicable here.

In early 1980, I met Bob for the first time. He had come to Portland to meet me after hearing about my electrified Datsun 1200, the same 1200 that today is known as 'Blue Meanie'. Back then, it ran at 48 volts on 8 tortured golf car batteries that were often discharged well over 1000 amps into an aircraft starter generator. Understandably, the first set of batteries only lasted about 6 months, but even with a low 48 volts, the car could really smoke the tires!

Bob was amused at the wacky Portland dude who cared more about peeling rubber and having a rock'n stereo in his EV, than range per charge, and he tried his best to enlist me in the Oregon EV club. At the time, I was disinterested in the duct tape and baling wire crowd, disinterested in rolling science projects, and not the least bit interested in being part of a club that I perceived as mostly a gathering of nerdy electric car freaks with no regard to attention to detail.

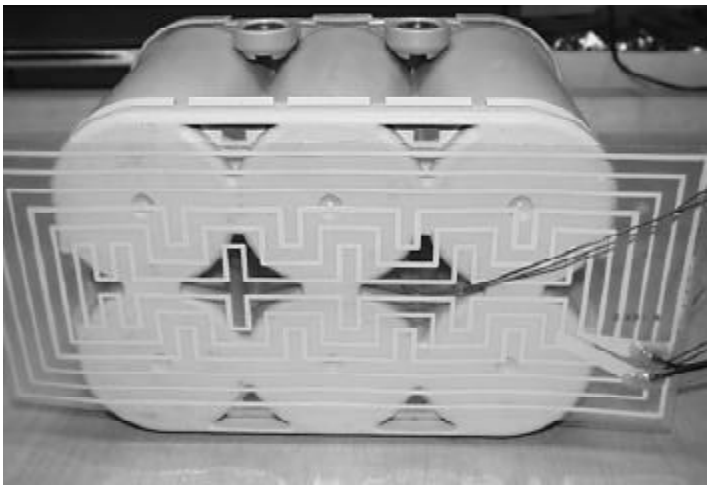
That was probably a mistake on my part, because I could have gotten to know Bob and the other EVers of time better. Anyway, we kind of went our separate ways back then.

I was reintroduced to Bob in the 90's, as we would rub shoulders at the various EV shows, symposiums, and EV races we'd attend. I got to know him much better when he and I hung out together at EVS17 in Orlando back in '97, and learned that he was indeed, a very generous, kind person with a huge amount of EV knowledge compressed in his brain. The EV community has lost a good man and a great resource.

See Ya....John Wayland

Battery Heater Control - How to Keep EV Batteries Happy

By Victor Tikhonov, edited by Ron Freund



Battery heater , on each battery

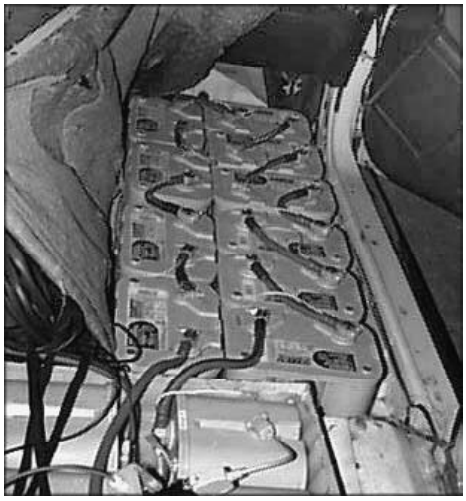
Everyone knows that the temperature affects the battery performance more than anything else, regardless of the battery chemistry. So unless it is enclosed in the constant temperature enclosure (like ZEBRA NaNiCl battery), maintaining optimal temperature externally is desirable. The key advantages are your pack operates at the peak of performance, your range is maximized, predictable, and stable (all else being equal), and the charging is simplified since no temperature compensation needed.

I will describe a simple temperature management system (TMS) designed for Optima lead acid pack. With equal success it can be used with any other sealed or flooded PbA battery type. The TMS consists of two parts – battery heaters and temperature controller. While there are many implementations of these components possible, let's review the simple one I have implemented – it works just as intended since day one, and after initial calibration, has required no attention at all.

Fig 1: Battery heater componients

The heaters I use are the individual resistive type for each of 28 batteries I have in my ACRX. Fig. 1 shows all components. Each heater is rated at 36W from a 12V source and is a "stick on" type. It consists of a conductive foil deposited in serpentine fashion on a flexible adhesive insulating substrate. The thickness of the foil is about 0.5 mm so no extra space is required other than thermal insulation. Other than its minimal thickness, there is another advantage of this heating element – it can be wrapped around bottom or the side of any shape battery. In my case the element was longer and narrower than Optima bottom, but it didn't bother me a bit – the temperature conductivity of the lead inside takes care of uniform heat distribution. As long as the heating rate is not too aggressive, the temperature of the top of the battery is pretty much the same as on the bottom. In my case the thermal insulation is minimal, but since the car is plugged in at all times that it is not driven, there is no need for bulkier insulation (not to mention that there is not much available space for it).

I split all the batteries in three groups according to their physical location – group 1 under hood, group 2 on the floor and group 3 in rear battery box. The heaters in each group are connected in a series string (2 groups have 9 heaters, one group has 10, for a total of 28) making each string rated for 120VAC. So for 240VAC input – two strings are in parallel connected between one hot and neutral, and the third string is between the other hot and neutral. In this way the load is more evenly distributed. For 120VAC mains both hot load wires are shorted together with adapter cable so all three strings are connected in parallel. This allows having any input voltage without any switches or jumpers.



Battery group 2 for linking heaters together

Each group of batteries has three temperature sensors – small NTC (Negative Temperature Coefficient) thermistors taped to the middle cylinder of the Optima in its cavity (fig. 2). Two sensors average temperatures of the batteries in a given group, thus providing more accurate result. The third sensor is not connected to the circuit and is used as the temperature monitor – once profiled (by measuring sensor resistance) I can tell the temperature to +/- 0.5ºC accuracy. Also each battery with a temperature sensor in it has a dummy resistor of value equal to the sensor's 25ºC resistance. More detail on this as follows.

The temperature controller consists of 3 identical independent channels and common power supply. Each channel is constructed as a simple voltage comparator, driving a TRIAC loaded with heating elements. The comparator built around LM311 IC just compares the voltage drop on the sensor with the voltage drop on the dummy resistor. When the battery temperature rises, the resistance of NTC sensor (and voltage on it) drops, causing output of the comparator

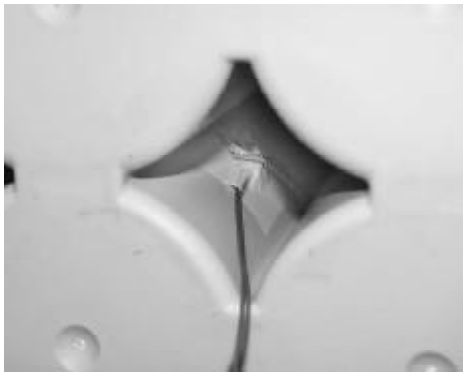
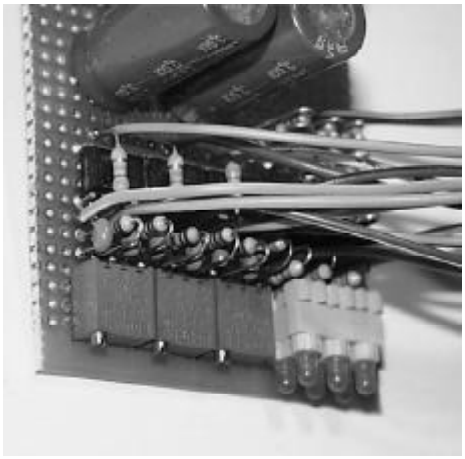


Fig 2: Temperature sensor taped to battery



Trimming pots and green monitoring LEDs on main board, close up view

to go low delivering 0 V to the gate of triac. Thus the heaters de-energized and the batteries cool off. When resistance of the sensor exceeds that of dummy resistor (too low temperature), opposite happens: the output of comparator rails to Vdd opening TRIAC and heaters turn on. So the temperature cycles fluctuating around a set point 1º to 2º C, which provides enough accuracy for all practical purposes. A very important element is the positive feed back resistor introducing hysteresis in the control loop. Without it the controller won't work! As soon as the voltages on the comparator approach equilibrium, the output becomes very susceptible to the noise and interference on the inputs causing switching of the output, usually at a 60Hz. Another tactic to improve noise immunity is to have dummy resistors mounted remotely at the same distance as the sensors and ideally – in the same spot. The wiring from the sensor and the dummy resistor is twisted 4-wire cable (I made it by twisting four 26 gauge wires with an electric drill). Since the common mode rejection ability of the comparator is very high, absolute voltage induced on the wiring from near by AC line and appearing on the inputs won't matter. Only the voltage difference counts. This allows the use of unshielded wiring.

As a visual indicator I use an LED connected in parallel with each string (with a current limiting resistor). This monitors if the AC voltage is applied on the heater elements. The current through it is monitored with another LED connected in parallel to three series diodes (which provide about 2V voltage drop when current passes through them). Another diode provides conductivity during the opposite cycle of the 60 Hz. AC wave.

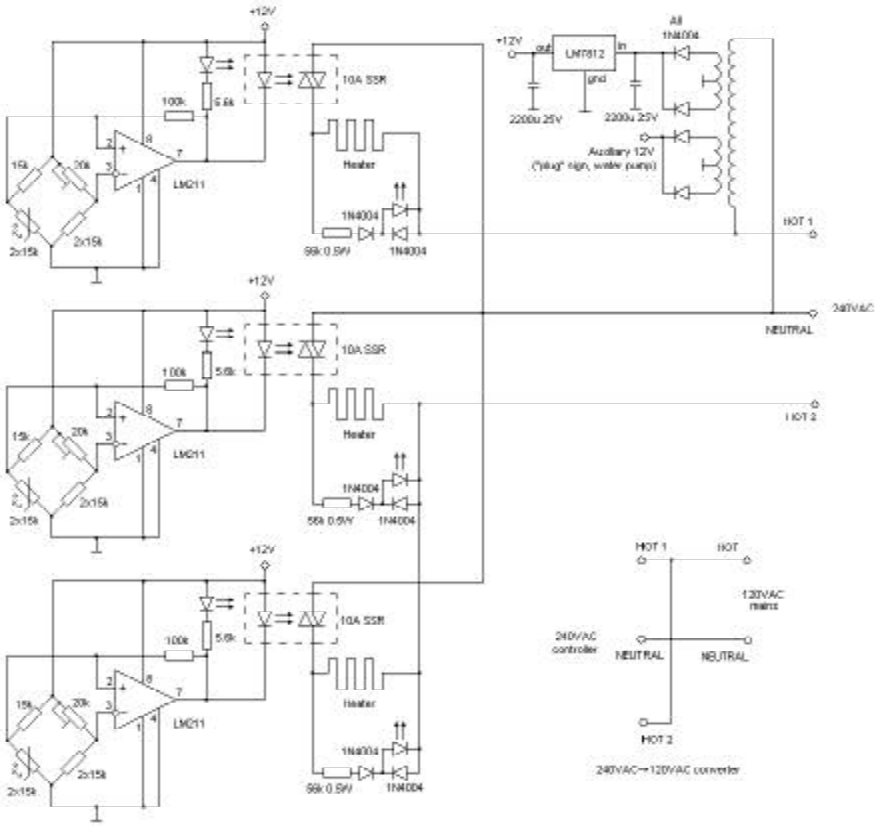
Finally, there is an adapter (a patch cord) for shorting two loads used for 240VAC mains as one hot 120V input using this common point. I carry this cord with me in case I need an "opportunity charge" when only 120VAC mains are available. Charging ability is reduced though, because each string consumes 36W/12V=3A, or 9A total for the heaters in the worst case. Since one or two may be off at any moment, real consumption may be 3A, 6A or 9A. This leaves only 6A for charging before the 15A capacity of standard household outlet is reached. [Ed: Assuming the charger is fully PFC corrected, which is until today rare!] For a 20A outlet the throughput is 11A. So if the situation arises where faster charging is preferred rather than maintaining constant pack temperature, there is the option to turn the heaters off while leaving charger on. By default vice versa is also available: the charger can be disconnected and the heaters cycle on/off overnight – that's how I use my system.

Assembled controller, consisting of solid state relays and the power connections

Please visit my web site to see the electrical schematic and construction details: http://www.metricmind.com/ac_honda/main.htm and click on the "Battery, battery equalizers, and battery heaters" link on the left side banner. Please email me to victor@metricmind.com for any questions you may have. Good luck with your projects!

