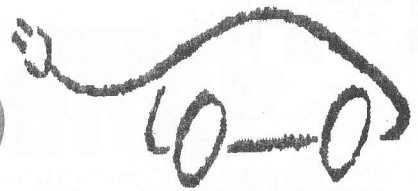


CURRENT EVENTS



February-March '00

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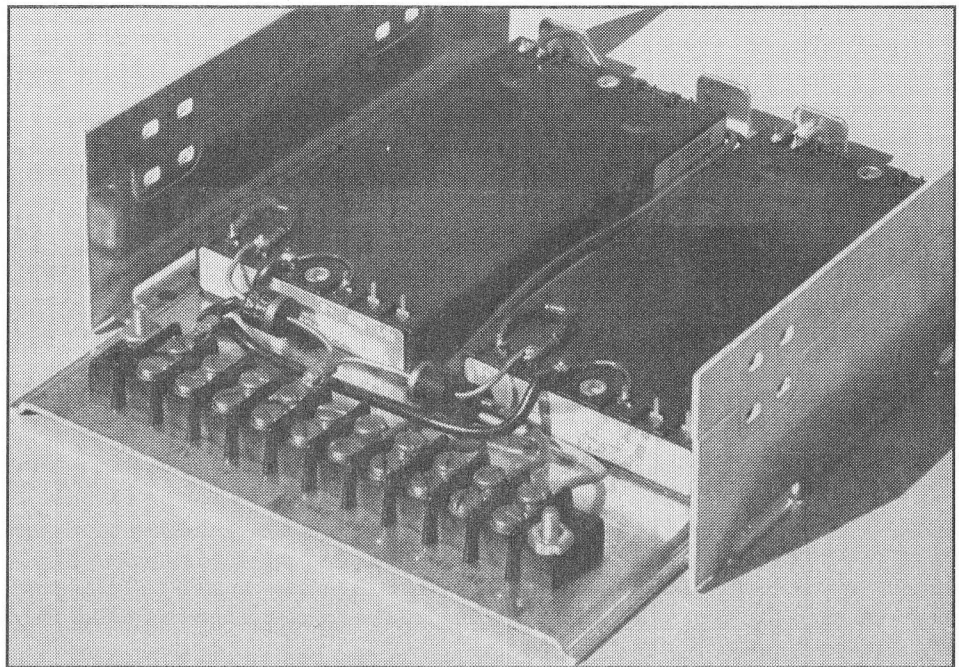
Vol. 32 No. 2&3

Price Breakthrough Build Your Own DC to DC Converter for Only \$35

By
Scott Cornell

A simple 84-144V input, 13.5V
100W output DC to DC converter
for EV use for under \$35.00

There are many old (and some new) EVs on the road that don't have DC to DC converters for 12V battery charging and maintenance. Most were designed or built that way, and have not been updated because of the relatively high (over \$200) cost of DC to DC converters. In this article, I'll provide plans, parts sources, and assembly ideas for a DC to DC converter that anyone who can solder can build for around \$35.00. The unit presented in this article won't run all of a vehicle's accessories on a dark, stormy night all by itself (you still need a 12V battery), but it will eliminate the need for a separate 12V battery charger, and



Continued on page 15

In This Issue

- 1** For years now it has cost almost as much to buy an onboard 12V DC to DC accessory battery charger as to buy a charger for the main pack. A Sevcon could cost \$400 and a Todd maybe half that. While they might not be cheap, they are sure worth it. That's why Scott Cornell's DC to DC design is such BIG news. Using standard telephone company hardware it is possible to put together something for a fraction of the normal cost.
- 6** You would think that living with the hills in San Francisco that it would be an unlikely place to own and ride an electric motorcycle. Not true for Bob Burnside who has made the most of it now for years. This month enjoy a first hand view of what it is like to use a Lectra in a city that can be a challenge for many cars.
- 8** Paul Brasch for years was one of the leading visionaries in the EAA. He was always pushing to improve EV performance from the earliest days. In his paper "Theoretical Benefits of Electrolyte Recirculation" he clearly explains how you can get 20% additional performance out of existing lead acid chemistry. The technical approach described is still a technology that should see the light of day.
- 12** This month CE's coverage of chapter activities focuses on the Phoenix Chapter and their new president's project DV8BUG. Roy Thompson describes the history of his bug and how it has gotten where it is now. He also touches on their approach of reaching out to the Hot Rod community