Victor Tikhonov
'91 Honda ACRX

Complete electrical schematic of the controller. Works as expected.



The following is the story, in his own words, of Bob Wing's conversion of a 1959 MGA sports car to electric power, and a chronicle of its evolution until Bob sold it in 1999.

CONVERSING A 1959 MGA TO A ZEV ELECTRIC CAR

Part 1

Copyright 1991 Bob Wing

I now look back on the great gas shortage of 1973, with its long lines at service stations and rising fuel costs, as a positive influence. It motivated me to act on a long-standing desire to have a battery powered electric car for local travel.

My job in Menlo Park, California was 1/2 mile from home and offered an ideal situation for electric vehicle application. But I did not want just any electric vehicle, I wanted a rag top — something that did not look like other small sport cars on the road. Then I stumbled across a promising listing in a trade paper: $100 for a '59 MGA roadster, or what was left of it after two inoperative MGAs were rebuilt into one operational gas car. Since an internal combustion engine was not required and the body was straight, it was just the right car for my conversion plan.

Now that I had made my electric vehicle commitment it was time to obtain some expert opinion. I'd been thinking about joining the Electric Auto Association for some months and now it was time to take action. At monthly chapter meetings and rallies I was able to get enough information and helpful suggestions to proceed. Many ideas were of course contradictory but one could see operating EVs with different controls, battery count and motors.

Armed with my newly acquired knowledge I started my conversion project. I cleared the engine compartment, rebuilt the brake system, replaced the worn differential, removed the spare tire (since battery space was limited), gas tank, heater and other parts not needed. As this is a British car the Lucas wiring had deteriorated and needed replacement. I saved the gas tank in case a hybrid engine or heater later was needed later.

I knew that on occasion I was bound to find myself on the road with dead batteries. MGAs are notoriously hard to find any part of the frame for towing support. However it was possible to make a false front axle of 1 1/2 inch galvanized pipe with caps at each end and attached it with "U" bolts to the front bumper supports. This false axle made a secure connection for a VW tow bar. I've towed the MGA over 3000 miles north and south on Interstate 5.

Next, I collected all the mechanical and electrical parts required for the conversion except for the batteries. I purchased them last so they would be fresh. (Always insist that all the batteries are from the same batch on the same manufacturing date.)

Now was the time to plan for the location of the wiring, motor mounts, controller, on-board battery charger and batteries. Batteries should be mounted outside the passenger area for the safety of the occupants. My first traction motor was a surplus aircraft starter-generator and 200 amp contactors (relays) from wing-flap controllers, with a 24/48-volt series/parallel battery pack.

Speed control and range were not satisfactory on my electric MGA. But four motors and three controllers later I found the optimum system I wanted: 14 Trojan 6-volt golf cart batteries with a range of 24 miles between charges. The traction motor was mounted on an adaptor plate on the clutch bell housing with the flywheel mounted on the electric motor shaft. The 5-speed gear box was kept for a safety mechanical disconnect and to reverse without the use of another relay as contactors are troublesome. Most of my forward driving is done in 2d and 3rd gear, 1st being used for steep hills. My MGA can reach 25 mph in 2nd, 45 in 3rd and 63 in 4th on the level ground. I don't use the clutch when starting or stopping, only when shifting.

If the entire battery pack is connected directly across the motor without a current limiting device something is going to break and it is usually one or both drive axles due to the high starting torque of an electric motor. Before I found my optimum system I went through three motor-generators. The first two were very cheap and had been used in a mechanical experiment as I found out later. The drive shafts had been twisted off and the seller had welded on new ones. When power was applied under load the motor sounded like a police siren as the armature rubbed the stator. I had to coast any time a police car came into view.

The third used starter-generator had very noisy brushes and the most efficient speed was 7000 rpm, which was beyond the redline on the MGA. Finally, I installed a solid state controller and a new 20-hp Prestolite motor designed for EV application. If I had installed it initially many hours and dollars would have been saved.

The result of my research and effort is now a valuable second car, useful for errands. Occasionally I have to borrow a cup of electricity to get home but I have never had to grind the valves, install a timing belt, change the oil, install a new starter or alternator.

Moving to Oregon in 1979 with California plates made it difficult to meet any one outside of business contacts. But I was invited to show the MGA at the Seattle 1979 Environmental Faire for six days and appeared on a 1/2 hour TV interview which included a video of the car being driven to the Faire. The Bonneville Power Administration had an ElectraVan there also. About 260 people left their names and addresses indicating interest in joining an electric vehicle club.

But it was impractical for me to be active in a new group as I lived 170 miles south. The Seattle Electric Vehicle Association was being formed so I gave the organizers my

list and this group is still functioning today and is affiliated with the EAA. I still try to get the annual Seattle EV rally as there are always new EV ideas and old friends to see. My MGA has been shown at various shopping centers and on the Oregon PBS TV stations.

Nearer my home I organized a Salem Chapter of the EAA with monthly meetings and a quarterly workshop on Saturday mornings in my garage. I found a '73 Subaru coupe with a blown engine and with volunteer help from the EAA members we completed the conversion. In time I founded additional EAA chapters in Portland, Albany-Corvallis and Medford.

In 1982 we moved to Inverness north of San Francisco and towed three EVs, one at a time, 600+ miles south.

My electric cars had 14 6-Volt batteries with maximum range at 75 degrees F of 25 miles on a charge. An ambient temperature of 40 degrees F cuts the range about in half if there is any hill climbing unless the recharging is done just prior to use to warm the batteries. The MGA gets 2 miles per kilowatt-hour and at our present rate that is 7.9 cents per mile.

With only one moving part in the motor, maintenance is minimal but water must be added to the batteries or at least checked monthly. It is really a pleasure to go to the gas station only to get air for the tires. I usually use the MGA each day to pick up the mail at the Post Office or for other errands.

There are lots of day visitors in the area since Point Reyes National Seashore and the Tomales Bay State Park surround us. Some people stop to shop in Inverness and immediately notice the quiet operation of the MGA. At least one person a week says "Is that a '59, I had one just like that." I have to respond "no, not just like mine." They insist and then I open the hood.

The electric vehicle cost $4500 to complete over a five-year period. In today's market it could be $8,000, less if you find a used EV for parts. There were no finance charges as the monthly payments consisted of buying parts. The traction batteries have lasted 7 to 9 years but the replacement can be a major expense. But one always hopes for a new lightweight battery that will permit twice the mileage at half the weight.

The MGA with gasoline engine weighed 1,995 pounds while the EV version weighed in at 2,950. For those of you who have solar, hydraulic or wind power the EV can be can be used as the supplementary battery pack for your home. The EV is also useful for emergency power. In west Marin County we lost commercial power for four days during the 1982 storm and 6-8 hour blackouts occur each year. During the blackouts I run 100-watt reading lights in the house from the traction battery pack.

Car conversions to battery operation can be accomplished by most anyone who can use common tools with some technical skill. Perhaps the quickest way to obtain the technical help is to join the Electric Auto Association. Membership is $25 per year for 12 monthly issues of the international newsletter and notices of chapter meetings.

Continued on page 24

CONVERSION WORKSHOP, STEP 10
BATTERY BOX & BATTERY BOX HOLDDOWN DESIGN

By Michael P. Brown, © 2002

Last issue we talked about the design and fabrication of battery racks and how to secure them to the car. This issue we will talk about the kinds of coatings used to protect the racks from the elements and any stray battery acid. Once we have that covered, we'll look at battery box design, materials, construction, and ventilation. Then we'll wrap it all up with a discussion of the battery box holddowns. These are the parts that hold the battery box, batteries, and battery box lid to the battery rack, which is attached to the chassis of the car or truck.

Paint Your Wagon

So now you have your new battery racks fresh from the welder, but they are bare metal. What do you do to protect them from the elements and possible contact with battery acid? The first thing to do is to have them sandblasted. Sandblasting removes any surface rust that might have started to form. It also removes the thin coat of mill slag, which is a byproduct of the steel mill process that forms the steel into the angle, flat, and channel stock we used to build the racks.

Once the racks are cleaned down to real bare metal, they should be washed with hot soapy water and thoroughly dried. When they are dry, they should be immediately sprayed with epoxy-based primer paint. After the primer is dry, the epoxy-based topcoat paint in the color of your choice can be applied. The reason for the emphasis on epoxy primer and paint is that epoxy-based paints are the most resistant to battery acid.

You can do all the painting yourself with rental equipment, or have a local autobody shop do it. The sandblasting should be left to a professional because of the equipment involved and the mess it makes, which leaves sand in everything, forever.

Another coating process that can be used is powder coating. Like paints, powder coating comes in different grades, and I again recommend the epoxy version. This process also starts with sandblasting. Then the parts are hung on racks and the dry epoxy-based powder is applied by the electrostatic attraction process. In this process, the part is given a negative charge and the powder is given a positive charge. As the powder leaves the compressed air powered gun, it is attracted to the part and flows around it, inside corners, and into hidden areas.

After the parts are coated, they and the rack holding them are placed in an oven and baked at 375 to 400°F for a suitable amount of time to cure the powder and fusion-bond it to the part. This process results in a finish that is tougher, more durable, and more chip resistant than conventional spray paint. The epoxy powder-coated part is resistant to battery acid, and the coating acts as an electrical insulator, two features that are helpful in an EV.

We have the battery racks for our Voltsrabbit and Voltsporsche kits powder coated because, in addition to the above benefits, it also holds up better during shipping, and is cheaper than conventional painting. There is an additional environmental benefit. The powder coating process does not release any volatile solvents into the atmosphere. If you can find a company in your area that does powder coating, you should give serious thought to having your racks powder coated.

Thinking Inside The Box

Now let's take a look at battery boxes. The main purpose of the battery box is protection. It contains the batteries in one place and protects us from the batteries' chemical and electrical dangers. The battery box also protects the batteries from the elements and accidental short circuits caused by mishap or carelessness.

A sealed and ventilated battery box is required anytime batteries are placed in the passenger compartment of the car. This applies to batteries placed in the trunk if the box is not separated from the passenger area by a steel firewall. In fact, the only place it is permissible to put batteries in open racks with holddowns is in the former engine compartment, which the factory takes great pains to seal off from the passenger compartment. Even in a pickup truck conversion, where some of the batteries are placed under the bed, these batteries should be in boxes for protection against dirt and possible damage by road debris.

So, given their heavy responsibility, some careful thought should be devoted to battery box design, the material used, and how the boxes are constructed.

A lot of the design work on the battery boxes has already been done when the racks were designed. The size and shape of the box was determined when we did the original battery layouts. The choice of material was made because the thickness of the box walls determined the dimensions of the rack that holds the box.

Cable Ready

One of the design tasks remaining is deciding where the cables that connect the batteries to each other, and to the other drive components, are going to enter and exit the boxes. The goal here is to connect the batteries in each box in series, connect the boxes into a series string, and finally connect the most positive and most negative terminals of the battery pack to the controller, all with the shortest possible lengths of cable.

This is accomplished by orienting the batteries in the box so that the positive post of one battery can be easily connected to the negative post of the next battery in the series. Depending on where in the box

you start the string, you will end up with one battery with a bare positive terminal and one battery with a bare negative terminal. The trick is to arrange the batteries in the box in such a way that bare terminals are on the side of the box that you want the cables to enter.

I have a sheet of scale drawings of the batteries we use that can be cut out and used to help you lay out your battery pack. Copies are available for the asking. Once you've found the arrangement you want, mark the location of the cable holes on your battery box plans.

Good Air In, Bad Air Out

The passenger compartment battery boxes have to be ventilated to the outside of the car. So part of the battery box design is the location of the air inlet and exhaust ports, and the location of the fan that provides air flow to the system.

Before we get into the nuts and bolts of battery box ventilation, let's discuss the reason for it. Lead acid batteries give off hydrogen gas when being charged and discharged. More hydrogen is given off during charging because the batteries are intentionally gassed. This is done to equalize the charges of the individual batteries at the end of the charging cycle.

During discharge, much less hydrogen is given off, and then only when heavy demand is placed on the batteries when they are already almost fully discharged. When four percent of the atmosphere in a closed space is hydrogen, you have an explosive mixture. The mission of the battery box ventilation system is to prevent that much hydrogen from gathering in a sealed battery box, or leaking into the passenger space of the car.

There are two types of battery box ventilation systems: the sealed box/pressure fan system, and the unsealed box/suction fan system. The sealed box/pressure fan system is the system used when there is a battery box in the passenger compartment, or where the trunk is not sealed off from the passenger compartment by a steel firewall. The battery box is airtight except for an inlet port with a fan in it that draws air from the outside of the car, and an exhaust port that is connected by a duct hose to an exhaust vent that is open to the outside of the car.

When the battery charger is plugged in, the fan comes on and blows fresh air across the tops of the batteries and out through the exhaust system to the outside of the car. Since the fan comes on at the very start of charging, it blows away any hydrogen produced while sitting after driving. The constant flow of air across the batteries does not allow any buildup during charging. If the exhaust vent outlet is placed in the airflow under the car and perpendicular to the airflow, suction called "road draft" will build up in the exhaust port, and will pull any hydrogen produced during driving out of the battery box.

The unsealed box/suction fan system is used on battery boxes that are under the hood, under the bed of a pickup truck, or in a sealed trunk. With this system, when the fan in the exhaust port comes on with the charger, outside air is drawn through several small inlet ports on the opposite side of the battery box, across the batteries, into the exhaust port, through the fan, and out into the outside air. Any hydrogen produced during

driving exits through the inlet holes.

If this system is used in a sealed trunk, air should be allowed into the trunk in some way that doesn't allow dirt or water in. This is especially true if the battery charger is in the trunk, and is also drawing its cooling air from the inside of the trunk. The exhaust outlet should be positioned in a place where it can take advantage of the road draft effect.

We use both brushless DC and AC fans depending on the type of ventilation system and the number of fans needed. An underground sprinkler supply store, with its large stock of PVC pipe and fittings, is a good source of supply for the inlet and exhaust parts needed. A specialty hose shop can supply the hoses you might need to hook things together. A marine supply store is another good source for this type of parts.

The location of the intake and exhaust ports and fans on the battery boxes, as well as any fresh air intakes and exhaust outlets on the car's body, should be determined at this time.

The Hole Thing

Getting back to battery box design, let's discuss the size and shape of the ventilation ports that have to be cut in the side of the battery box. Since space considerations always seem to dictate the shortest possible battery boxes, the distance between the top of the battery and the battery box lid averages about 1-3/4 inches (4.4 cm). Cut a rectangular port in the side of the box, using as much of the space above the batteries as you can for the height of the port. Use the diameter of the fan blade as the length of the port.

When mounting the fan, do not just bolt it to the side of the box with part of the fan covered by the box and part blowing through the port. The differences in the airflow between covered and open sides of the fan blades puts excessive strain on the fan bearings, and causes early failure.

If you can't get a wide enough hole in the box, you can get around this problem by mounting the fan on a one inch long spacer tube big enough to match the diameter of the fan blades. You can then mount this assembly to the box. The spacer tube provides a space that allows the airflow to smooth out before it enters the port in the side of the box.

If the fan has to be connected by a hose to a fitting that goes to the outside of the passenger compartment, build a housing that has this smoothing space on one side of the fan and a flange to attach the hose to on the other side. The locations of the ports and any mounting holes for fans or hose flanges should be drawn on your battery box plans.

Wooden You Know

In the first part of this series of articles, I suggested that you start your battery rack design with the thickest battery box material. This gives you the worst case largest dimensions for your proposed battery box/battery rack assembly. If you do that and find that using a thinner material will allow you to install the required number of batteries in the desired location, you have that option.

Now we'll take a look at some popular battery box materials and the methods used to construct battery boxes from them.

Following the advice given above, let's start with the thickest material that has been used for battery boxes, which is plywood. Plywood has the advantages of being cheap, widely available, and easy to work with, using a minimum of special tools. Its disadvantages are the thickness necessary to provide the required strength for a safe battery box, the weight that comes with the thickness, and the need for reinforcement of the box to further strengthen it. A minor disadvantage is lack of acid resistance, which can be eliminated with the application of our old friend, epoxy paint.

The plywood to be used should be "good-on-one-side" grade 5/8 inch thick. If you have a space problem, 1/2 inch is the absolute minimum. Care should be taken to make all cuts straight and all angles true for ease of assembly. A well set up table saw with a plywood cutting blade is helpful here.

All ventilation holes should be cut into the sides of the box as necessary before the box is assembled. The boxes are assembled using a combination of stainless steel grabber screws for corrosion resistance, and structural adhesive for added strength. Box construction is speeded up if you use one electric drill for pilot holes and another drill to install the screws.

If the box is to be used in a suspension rack, no additional reinforcement is needed. However, if it is being used in a bridge or floor rack, the box should be reinforced. If the box is a rectangle, a good way to do that is to have a local moving and shipping company apply steel banding at two levels around the sides of the box.

If the box has an irregular shape, you should reinforce the corners, which are the weakest part of the box, with aluminum angle stock or steel angle brackets. When it is all finished, paint it inside and out with epoxy paint. A box I made this way served as a battery box for ten years before the car was scrapped, and is now in use as a lock box for UPS deliveries.

Fun With Fiberglass

Battery boxes have been made of fiberglass cloth and epoxy resin, which is somewhat lighter and stronger than plywood. The problem with this method is the necessity to build a mold to lay up the cloth and resin on or in. This is a lot of work for a one-off piece. If you are experienced in fiberglass work and comfortable with the amount of work involved, it is a good material to use, and makes attractive boxes.

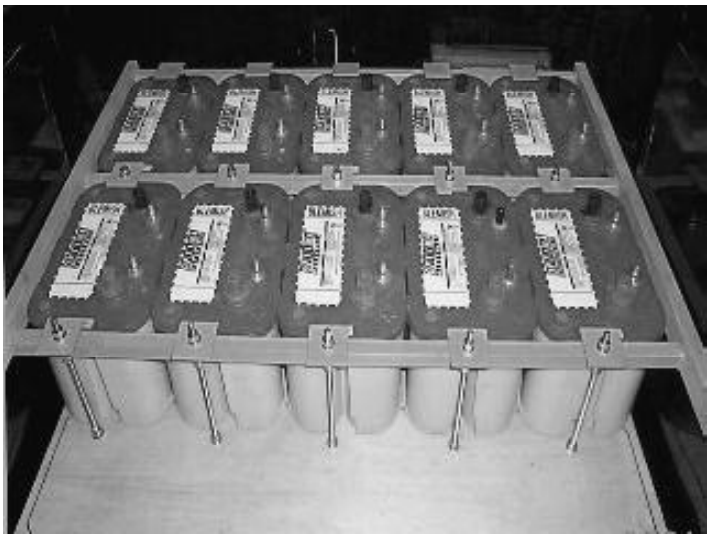
One Word: Plastics

The next material is ¼" polypropylene sheet, which is thin, lightweight, is not harmed by battery acid, and doesn't need painting. However, like a plywood box, it needs a rack to reinforce it. If it will be used with a bridge or floor, this will have to be taken into consideration in the rack design.

A polypropylene box is constructed by clamping the pieces of the box in place and then welding the seams together with a hot air welding gun and polypropylene rod. The special tools involved and the skill level required to achieve good results make the job of fabricating polypropylene battery boxes one best left to a professional.

I feel that, despite the need for a more complex rack and professional fabrication, the welded polypropylene battery box still has

advantages. It is acid resistant and attractive, like the fiberglass box. But there is no need to build a mold in order to fabricate it. A polypropylene box is thinner, lighter, and stronger than a plywood box, and doesn't need to be painted to protect it from battery acid.



Example of battery holddowns

If a polypropylene battery box appeals to you, look in the Yellow Pages under the "Plastic Fabricators" heading to see if there is somebody in your area who does polypropylene fabricating.

Full Metal Jacket

The last box material we are going to talk about is metal, specifically, aluminum or steel. A metal box is the most expensive type of box to have fabricated. The reasons are the number of special tools required such as sheetmetal breaks, cutting shears, and welders, and the skilled workers necessary to operate them.

The metal box offers the strongest box for the least weight and thickness of any material. One of the other advantages of the steel box is that it can be used like a suspension rack and welded into the hole in the body, eliminating the battery rack itself. An aluminum battery box would have to be bolted to the chassis but could use a simpler, lighter version of a bridge or floor rack system.

Randy Holmquist of Canadian EVs uses metal boxes on his Metro and Chevy S-10 kits, and is very happy with them. Metal boxes are very susceptible to corrosion so they should be painted inside and out with epoxy paint. Randy uses spray-in truck bed liner on the insides of his boxes and reports good results. If space considerations force you to use a thin battery box, and the fabrication expense is not prohibitive, a metal box is a good way to go.

Know When To Hold 'Em

So far in this series of articles, we have built battery racks and secured them to the chassis, built battery boxes and installed them in their racks. The last item to consider is how to hold these boxes filled with batteries in place. Since the batteries are held in place by the sides and floor of the box, the only movement left to consider is the slight up and down movement caused by bumps in the road, and the catastrophic movement caused by a crash or in the worst case, a rollover.

The place to start talking about battery box holddowns is the battery box lid. On plywood and metal boxes, the lid is made of the same thickness material as the sides of the box. The lid of a polypropylene box is made of ½" material. Provision should be made in the lids for a weatherstrip type seal between the lid and the top of the box.

To make the lid part of the holddown system, spacers sized to fit between the battery tops and the lid bottom should be fastened to the lid. These spacers should be made of the same material as the lid and be screwed or welded to the lid. Place the spacers where they can contact as many corners of the batteries as possible without interfering with the battery interconnects or other cables.

The job of holding the battery box, batteries, and lid to the battery rack is done by 2 inches wide x 1/8 inch thick straps positioned over the rows of spacers on top of the lid. They can be oriented front-to-rear or side-to-side, whichever is most convenient. Use as many straps as you have rows of spacers.

The straps can be fastened to the lids with screws or double-backed tape if desired. The important thing is that they are fastened to the rack below. We weld Grade 8, 3/8 -16 bolts to the racks and use matching wing nuts and washers to hold the straps to the racks.

To Make A Long Story Short

As long as this series has been, I have only skimmed the surface of the subject. If you have any specific questions about battery containment systems, write or e-mail me and I'll try to help.

Michael Brown is chronicling the various stages of the ICE to EV conversion process. As fonder of Electro Automotive, he has many years of hands-on professional experience in the automotive industry, working with both ordinary family cars and race cars.

Access
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Closeup of battery holddown bolt/plate

CEV (CANADIAN ELECTRIC VEHICLES LTD) – EV Trucks

By Randy Holmquest

A lots has happened @ CEV this past year. We have gone from mostly selling conversion parts to building industrial EV's. Some of our business is still selling parts, mostly to US customers but the majority of sales are for our Isuzu based 12,000 lb. trucks. We were approached at the beginning off the year to build 5 aircraft refueling trucks for the LA airport. An Isuzu Dealer in Portland, OR was supplying the cab & chassis already stripped to our spec's, i.e., no engines, radiators, fuel tanks, etc. Before we could deliver the first truck, they upped the order to eight trucks, which put a real squeeze on our resources.

The trucks used a 96V separately excited motor & controller, which gave good performance and lots of programmable features like regen & direction change without contactors. The first 8 trucks were locked into second gear, which gave them a top speed of about 22 mph at full GVW of 12,000 lb. Later trucks were set in first gear to give a better hill climbing performance but lowered the top speed to 17 mph. These speeds are perfect for the 18-mph top speed limit at the airports. The range of the trucks was about 15-18 miles, which also worked well on the limited areas of airports with some trucks going two days before recharging. The Zivan 5KW chargers can charge the 245 Ah batteries in about 5 hrs.

The ISUZU dealer in Portland was impressed with our work and had a one day show in Portland and which a number of airline industry reps flew in for, as well as engineers from ISUZU. They sold two more trucks and got a lot of interest from ISUZU. In Oct we were asked to have in the ISUZU show booth at the largest annual ground support show in North America. As it turned

out we had 3 of our trucks on display under various customers' equipment. Two more trucks were sold to Puerto Rico with an additional order of six pending. This month we were also awarded the "INNOVA AWARD" from industrial and utility vehicle magazine for our innovative chassis design. In the future, we will be shipping "kits" to Portland rather than shipping the whole trucks back and forth. This will free up some of our space and time to concentrate on other new projects.

2001 also saw the design and manufacturing of Might-E Tug. We were approached by a local hospital to build some sort of electric power system for the big laundry carts that normally had to be pushed or pulled by hand. They were having too many WCB claims related to pulled muscles. We built a crude prototype and sent it out for field testing. By the time we built the third test unit the hospitals were happy with it and started ordering them. At the same time a company in Nanaimo had developed a new type of laundry handling system that was selling like crazy into hospitals. They were small carts on wheels that hooked together like a train and then you pulled the whole bunch from the front. They saw one of our first tugs and are now the exclusive Canadian distributor with sales all across Canada.

Might-E Tug *small EV application*

CEV also sold its first Might-E Trucks this year to Corrections Canada. We installed a van body on the back and it's used as a carpenter's truck inside a federal prison. We are about to start building 3 more Might-E Trucks which is our own design of an electric powered ¾ ton truck. It uses a 96V Sepex drive system in a direct drive configuration that can deliver speed up to 80 km/h or load carrying up to 1500 lb., depending on gearing. The trucks are totally built on-site including frame, cab, and drive system. CEV's GEO & S10 conversions kits were also finalized complete with installation manuals and a few of these kits were sold along with many of the individual components like motor mounts and adapter plates to US customers. Only one conversion was done this year which was a 1987 Dodge Dakota truck that had a van body

built onto the back of it. It had a Kostov motor and DCP controller running on 144V and charged with a NG3 Zivan charger. The truck also had power steering, power brakes and an automatic transmission. Last week we started overhauling a Dodge mini van that was poorly converted in California and never really got much used by the owner.

We also have a Chevy S10 under development that utilized our 96V SEPEX drive system. This is a very cool system to drive and it will push a 12,000 lb. fueling tanker at 22 mph. It should have no problems with a 4500 lb. S10. The regen is the best part of the whole system as it regens hard all the way down to a stop and will hold you at a stop. We always welcome visitors, if you can find us.

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By Lee A. Hart

[Editor Note: With the recent shipments of Rich Rudman's auto-ranging PFC-20 and PFC-50 (the first ever reasonably priced fully power factor corrected chargers) for purchase by EV conversion enthusiasts, CE staff feels reprinting this explanation will be both timely and helpful to all users of EV chargers.]

If power is all that simple, why can't you get more of it out of the wall and into your EV without blowing your breakers? The answer involves the behavior of AC systems and a quantity known as Power Factor.

AC Ain't So Easy

In a DC system, wattage is easy to find. Volts x amps = watts. Volts and amps can be measured with any simple meter. In an AC system it ain't so easy. Suppose you connect a big transformer to the AC line with no load on its secondary. A voltmeter reads 120 VAC, and an ammeter indicates 10 amps of current flowing in the primary. 120 volts x 10 amps = 1200 watts. Yet nothing gets hot. Where is the energy going?

Watt-Eating Inductance

If you check the watt-hour meter on the side of your house, you will also find it is not moving. That's because an unloaded transformer is highly inductive. You are drawing reactive power (measured in VA) but no real power (measured in watts). An oscilloscope would show that the current waveform lags the voltage waveform by almost 90 degrees. When the voltage is at its peak, the current is zero; when the current peaks the voltage is zero.

If you carefully multiplied the instantaneous voltage and current waveforms at every point and averaged the result, you would find it to be nearly zero (The value would be exactly zero for a perfect inductor). It is too tedious to do this every time we want to measure AC wattage, so a correction factor was devised. In an AC circuit, real power is given by:

volts x amps x PF = watts

where PF is the Power Factor, defined as the cosine- of the phase angle between the voltage and current waveforms. In the more general case, PF = watts (real power or what a wattmeter measures) divided by VA (apparent power or what you get if you simply multiply volts x amps). Purely resistive loads (such as a resistor, light bulb, toaster, etc.) have a PF of 1.0. Inductive loads (such as induction motors, transformers, and fluorescent lamp ballasts) and capacitive loads (capacitors, filters, battery chargers, synchronous motors) have PF of around 0.5 to 0.8.

Crest Factor

Historically most devices have fairly good power factors; they may cause a phase shift, but at least the current is still basically a sine wave. But recent electronic devices such as light dimmers, computers, switching power supplies, capacitor-input filters, and some battery chargers produce bizarrely distorted current waveforms. These distortions cause much higher power distribution losses.

Crest factor is the ratio between peak current and average current. Circuits with rectifiers, capacitors charging or batteries can easily have crest factors of 10 or more (AC line current is 100 amps peak, 10 amps average). A crest factor of 10 means losses in wiring and connectors are 100 times higher! No wonder these devices cause great consternation among utility companies!

Basic Power Factor Correction

If your current waveform is basically sinusoidal, just out of phase with the voltage, power factor correction is straightforward. If the load is inductive, add capacitance across the AC line to cancel it. If the load is capacitive, add inductance.

Since devices with a motor or transformer are inductive, adding an input capacitor will REDUCE input current! If the waveform is mildly distorted, such as that of a transformer feeding a rectifier that has a capacitive load (or a battery), you need a more complex passive filter. A one- or two-pole LC filter, for example.

If the waveform is highly, distorted (with a high crest factor), passive filter components become too big to be practical. This is when devices using electronic or active PF correction begin to look attractive.

Electronic Power Factor Correction

Basically electronic PF correction circuits actively force the AC line current to match the AC line voltage waveform. A common power factor corrector has three stages.

1. An input rectifier withno-filter to produce pulsating DC.

2. A DC-DC converter that steps this up to a semi-regulated DC voltage so the current drawn from the pulsating supply is proportional to its voltage. (This forces the input current to match the input voltage.

3. A second DC-DC converter that provides isolation and steps the high voltage down to the desired output voltage.

So What?

Since power factor does not make your watt-hour meter spin faster, why do you care? Because a device with a low power factor has to draw MORE current to get the same power, a charger with a 0.5 power factor draws twice the amps from the AC line for a given number of charging watts. And when you double the amps you quadruple the resistive losses in all the supply wiring and connectors. That's due to the power loss through the line resistance, P = I^2 X R.

Electrical Pollution

Poor power and crest factors mess up the AC line waveform. Instead of a clean pure stable sine wave that makes US power the envy of the world, the top gets clipped off and the sides are distorted. This makes other products work less efficiently. Motors run hotter on washing machines, computers crash more often, etc. Plugging in a device that distorts the supply waveform is a form of electrical pollution. You are dumping your garbage into everyone else's power. - LH

Lee Hart wrote this excellent discussion in response to questions from the EVDL. List members Mark Bahlke and David Volkenand requested this be re-printed. (From the August 1996 issue of CE.)

Education Corner – High School Sponsored Events

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

Anyone that has ever coordinated an electric vehicle EVent knows just how difficult and time-consuming the task is. There are invitations to send out, insurance to obtain, facility permits to apply for, food to buy, road courses to design, press releases to write – the list goes on.

1994 Ford GT Probe from Miramar HS

As tough as this is for an *adult*, how would you like to do all of this as a *teenager*?

That is exactly what hundreds of high school students have been doing for several years in the southeastern US. Since 1996, three high schools have conducted some of the best electric vehicle rallies in the country. The schools are: Northampton-East High School in Conway, North Carolina; Richmond Technical Center in Richmond, Virginia; and, most recently, Miramar High School in Miramar, Florida.

These events have been two-day affairs where the students compete in an autocross on one day and then in a race or range event the next. The events are not super-competitive, maintaining a great balance of competitive spirit and cooperative sportsmanship. Participating in these events allows the students to earn "School Initiative" points in the yearlong EV Challenge educational program and competition. In addition to high school participants, Electric Auto Association members and the general public often participate in a specially designated "open class."

According to Lowell Simmons, automotive instructor at Miramar High School, conducting a rally is just another way to spread the educational wealth beyond the mechanics of the car. "Like we say, it's not a car – it's a program."

The 7th Annual Northampton Rally is already planned for October 4th-5th. Contact Danny Johnson (johnsond.east@ncs.schoollink.net) at Northampton-East for more information. And Miramar High School is already planning for next year's EVent. Contact Lowell Simmons to learn more at lsim676301@aol.com.

"Miramar High School's First Annual Electric Vehicle Rally"

By Chris Francis, a junior at Miramar HS

The Electric Vehicle Competition Team here at Miramar High School decided last fall to host the First Annual Miramar Electric Vehicle Rally here in Miramar, Florida. Our director, Mr. Simmons, has been involved in EV competitions since 1996. He drew upon his past experiences in setting up our rally.

Last fall we went to the 6th Annual Northampton Electric Vehicle Rally in Northampton County, North Carolina. Mr. Simmons told us that we were going to put on a competition similar to what they put on. All of the students had jobs assigned to us for this competition. We worked for months getting all the necessary permits and paperwork ready for the event. Finally, on February 15th, 2002, our competition began. Schools from as far away as Virginia came down here to compete in our rally.

Our first day of competition began at a nearby mall parking area. Mr. William Dykeman, a parent volunteer, set up an autocross course in which all the vehicles had to drive around. Teams could choose whether to compete in a high school class or an open class. My school decided to compete in the open class since we had more voltage than the other schools present. Our purple Ford Probe posted the fasted time of the day. A Datsun 240Z from the Central Shenandoah Valley Regional Governor's School in Virginia won the high school class. Everyone else had a great time at the event. We even had a couple of Ford Th!nks and a county-owned electric Ford Ranger brought here by a local Ford dealership. Our county owns several of these Rangers which are maintained by this dealership which is called World Ford.

Our second day of competition began with a cross-county road rally. All of the vehicles chose one of two formats to follow. They could either run in a timed rally format or run until all battery power was exhausted. Finally, after many miles of driving, the Ford Escort from Northampton-East High School (yes, the same school that hosted last fall's rally) was victorious. A Porsche 924 from Port St. Lucie, Florida, won the open class. Mr. Eric Clunn of Grassroots EVs finished the course amazingly within a minute of the predetermined rally time. This time was a secret and not let out until the awards ceremony.

1971 Datsun 240-Z from the Central Shenandoah Valley Regional Governor's School

The third part of our competition was a car show. Our Probe was chosen to be the best in design by the general public in attendance.

In conjunction with the
Tour de Sol: The Great American Green Transportation Festival
EAA and its Washington DC Chapter, EVA/DC
will sponsor the
First Ever EAA Chapters Conference

EVision with Direction

The Electric Auto Association and the Electric Vehicle Association of Greater DC will be hosting the EAA Chapters Conference, which is open to all, especially EAA Chapter officers and individual members who wish to form and charter an EAA Chapter. This is an in-person "get to know you" meeting and open idea exchange for all chapters. The theme is "EVision with Direction".

On 14 May on the Capitol Mall, coinciding with the start of the annual Tour de Sol in DC, EVA/DC is planning a social mixer amidst the Tour de Sol activities, a Lemonade Social with a light luncheon around 11:00 AM.

In mid-afternoon we will have a general conference session, either at the Smithsonian or at the Department of Energy. Time permitting, we are working on a possible Ice Cream Social in conjunction with a visit to the nearby Smithsonian Museums to see the original "Sunraycer" and other fascinating exhibits.

Evening sessions, after a spaghetti dinner, would include a Presidents Get-together, Web Masters linking, Newsletter editors meeting with Current EVents Publisher-Editors, and a brief discussion of "How to Start Up a Chapter".

On Wednesday, 15 May, just west of the greater Philadelphia area, we're working on a fabulous day and evening banquet at the Boyertown Auto Museum, <http://www.boyertownmuseum.org>. That Event will wrap up our conference.

Please discuss this matter among your membership, encourage officers or member representatives to attend, and provide feedback and register interest (for a much needed headcount) in the next few weeks to:

* 1st Ever Chapter Conference chairman Jerry Asher; email to: <EVisionA2Z@usa.net> or call him directly (202) 545-8511, or

* Board Members <email to: board@eaaev.org>, or

* EVA/DC's Chip Gribben, Special EVents Chairman <email to: futurev@radix.net>.

We, the EV Competition Team, have already started planning for the 2003 2nd Annual Miramar Electric Vehicle Rally. Next year will be even bigger and better than this year's. Plan on coming down here to Miramar, Florida for a great time next year.

Note from Eric Ryan:
Next month I plan on writing an article about the EV Challenge final event that will take place on April 26-27. This will be the largest gathering of street-legal high school EVs in history.

For more information, check out the EV Challenge website at www.evchallenge.org.

GENERATOR FOR HYBRID ELECTRIC CAR - AUXILIARY POWER UNIT

By Bill Palmer

Are you planning to build a hybrid electric vehicle? If so, you may find this idea useful. It uses a standard, "off-the-shelf", 28 Volt, 290 Amp, 8 kW truck alternator to produce 140 Volts at 290 Amps, (40 kW).

A series hybrid electric vehicle needs an engine-driven generator in an auxiliary power unit to provide electric power for rural cruising and for recharging the battery. A few years ago several of us EAA members converted a Chevrolet Corsica to hybrid electric power. We called it "XA-100." One unique feature of the conversion was the generator we used in the auxiliary power unit. It was a standard, off the shelf, heavy-duty Leece-Neville-type alternator made by Prestolite for buses, fire trucks, etc. rated 28 volts and 290 Amperes, called a model 2272AA. We drove it with an English rotary engine at 6000 rpm. Even though it is called an alternator, it has rectifiers in its output circuit, so its output is direct current. Does that make it a generator or is it still an alternator?

The car battery system was 120 Volts, so we needed about 140 Volts for charging. Does generating 140 Volts with a 28-volt alternator sound strange? One design basis for the alternator is that it must generate rated voltage when the bus or truck engine is idling. So it must generate 28 Volts at an alternator speed of about 1200-rpm. Since the generated voltage is proportional to the field strength and rotor speed, if we keep the field strength the same as at idle speed and increase the rotor speed by a factor of five, the voltage should increase to five times the idle voltage. So, at 6000 rpm, the alternator does generate 140 Volts.

You may ask whether that voltage overstresses the winding insulation. NEMA standards require that electric equipment insulation be designed and tested for twice rated operating voltage plus 1000 Volts. So, there is plenty of insulation margin left even though we stretched the margin a little bit.

You also may ask about over-heating when operating an 8 kW machine at 40 kW. Current flowing in the winding resistance causes heating in electrical devices. It is proportional to current squared times the resistance. So, if we don't exceed the rated current, it should not overheat. We ran hours of tests with thermocouples attached to the alternator windings. It never overheated.

If you want to use an alternator this way, I suggest that you do two things:

1. Check the voltage rating of the rectifiers in the alternator. If they are rated less than twice the voltage you will operate at-change them even if you have to mount them externally.

2. Get, or make, a voltage regulator to control the field current. Of course, the 28-Volt regulator normally used with the alternator will not work at your higher voltage.

This is a way to use a standard, off-the-shelf device in a unique application, which would otherwise require a special, hard-to-find, and probably very expensive machine. The same principles would apply to any other alternator you might want to use, such as a 40 Amp or higher rating, standard automotive alternator.

[Ed: Bill Palmer is one of our founding members of the EAA, living in Los Altos, CA. His wisdom and technical insights are as valuable today as they were when he and his associates first met in the late 1960s. Thank you, Bill!]

Yahoo Groups - EV & Hybrid

By Ed Thorpe

The internet company Yahoo! sponsers free discussion groups about a variety of topics. From any computer, even the general access ones at the public library, you can explore general to specific issues about EVs and Hybrids. The starting point is:

http://groups.yahoo.com/

First you must create a signin or Yahoo! Login (how you will be identified). With that unique name you then need to register your email address - for sending/receiving correspondence, and deside how to participate - individual emails, digest (daily summaries) or none (just look on the website). The discussion groups allow you to:

- Share photos & files, plan events.
- Discuss solutions and problems freely.
- Some are public and others are private (for members only), which require separate registration.

Some of the discussion groups available are found by searching under words like "Electric Vehicle", "Hybrid", etc:

EVList (Public)
The EV List is a great free resouce of EV information! EVLN newswires & EV QnA from the SJSU listproc are archived here. This group is for the benefit of Electric Vehicle interested people.

ElectricVehicles (Public)
A place for those people interested in pursuing or acquiring information in a discussion of the pros and cons of pure electric vehicle ownership. Primarily for vehicles offered by the major car companies as the Honda EV+, GM EV1, Chrysler (Dodge)EPIC minivan, Toyota RAV-EV, Nissan Altera, Ford Ranger EV, etc.

EVClubSouth (Public)
The EV Club Of The South is for EV drivers, their families and others interested in electric vehicles. Our purpose is "To be the voice of our members and to promote the successful growth of the electric vehicle in the United States and the world. "

Additional groups for EVs like RAV4 EV, Corbin Sparrow, Solectria Force, Ford Think, U.S.Electricar, Esarati, and others.

toyota-prius (For Members)
The group is to share information among owners and others interested in the Toyota Prius.

Prius_Technical_Stuff (For Members)
Subset of the toyota-prius group for numerous posts regarding the multi-display as well as the potential of being able to change parameters in the on-board computer, and other things.

Also there are Prius groups in Chicago, Georgia, Canada, UK, France plus groups for the Honda Insight and new Civic Hybrids.

Australian Race to Showcase Solar Vehicles

The Australian Greenhouse Office (AGO) recently announced that its SunRace 2002 will pit solar-powered and electric vehicles against each other in an 11-day race that will cover more than 2,300 kilometers (about 1,429 miles) from Adelaide to Sydney.

This year's race will be launched by John Brumby, a member of Parliament and state and regional development minister for the state of Victoria.

"The Australian Greenhouse Office SunRace 2002 is a great opportunity for the government to take important messages about reducing greenhouse gases to the community," said AGO chief executive Gwen Andrews.

The SunRace was honored with a National Banksia Environmental Award for Communications ("Promoting Change Through Informed Participation") in 2001, and is seen by supporters as one of the most high-profile opportunities to promote environmental awareness.

VA Tech, NREL Researchers Study Hybrid FCVs

Researchers from Virginia Polytechnic Institute (Virginia Tech) and the National Renewable Energy Laboratory (NREL) recently completed a study examining the effect of hybridization on the fuel economy of a sport-utility fuel cell vehicle (FCV). The scientists conducted the tests on a model year 2000 Chevrolet Suburban LT converted to run on fuel cells.

The sport-utility vehicle (SUV) featured a four-wheel electric traction drive with two 83-kilowatt (kW) alternating current (AC) induction motors, delivering 166 kW of tractive power. The proton exchange membrane for the vehicle was based on a design by Energy Partners. The battery system in the model was based on a 25-ampere hour (Ah) Hawker Genesis sealed lead acid battery, with 28 12-volt modules used in the vehicle.

In order to determine the vehicle's performance, the researchers used NREL's ADVISOR simulation model. The scientists then tested a range of configurations, from pure battery electric operation to 100 percent fuel cell power with no assistance from batteries. Maximum fuel cell output was estimated at 225 kW, while maximum battery output was assumed to be 80 Ah.

The researchers used four driving cycles to test the vehicle in various scenarios: the urban dynamometer driving schedule (UDDS), the highway fuel economy test (HWET), a portion of the supplemental federal test procedure (US06) and a constant highway speed test (C65).

The team concluded that "some degree of hybridization can improve energy efficiency" and that the size of the fuel cells "can have up to a 20 percent impact on fuel economy."

In general, the team found that the minimum power level increases as the degree of hybridization and the size of the fuel cell stack increases. However, decreasing battery capacity creates a lower-cycle average battery efficiency. In addition, higher degrees of hybridization were found to decrease fuel economy, due to the vehicle's reduced ability to capture regenerative brake energy. (HYBRID VEHICLES: FEBRUARY 2002)

Ford Delivers Th!nk EVs to Scotland Yard

Ford Motor Company recently announced it has delivered two TH!NK City electric vehicles (EVs) to Scotland Yard. The police department said the vehicles' top speed of 56 miles per hour will not allow them to participate in pursuit duties, but will allow them to be used for general duties and house calls.

"This is a revolutionary move as we seek to introduce new greener and more environmentally friendly ways of delivering efficient service," said Metropolitan Police Commissioner John Stevens. "I am delighted at their introduction and look forward to hearing about their progress."

Stevens said the vehicle's quiet electric motors will allow the police to "creep up" on criminals. The police said that so far the vehicles have been warmly received by the public. The vehicles were acquired under a three-year lease from Ford. The department expects to put more of the vehicles into service later this year.

The two-seat vehicles, whose bodies are made from recyclable thermoplastic, have a single-charge range of about 100 miles. The vehicles can be recharged from a standard three-prong outlet in about eight hours.

Volkswagen Unveils Electric-Powered Bicycles

German automaker Volkswagen introduced its first electric bicycle last month at a press conference in Berlin. The bike was presented by Volkswagen government relations manager Reinhold Kopp to Claudia Roth, a member of parliament from the German Green Party.

The new bike is a modified version of a model manufactured by Votex, a Volkswagen subsidiary. The aluminum-frame, 21-gear bike features a motor and battery that weighs 11 kilograms (about 24 pounds). The bike has a power output of 0.25 kilowatts and a top speed of 14 miles per hour.

The motor, which is controlled from a twist grip on the handlebar, will only operate while the rider is pedaling. Volkswagen noted that the bicycle is not yet planned for production.

"Volkswagen has been accumulating experience in the research and development of

alternative drivelines since the 1970s, including small-scale production of the Golf CityStromer, a battery-powered car with an electric traction motor," said Volkswagen research chief Ulrich Eichorn.

Vermont Leasing Program to Promote Evs

The Burlington Electric Department (BED) recently announced it has formed a collaborative leasing program with EVermont, the Chittenden County Metropolitan Planning Organization, the Vermont Agency of Transportation and Vermont Gas to promote electric vehicles (EVs) in Chittenden County, VT.

BED said several city departments in Burlington, the University of Vermont, Winooski Parks and Recreation Department and the town of Williston will each be leasing an EV through the new program. Vermont currently has nearly 300 EVs in operation, a number that EVermont, a statewide non-profit group that promotes EVs, hopes to increase.

BED customer and energy services manager and Alliance for Climate Action (ACA) chair Tom Buckley said the lease program fits into the broader goals established by ACA to reduce area greenhouse gas emissions.

"On April 15, when ACA launches the '10 Percent Challenge,' a program aimed at getting every person and business to reduce their own greenhouse gas emissions by at least 10 percent, we hope we can boost programs such as this that help us achieve our emission reduction goals," said Buckley. "When we drive electric cars, especially when the electrons come from a clean and renewable source...we are helping to clean up the air locally and reduce global warming on the larger scale."

BED said the public-private leasing program partnership was formed to help Chittenden County municipalities use EVs at the same cost as conventionally fueled automobiles. The lease program will run for 36 months.

Miami Beach TMA Revives Electric Bus Project

Three years ago, the Miami Beach Transportation Management Association (MBTMA) unveiled a small fleet of ElectroWave electric-powered buses intended to help reduce traffic congestion by shuttling passengers between hotels, restaurants and businesses. However, a lack of regular inspections and the region's humid climate have rendered more than half of the original fleet useless.

"Miami Beach is a good example of a transit community learning from its mistakes," said Electric Transit Vehicle Institute (ETVI) engineer Ken Cox.

The MBTMA recently awarded ETVI full responsibility for the ElectroWave electric bus program. The institute has since established an office in Miami that includes a team of 10 mechanics and assistants who service the buses.

ETVI said it has installed E-meters on the buses which tell the driver the amount of battery power remaining. In addition, the institute has trained drivers to avoid driving styles that drain electricity.

In the future, ETVI hopes to install a second charging facility. So far, new batteries, chargers, bus lifts and parts have been ordered. Additionally, ETVI plans to introduce a maintenance inspection rotation.

"Although improvements take time, they will pay off in the long run," said MBTMA executive director Judy Evans. "The ElectroWave shuttle has proven invaluable. We know that the ElectroWave program can make a real difference." (EVS IN TRANSIT: WINTER 2002)

North Carolina Bill Includes Rebates for Cleaner Cars

A bill before the North Carolina state legislature would add $1 to the state's automobile registration fee in order to fund a rebate program that would provide rebates for environmentally friendly cars.

The rebates are designed to help spur interest in vehicles such as the Honda Insight and Toyota Prius hybrid electric vehicles. A Prius costs about $20,000, compared with a similarly sized Toyota Corolla, which costs about $15,000.

The rebate, which in the case of the Prius would be about $2,500, would help minimize the difference in cost. "A lot of people buying them right now have been interested in that type of technology or have been environmental folks to begin with and just doing their part," said Raleigh, NC-based Fred Anderson Toyota Internet sales manager Carl Anderson.

Democratic state representative Joe Tolson, who acknowledges that the fee hike is not likely to be popular given the uncertain economic times, is sponsoring the bill. Nonetheless, Tolson said the rebates are a way to help "reduce our dependence on foreign oil and help clean up our air." (RALEIGH NEWS AND OBSERVER: 2/12)

U.K. Official Calls for Ban on Gasoline Cars

The British government's highest-ranking scientific advisor David King recently proposed that the United Kingdom (U.K.) ban the sale of gasoline- and diesel-powered vehicles in order to encourage the development of electric and fuel cell-powered vehicles. King said the country should follow the example of the Lombardy region of Italy, which will ban the sale of fossil fuel-powered vehicles in 2005.

"I think we need a State of Lombardy-type statement from the U.K.," said King. "We need to be pressing for the economic drivers which are required to bring these technologies to Britain."

King did not specify when he thinks the ban should be implemented, but noted that he believes "green" cars will soon be "widely available." Environmental groups praised King's proposal, saying that he is the first U.K. government advisor to advocate such a policy.

"This is a hugely significant statement from someone at the center of government," said Friends of the Earth director designate Tony Juniper.

King said the U.K. government's Policy and Innovation Unit had failed to properly address the potential threat of climate change "as clearly as [he] would have liked to see." King's proposal is primarily intended as a method for curbing the U.K.'s greenhouse

gas emissions.
Environmental groups said gasoline- and diesel-powered vehicles account for approximately 25 percent of Britain's annual carbon dioxide (CO2) emissions. (THE INDEPENDENT: 2/17)

Segway Supporters Fight for Change in Laws

Although the new self-balancing Segway Human Transporter is expected to "revolutionize" transportation in urban areas, the battery-powered scooter must first obtain permission to operate in the same areas where people walk. Company officials said bills have been introduced in more than 30 legislatures, with new rules becoming law in New Hampshire, New Jersey and New Mexico.

For example, the transportation committee of the Minnesota House of Representatives recently introduced a bill that would establish a set of rules for use of the electric scooters on the state's bicycle paths and sidewalks. The bill would allow the Segway to travel on sidewalks and bike paths at "reasonable speeds," as well as roads with speed limits below 35 miles per hour (mph) where there is no sidewalk.

The vehicle is able to travel at speeds up to 15 mph, but Segway supporters do not want the technology regulated as a motor vehicle. However, backers acknowledge that some rules will be required for the scooters.

EVAA to Host Industry Conference in Florida

The Electric Vehicle Association of the Americas (EVAA) recently announced it will hold its second annual Electric Transportation Industry Conference on December 10 through 13 at the Westin Diplomat Resort and Convention Center in Hollywood, FL. EVAA said the conference is being organized in response to positive feedback on last year's conference from conference delegates, exhibitors, and the press.

EVAA said the conference will include three plenary sessions featuring key government officials and world industry leaders. The EVAA conference committee is also organizing concurrent "track sessions" that will feature panel discussions devoted to technology, policy, infrastructure, and market issues surrounding battery-, hybrid-, and fuel cell-powered transportation, as well as a series of tutorial sessions on specific technology and policy topics.

EVAA said another feature of the event will be an exhibit hall showcasing new and emerging battery, hybrid and fuel cell products, and a vehicle "Ride'n'Drive."

"We chose to hold the 2002 [conference] in Broward County, FL, where there is great interest and growing use of electric transportation technologies...to help highlight the emerging markets for these new, clean and efficient technologies," said Florida Power and Light regional fleet manager and EVAA conferences committee co-chair Bob Schomber.

New Driver-Free ULTra Taxis Head to Wales

Bristol, England-based Advanced Transport Systems, Ltd. recently began testing its driverless, pod-like taxi system, known as Urban Light Transport or ULTra. The pods are

battery-powered and travel on above-ground tracks at a maximum speed of 25 miles per hour. The company said the pods recharge at each stop.

Advanced Transport also said the pods, which were conceived by Bristol University professor Martin Lowson, seat four; accommodate wheelchairs, bikes and strollers; and are designed to stop upon detection of alien objects on the track.
The pod system would feature set stops and would be activated by an electronic card embedded with the intended destination. The cost of a pod ride is expected to be similar to that of a bus trip, according to ULTra designers.

The ULTra project is anticipated to begin in the Cardiff Bay section of Wales, with a goal of 30 operational pods by 2004, according to Advanced Transport director of business development Richard Treychenne. The company would then begin installing pods in the city of Cardiff.

The pod system would cost approximately one-third to one-half the cost of a light rail project. Advanced Transport estimates that linking the city to the bay would cost approximately 45 million pounds (about $65 million).

L.A. Retail Complex to Employ Wireless Trolley

Caruso Affiliated Holdings recently installed a wireless trolley at Los Angeles, CA's The Grove, a retail and entertainment center set to open in March. Caruso said the trolley runs on clean inductive technology, which is being used for the first time in the U.S.
According to Caruso, the trolley derives its power from 52 on-board 12-volt batteries that are recharged inductively each time the car passes over an in-ground coil at the east end of the track. Unlike a conventional transformer, where the two elements are tightly coupled, the inductive power technology transfers the charge across a one-inch air gap to the on-board battery system, said Caruso. Caruso said the novel technology allows for clean and efficient recharging with no emissions.

Caruso said the trolley technology, currently found only in Europe and New Zealand, has also piqued the interest of transportation managers across the country who will be visiting The Grove to assess the system for broader public transportation needs.

The trolley, which will transport riders from The Grove to Los Angeles' historic Farmers Market, features double decks, carries up to 62 passengers and runs at a maximum speed of five miles per hour. The trolley was built by Production Resource Group.

Yamaha to Introduce Electric Motor Scooter

Japan's Yamaha Motor Company recently announced plans to market its electric motor scooter — the Passol — beginning this fall. Company officials noted that the marketing campaign for the scooter will target female customers.
"We want to spur demand among female consumers on the strength of the Passol being light and pollution free," said Yamaha.

The scooter, which weighs 40 kilograms — about half the weight of a gasoline-powered scooter — is powered by a rechargeable lithium-ion battery and can travel between 25 and 30 kilometers on a single charge.

While pricing for the Passol is not yet determined, Yamaha officials said the scooter could cost around 200,000 yen (about $1,500). The company said consumers with a valid drivers license or a license to drive 50 cubic-centimeter motorcycles will be allowed to drive the Passol. (KYODO: 2/20)

Grand Canyon to Test Segway Scooters

Officials at Grand Canyon National Park (GCNP) recently announced the park has been selected by the National Park Service (NPS) to test the Segway Human Transporter, a self-balancing, electric-powered scooter. GCNP said it is slated to receive five Segways in April for one week of testing.

While the Segway has already been tested in several city locations, the company has entered into an agreement with NPS to try out the device on more challenging terrain. Traver said GCNP might test the Segway to "monitor the campground," to transport "people back and forth between headquarters and Canyon View [Information Plaza]," or to ride on new sections of the Greenway Trail System.

"Transportation is an integral, defining feature of the national park experience and alternative modes of transportation are always being explored," said NPS. (GRAND CANYON NEWS: 2/28)

Improved Electric Buses Coming to New York City

New electric buses manufactured by Chattanooga, TN-based Advanced Vehicle Systems, Inc. (AVS) will be the first vehicles of their kind to feature ultracapacitors made by Maxwell. The buses are planned for use in New York City.

The ultracapacitors will enable the buses to absorb more regenerative energy through the braking process. The new technology will also help extend battery life, with the buses' battery packs now able to travel 60 miles between charges.

"The demanding traffic environment of Manhattan will provide an excellent showcase for the capabilities of these clean, quiet transit vehicles," said AVS chairman Joe Ferguson.

The New York Power Authority will buy the buses and the New York City Metropolitan Transit Authority will handle maintenance and technical support. (EV NEWS: FEBRUARY 2002)

Hollywood Star Purchases Toyota RAV4-EV

Toyota recently announced that Hollywood actor and environmentalist Ed Begley, Jr. is the first retail customer of Toyota's newest electric vehicle (EV), the RAV4-EV. Toyota said the zero-emission vehicle (ZEV) went on sale in California earlier this year, drawing much attention from the media and lawmakers.

"The RAV4-EV demonstrates Toyota's commitment to the environment, the EV market and consumers like myself who are looking for a functional [ZEV] to meet their everyday needs," said Begley. "I am very excited and honored to be the first retail owner of a RAV4-EV in California."

Toyota said the RAV4-EV is a zero-emission, state-of-the-art electric version of the company's popular RAV4 sport-utility vehicle (SUV). The company said the RAV4-EV is one of the best-selling EVs in the country, with more than 900 in service nationwide, including 700 in California alone.

The automaker introduced the vehicle in an attempt to meet a mandate from the California Air Resources Board (CARB) that will require 10 percent of all new vehicles sold in the state to meet low emissions standards, two percent of which must qualify as ZEVs by 2003.

The company said a maintenance-free, permanent magnet 50-kilowatt (kW) motor powers the RAV4-EV. The vehicle can reach speeds of up to 78 miles per hour and has a single-charge range of 100 miles.

Begley also owns a Toyota Prius hybrid electric vehicle (HEV).

Article Compares Insight, Prius to Civic HEV

An article appearing in a recent edition of the Chicago Tribune compared Honda's new Civic hybrid electric vehicle (HEV) to the automaker's other HEV, the Insight, as well as to Toyota's Prius HEV.

The article noted that the Civic HEV "doesn't look or act like anything other than a normal Civic," except for a "hybrid" badge on the deck-lid and a battery charge gauge on the dashboard.

The Civic HEV has a wheelbase of 103.1 inches, compared to the Insight's 94.5-inch wheelbase and the Prius' 100.4-inch wheelbase. The Prius offers a 58 horsepower (hp) gasoline-powered engine paired with a 30-hp electric motor, while the Civic HEV features a 85-hp gasoline engine paired with a 13-hp electric motor.

The Civic HEV is able to achieve 47 miles per gallon (mpg) in the city and 51 mpg on the highway, while the Insight has a mileage rating of 61 mpg in the city and 70 mpg on the highway. In addition, the Insight HEV is slightly less expensive than the Civic HEV, which costs approximately $20,000 with a manual transmission and $21,000

New Honda Civic 4-door Hybrid.

with Honda's continuously variable transmission (CVT).

The article said the "only negative" with the hybrid Civic is the battery pack placed behind the rear seat, which sacrifices a small amount of trunk space and the ability to feature folding rear seats.

Honda said the Civic HEVs will be built Japan. The automaker expects to sell approximately 2,000 of the HEVs per month. (CHICAGO TRIBUNE: 3/10)

Honda to Begin Offering Civic HEVs

Honda recently announced that its Civic hybrid electric vehicles (HEVs) will be reaching dealerships in the U.S. this week. The automaker said the Civic HEVs would have a manufacturer's suggested retail price (MSRP) of $19,550.

"The Civic is one of the cornerstones of the Honda brand and adding a hybrid to the Civic lineup is an example of the faith and confidence we have in the future of hybrid technology," said American Honda executive vice president Tom Elliott. The company noted that the Civic HEVs will be available at all U.S. Honda dealerships nationwide.

Honda said the five-speed, manual transmission Civic HEV has earned an Environmental Protection Agency (EPA) city fuel economy rating of 46 miles per gallon (mpg) and a highway fuel economy rating of 51 mpg.

The Civic HEV with a continuously variable automatic transmission (CVT) has earned a rating of 48 mpg in the city, and 47 mpg on the highway. The Civic HEV with CVT technology has an MSRP of $20,550.

Keio University Engineers Develop Battery-Powered Limousine

Engineers at Japan's Keio University (KU) have developed a prototype battery-powered limousine that is nearly 22 feet in length and able to seat nine passengers. The Keio Advanced Zero emission vehicle (KAZ) features an in-wheel drive system with a motor, reduction gears, a wheel bearing and a mechanical brake included in each of the vehicle's eight wheels.

KU researchers said the vehicle's in-wheel drive system helps protect occupants against hostile attacks. For example, if attackers shoot out one wheel, the seven remaining wheels can provide the stability and power required to continue driving.

In addition, KAZ engineers said the vehicle is able to travel at speeds approaching 300 kilometers per hour. KAZ developers hope to market the limousine to celebrities, business executives and political leaders who require personal protection.

Each electric motor provides 55 kilowatts of output. Because the vehicle does not require an engine compartment and most of the drive system is located outside of the chassis, the KAZ features a large interior space with a floor that is flat the entire length of the limousine.

KU engineers developed a tandem suspension for the vehicle in an effort to limit the amount that the wheel wells intrude into the interior. The suspension system transfers the load from the wheel wells into two smaller wheels with dampers connected by an oil-filled pipe.

The total weight of the drive system for one wheel is approximately 40 kilograms (kg), with 22 kg comprised of the electric motor. The systems' direct current brushless motors utilize concentrated windings and a surface permanent magnet. (THE CLEAN FUELS REPORT: MARCH 2002)

'Clean Mobility Center' Offers EVs to Commuters

CALSTART recently announced a partnership with Bikestation Coalition and Flexcar to develop "Clean Mobility Centers" (CMCs), where transit commuters and local travelers can access electric cars, bikes and scooters. The partnership will inaugurate its first fully integrated CMC at Bikestation's Long Beach, CA, facility on April 19.

The goal of the CMC is to provide a range of zero-emission electric vehicles (EVs) for short trips to and from Bikestation Long Beach, where it can service commuters using the area Metro Blue Line and Long Beach Transit Buses, said CALSTART.

The partnership hopes to demonstrate that the convenience and flexibility of the CMC's shared-user EVs will make transit user-friendlier and help reduce pollution, traffic and parking congestion.

Vehicles offered at the CMC will include a mini-fleet of five Ford Th!nk City cars, two-seat EVs with a single charge range of 40 miles and a top speed of 55 miles per hour; Giant LA Free electric bikes; and Sam Ever electric motorscooters.
The CMC will also feature an integrated subscription system, an electronic bike locker system, valet bike parking and bike support services.

Pasadena, CA-based CALSTART is an advanced transportation technology consortium working to develop clean transportation solutions and systems. Bikestation is a national non-profit organization operating public bike transit centers. Seattle, WA-based Flexcar operates car-sharing programs in Seattle; Portland, OR; and Washington, D.C.

Nova Cruz Launches Voloci Electric Motorbike

Nova Cruz Products recently announced the debut of its Voloci electric motorbike, a lightweight, zero-emission vehicle with a top speed of 30 miles per hour (mph). The company said the Voloci bike has a range of up to 50 miles depending on battery configuration and riding conditions.

The Voloci is available with two different battery options – a sealed lead-acid system, with a list price of $1,995, and a nickel metal hydride system, with a list price of $2,495. The nickel metal hydride battery pack is fully removeable and exchangeable.

Nova Cruz said both battery systems can be charged in two to three hours, and a full charge requires about five cents worth of electricity.

Among the Voloci's features are a triple-clamp front suspension fork, a patent-pending rear suspension technology, and front and rear dual piston disc brakes. The company noted that the bike is also fully street legal, meets all federal motor vehicle safety standards, can be ridden in most locations without a motorcycle license and can be outfitted with an off-road package.

Nova Cruz is a joint venture between Technique Applied Science, Lunar Design and Cheskin Research.

ZAP Ships Out New Zappy Turbo Electric Scooter

Electric scooter company ZAP recently announced it has released the first 100 units of its new Zappy Turbo scooter. The electric vehicle was designed for scooter fans looking for increased speed and performance, according to ZAP.

"Scooter technology has gone way beyond taking a skateboard and slapping a motor on it," said ZAP engineer Rick Rocklewitz. "To reach that next plateau, you need to look at the system as a whole and create a package that has the right balance between performance, efficiency and durability. On the turbo we tweaked everything from the electronics to the construction to squeeze extra speed and torque out of the system while maintaining a lightweight, portable design."

ZAP said the scooter's new electronic propulsion system uses a proprietary motor-controller system that offers improved acceleration, hill-climbing ability and endurance. The scooter also includes a new key lock mechanism that allows it to fixed in the off position, a "cruise" mode of 14 miles per hour (MPH) or a "turbo" mode of 18 MPH.

Canadian EV Society Urges Increased Use of EVs

The Electric Vehicle Society of Canada (EVSC) recently urged Canadians to switch from conventional, gasoline-powered cars to battery-powered electric vehicles (EVs) that can be recharged using Canada's extensive hydropower resources. The group said mass-produced hybrid electric vehicles (HEVs) manufactured by Honda Motor Company and Toyota Motor Corporation do not meet its criteria for all-electric vehicles, and do not produce the same air quality benefits as EVs.

"The battery is the key to the electric vehicle, but the hybrid goes around that by not putting in connectors for the [hydropower] lines to charge the battery, so you can only charge it using gasoline," said EVSC Toronto chapter president Howard Willis Hutt.

The group noted that it also favors EVs over fuel cell-powered vehicles because fuel cell technology is currently "very fragile" and "30 years away from being dependable."

"We need the cleaner car and it isn't the hybrid," said Hutt. "We need to get onto the hydro lines and Ontario is blessed with clean hydropower. We need to be using it to power our vehicles, our subways and even get back to using trolley buses."

Hutt added the group hopes that automakers will develop more full-size battery-powered EVs instead of the smaller EVs currently being produced.

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at 112.32 before the race with the Current Eliminator so it looked to be a good match-up and the feature race of the day for the electric crowd. The Megacycle turned in it's best time of the day with Scott Pollacheck in the saddle, turning a quick 11.433 at 115.15 mph.

Otmar Ebenhoech drove his "CA POP E" dual motored, 'Zilla powered 914 Porsche to a SC/B record breaking 14.427 at 95.05 mph. Otmar put on a good show with a couple of nice smoky burnouts. Dennis

The Hall's "Milicycle" and other scooters

Berube didn't go away from Wicked Watts without some driving. He told Otmar that he could drive "CA POP E" and beat Otmar's time. Dennis had two tries, but came up short with a best time of 14.482 at 95.37 mph. Dennis crowed that he beat Otmar in mph, but that usually means one can't drive straight. :)

The NEDRA "SC" (Street Conversion) record at 192V has stood since Bob Boyd set it at Woodburn in 1998 with his beautiful little MR2. The record was 17.94 at 74.67 mph. Richard Furniss set a new record with AUTHORITY! Richard's EX-7 was not performing well at first. He turned in a rather tepid 18.22 sec at 74.92 mph. After Richard fixed a cooling problem did much better and finished the day with a 16.333 sec at 81.08 mph. He broke the old record by an astounding 1.61 seconds! Congratulations Richard Furniss!

Bill Kuehl raced his '85 Fiero with anew set of batteries and changed his voltage class. He set a new record for MC/C of 16.997 at 79.23 mph.

Kuehl's Fiero races against Furniss' RX-7

Bruce Meland (Electrifying Times publisher) brought his Kawashocki III motorcycle and made a few runs at 144V which is lower than the 192V it usually runs at. Bruce was testing his two speed transmission and managed to turn a respectable 17.524 sec at 71.85.

Bruce Parmenter was there with his 132V Blazer; he wins honors for fastest quarter-mile battery pack charge. :)

Everyone had a great time and went for eats at the Speedway Casino which, incidently, had been robbed of $13,000 while we were racing. I'll have to say we came away richer than those bandits when we were done at Wicked Watts.

We would like to congratulate all of those who participated in this EVent. They are the real winners. Thanks to Richard Furniss for organizing Wicked Watts. Thanks to the Young Electric Sign Company of Las Vegas and Insurance Solutions of Las Vegas for their sponsorship of this Event

BFN,
Rich Brown

2002 NEDRA Calendar

May 29, 2002
"**Mile High Electrics**"
Bandimere Speedway
Morrison, Colorado

June 29, 2002
"**Power of DC**"
Mason Dixon Drag Way
Hagerstown, Maryland

September 1, 2002
"**NEDRA Nationals**"
Woodburn Drag Strip
Woodburn, Oregon

Otmar's Porsche and others await their run

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The future of EVs is now much more promising in California with the Air Quality Management Control Districts setting standards to reduce air pollution. Of the 23 million registered motor vehicles in California, about 4,000 are registered as electrics according to the California Department of Motor Vehicles.

High power density batteries at a reasonable price are still at least five years away we are told — but the battery industry has been telling us that for at least five decades. Now, at least the four-year, $260 million public-private venture has been funded to develop better batteries. The United States Advanced Battery Consortium (USABC) is one of several joint research projects recently initiated by Chrysler, General Motors, Ford, and the Electric Power Research Institute, with the U.S. Department of Energy providing one half of the funding.

Before 1915 more than one-half of all the motor cars on the road were electrics. I can't help but wonder when we will see that ratio in the urban areas again, but improved batteries at reasonable cost could speed the change from internal combustion to electric vehicles.

Part 2

(This report appeared on the internet EV List and in the EVNews Magazine, page 26 in the July 1996 issue.)

ZAPI H2 controller is now installed in my '59 MGA Roadster and is working in the traction mode. I took the MGA out for 25 miles over several 400-foot hills to Abbotts Lagoon and North Beach on the Pt. Reyes National Seashore. The hills are still green on the Pacific Ocean with the high-low temperature reading in San Francisco of 62°F to 51°F. And I successfully passed the hill climb where my 11 year old controller blew up several weeks ago.

Compared to my 4 previous controllers the first thing I notice is that you can creep when starting. Although the 5k ohm linear pot is the same one I used with other controllers, the ZAPI start program provides different speed curves so the forward start can be very slow, half the speed of walking but moves up quickly to full current. And the controller is silent, I can hear the microswitch on the throttle pedal. No Curtis 1231C whine!

I have been waiting for regen since I first converted my '59 MGA Roadster in 1972. There are streets with 12 to 20% grades which I can easily go up but I do not trust my drum brakes on the long down hill. After talking in person and by email with Gary Flo of InnEVations, he said to me three times 'talk to Greg McCrea,' Electric Conversions in Sacramento CA who drives with a regen H2 in his own car and stocks them. So I made the two-hour drive.

I always like to meet an EV component supplier in person and know that my calls will be returned if I have questions. Greg was that kind of guy. He does conversions and repairs on EVs and had several phone calls and customers come in while I was there, each person getting his undivided attention. I was glad to wait and observe how his shop operates.

Greg does consulting in Switzerland and elsewhere in Europe for firms with special electric propulsion needs in their vehicle development projects. Electric go cart tracks are a very popular charge-per- ride activity in Europe. They must have a much smaller percent of the population of lawyers than the US. He also visits the ZAPI factory in Poviglio near Florence, Italy, talks with the technicians at the factory and brings back controllers as personal baggage on the return flight, saving on the shipping bill.

Greg's background includes solar-thermal and low-NOx natural gas combustion technology which seems to progress naturally to the lowest NOx technology; EVs. Much of the work at the shop includes support to EV users, from private conversions to government fleet operated OEM electrics. This provides an ideal opportunity to upgrade antiquated components as they fail with new technology. This makes the users happy to get the "Latest" while the shop technicians gain the "breaking in" experience of installation and tuning.

For the last three years at the current location, Greg has also been dealing in EV related surplus such as high-tension aircraft alternators suitable for hybrid drives and electric forklifts to the menial cable and contactors. Most of this material is from the military, a real life Swords to Plowshares operation.

The H2 comes in three physical sizes. I chose the 400 amp with reversing DPDT and braking SPDT contactors. This is the only one to fit in the space available in the MGA. There are also 500amp and 600 amp models that are longer, both available for up to 96 VDC. There will be a 120-volt model coming out in August. The H3 is two H2s tied together, which may be why the H3 is more difficult to set up. The H2 400 amp was US $545 and the H2 600 amp US $676, shipping from Italy added, contactors extra, programming labor a small extra charge. Two different programming hand held consoles are available at extra charge but Greg programmed mine for straight traction before he shipped it to me so I did not need to buy one.

Later I will remove my Prestolite 4001 motor (a predecessor to Advanced DC Motor installed circa 1978) to retard the brush ring to neutral as advised for regen mode. Some one will come to Inverness and reprogram the E-Prom for regen. There is something about the California Central Valley summer heat that encourages people to come visit the Pacific shore.

One of the fellows I first met in Greg's shop was Robb Robel who repairs and converts cars there. Robb is also working on own his own EV and about to install a H2. He was going on vacation in two weeks so I suggested he and his wife stay in our guest apartment as other EVers have. They did and we learned together, me mostly from Robb, how to read the 65 page 'User's Manual' translated from Italian to the English version by an Italian and locating the 20 or so pages that apply to this particular H2. It is really a shop manual for a technician who is wiring up lift trucks, field weakening, 5 cable motors instead of four, speed check, etc.

I will be able to do a second H2 installation much more quickly after this first rather lengthy learning process. I recommend anyone doing his or her first ZAPI installation have a consultant come for 4-6 hours. I hope there will be a true 'Owners manual' available soon.

The H2 has an LED indictor lamp on the controller, which flashes from 1 to 9, and 32 blinks or remains on. Each decoding blink displayed gives you one or more trouble descriptions for each. The continuous blink indicates low battery charge with less than 10% residual charge. We had just the 8 blinks so then it was for us to try to interpret the diagnosis page. We had installed the main contactor ahead of the traction positive feed and the ZAPI wanted it controlled just ahead of the motor with the B+ plus on at the controller at all times.

All the H2 contactor solenoids work on traction battery voltage so I used a 96-volt relay to control my 12 VDC Albright. With my 16 - 12-volt deep-cycle Optimas with BAT Ultra-Force catalyst connected in series-parallel, I get good acceleration for the two lane county roads through hilly terrain.

The H2 400 is the best controller l have ever used. It is flexible, can be reprogrammed in the future and can be used in other applications. And the price is right, less than half the cost of other controllers I considered, none of which would give me regen at this time. I recommend it for any light duty pickup or car as an ICE weighing under about 2400 pounds. My MGA weighed 1995 pounds initially, now 2500 pounds with equal weight on each axle. The H2 600 would be best for cars up to 50% heavier.

Part 3

Nov 1996

Regenerative Braking Now Installed in my '59 MGA Roadster.

I have been running my Italian ZAPI H2 400 amp 96 VDC controller in the standard traction mode since June 1996. For regenerative braking, there is the added cost of more contactors. In mid-October the Albright contactors arrived from the UK. They ship about every 6 weeks but the August vacations got in the way.

For regen you need a changeover contactor (single pole-double throw) and reversing contactor (double pole-double throw) at $190 and $329 respectively. This certainly adds to the cost of regen. But I require regen braking for the paved roads on hills in my neighborhood, as the MGA has drum brakes all around. The grades can be up to 18% on hills 400 to 1000 feet above sea level.

When driving with the ZAPI the car is in freewheeling as long as the throttle is just barely on. With the release of the throttle microswitch the mode is that of compression on an ICE engine. Then with the use of the brake pedal stop light switch connected to a relay a further speed reduction occurs by putting a larger regen current back in to the battery pack. For regen to work without damage to the motor it is necessary to move the brush ring to a neutral position midway between the clockwise and counter-clockwise direction of the motor. This is not difficult to do although it took me several months to find the information for my Prestolite 4001 motor.

Greg McCrea, Electric Conversions in Sacramento CA, plans to assemble ZAPIs in metal box with heat sinks and wiring complete so only the motor and battery cables need to feed in. Also a terminal block will be available for the microswitch leads making the installation much easier. He came over in October to show me how to cable the new Albright contactor and reprogram the H2 for regen.

I now feel much safer and under control going down the hills. There has never been any trouble going up hill. Compared to my four previous controllers the first thing I notice is that you can creep when starting. The ZAPI start program provides different speed curves so the forward start can be very slow, half the speed of walking but moves up quickly to full current. The ZAPI controller has built-in resistors across the contactor points so there is no arcing and no extra diodes are required in the solenoid circuit.

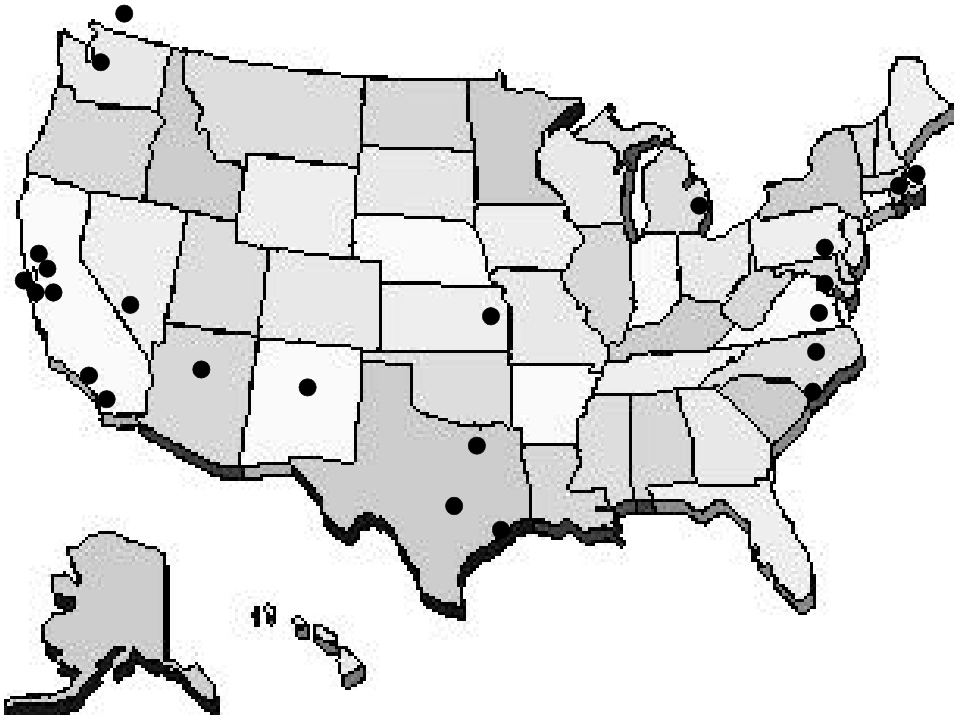
Bob Wing with MG at a Stanford EV Rally

Although I have a reverse gear I find the electronic reverse is much easier to use as it can work with any forward gear. The reverse gear has such a high gear ratio with an electric motor with high starting torque that more than once I have broken the welded motor clamp while in reverse. A dash mounted locking toggle switch with forward, neutral and reverse is very quick to use and the passenger cannot easily accidentally change it for you.

Also it is important to have motor governor speed control. With the motor under no load even at 72 VDC and now at 96 VDC the motor runs too fast with the clutch disengaged. Certainly you want the motor under load to go much faster that an ICE as the electric has good torque at low speed but is much more efficient near its upper end. I do not want to lose battery power to resistive heat through inefficiency.

continued on page 29.

24 ACTIVE CHAPTERS



CANADA

VANCOUVER EVA
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: Varies, see Web Site for details.

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
Contact: Louis Weiss, 1-818-705-2439
Mailing: 7012 Yarmouth Ave Reseda CA 91335-4826, USA
Meetings: 1st Sat./month, 10:00 am
Location: 1200 E. California Blvd, Pasadena, CA

NORTH BAY EAA
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: 3rd 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, San Diego, CA

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
Web Site: http://eaasv.org/
Contact: Will Beckett, 1-650-494-6922, willbeckett@email.com
Mailing: 4189 Baker Ave., Palo Alto, CA 94306-3908, USA
Meetings: 3rd Sat./month, 10:00 am
Location: Hewlett-Packard Co, Lobby A Auditorium, 3000 Hanover St., Palo Alto, CA

KANSAS / MISSOURI

MID AMERICA EAA
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: Godfather's Pizza, 8722 Santa Fe Drive, Shawnee Mission, KS

MASSACHUSETTS

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

PIONEER VALLEY EAA
Web Site: http://geocities.com/pveaa/
Contact: Emlen Jones, 1-413-549-6522, 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

MOTORCITY EAA *(new)*
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
Web Site: http://www.lveva.org/
Contact: William Kuehl, 1-702-645-2132, bill2k2000@yahoo.com
Mailing: 4504 W. Alexander Rd., N. Las Vegas, NV 89115-2489, USA
Meetings: 1st 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
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: Advanced Energy, 909 Capability Dr., Raleigh, NC

PENNSYLVANIA

EASTERN ELECTRIC VEHICLE CLUB EAA *(new)*
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
Web Site: http://www.dataline.net/hceaa/
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
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 04/20/02.

If you don't have a Chapter in your local area and are interested in starting one, contact membership@eaaev.org for more information.

Board of Directors 2002

Chairman
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chairman@eaaev.org

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

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treasurer@eaaev.org

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EAA Technology
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EAA Chapter Relations East
Jerry Asher
evjerry@usa.net

EV Charging
appointment pending

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

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

Notice: IRS requires us to ask for a full discloser 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

May 12 - 18, 2002
14TH ANNUAL TOUR DE SOL, Washington, DC to New York City
Manufactured, student and individual built cars will compete in a road rally event for the Tour de Sol championship.
Web Site: www.nesea.org/transportation/tour/

May 14 - 15, 2002
1ST ANNUAL EAA CHAPTERS CONFERENCE - EVISION WITH DIRECTION, Washington, DC
First ever all-Chapters EAA conference. First day at the Capital Mall followed by Smithsonian tours. Second day tour of Boyertown Auto Museum.
Contact: Jerry Asher
E-mail: EVisionA2Z@usa.net
Web Site: www.evadc.org/

May 15 - 17, 2002
6TH EUROPEAN CONFERENCE ON MOBILITY MANAGEMENT, Gent, Belgium
Conference on the strategies for sustainable mobility.
Contact: ECOMM 2002
Web Site: www.ecomm.org

May 29, 2002
MILE HIGH ELECTRICS, Bandimere Speedway, Morrison, Colorado, USA
Electric drag races.
Web Site: www.nedra.com

June, 2002
JUNIOR SOLAR SPRINT NORTHEAST CHAMPIONSHIP, TBD
Over 100 middle school groups from across the Northeast will compete with model solar cars for the Northeast Championship. Cars will be judged for Speed, Innovation, Craftsmanship, and Technical Merit.
Web Site: www.nesea.org/education/jss/

June 3 - 5, 2002
2002 FUTURE CAR CONGRESS, Arlington, Virginia, USA
Conference addressing issues involved in the development of automotive technologies aimed at reducing fuel consumption and emissions.
Contact: SAE
Phone: 1-724-772-4006
E-mail: meetings@sae.org
Web Site: www.futurecarcongress.org

June 9 - 14, 2002
14TH WORLD HYDROGEN ENERGY CONFERENCE, Montreal, Quebec, Canada
Conference on hydrogen as an energy source.
Contact: University of Quebec
Phone: 1-819-376-5108
Fax: 1-819-376-5164
E-mail: irhydrog@UQTR.Uquebec.Ca

June 19 - 21, 2002
11TH INTERNATIONAL TRANSPORT AND AIR POLLUTION SYMPOSIUM, Graz, Austria
Scientific conference assessing air pollution from transportation systems and effects on the environment.
Contact: Peter Sturm, Graz University of Technology
E-mail: sturm@vkmb.tu-graz.ac.at
Web Site: www.fvkma.tu-graz.ac.at

June 29, 2002
POWER OF DC, Mason Dixon Drag Way, Hagerstown, Maryland, USA
Electric drag races.
Web Site: www.nedra.com

July 21, 2002
FEDFLEET2002, Kansas City, Missouri, USA
Annual workshop of the National Federal Fleet Managers. Forum for fleet professionals at all levels of government as well as private fleets.
Contact: FedFleet 2002
Phone: 202/501-1777
E-mail: vehicle.policy@gsa.gov.org

Aug 24, 2002
EBEAA ANNUAL DISTANCE RALLY, East SF Bay, California, USA
Annual EV distance and public awareness rally.
Web Site: www.geocities.com/ebeaa

Sept 1, 2002
NEDRA NATIONALS, Woodburn Drag Strip, Woodburn, Oregon, USA
Annual national electric drag races.
Web Site: www.nedra.com

Sept 21, 2002
SVEAA ANNUAL RALLY, Stanford, California, USA
Annual national electric drag races.
Web Site: eaasv.org

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 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

June 19 - 21, 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

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.

continued from page 25.

There are 16 - 12 volt Optima prototype deep cycle batteries in two strings. My next project is to install Rich Rudman's battery regulators to limit charging to 14.7 VDC on each sealed battery. The kits sell for $7 or ready to install for $22 each. To complete my 24 year old project I want a 5kW, 120/240 Vac onboard charger to use at home or on the road.

Awarded best Classic Car at the Silicon Valley EAA '96 Rally at Stanford U.

My electric '59 MGA Roadster was sold on Jan 30,1999 to another EV enthusiast. The MGA could not have a better home and I have visiting rights.

Bob Wing, Ex-West Coast Editor EV News/Adv Technology Vehicles, EV Consultant

Sources for Existing EVs for 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.

Used EVs for Sale

FOR SALE: 1975 MGB EV $7000

Beautifully restored cherry red 1975 MGB, converted to electric in 1993-94. Participated in 1994 American Tour del Sol.

Contact: Dan Radack
Email: radack@radix.net
URL: http://lauragosse.home.mindspring.com/mg4sale.html
Phone: (202) 473-8003
Location: Washington, DC

Specifications:
Motor: Advanced DC FB-4001A (9 inch)
Batteries: 16 Exide GC-5 6 Volt Lead Acid, Non-sealed (96V pack)
Controller: Curtis Reconditioned Model 1221B-7401 (400 A)
Fuel Guage: Curtis Fuel Guage Model 900R
Charger: K&W Engineering BC-20
Tires: Goodyear, Low Rolling Resistance Tires
Includes Electric Vacuum Assist for braking, Double contactor circuit design for safety. MG has wire wheels, new convertible top and a new "tonneau" cover. Also seats reupholstered. Contact me for more information, including 1996 MG Magazine article on the car and its conversion.

Volunteers needed

Need EAA members to volunteer in the production of the CE publications:

Advertisement Manager:
To contact suppliers and EV related venders to advertise in CE. To send out billing invoices and verify current status of advertisements.

Column Editors:
To focus on a secific column, like Lee Hart's EVDL responses, and compile submissions for CE publications.

Submit interest to <ceeditor@eaaev.org>

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

_____

_____

_____

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 S	$ 8.00	
	*EAA Bumper Sticker #1 (10.5x3.75 inch)*	BS800	$ 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*	CATAL1		$5.00	
	Window Literature Holder (light plastic)	WL002		$15.00	
	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		$39.00	
		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
- Postal mail it with your payment for the amount plus * shipping and * handling to:

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

Name: _____ Email, Tel# _____

Address: _____

City, State Zip: _____

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

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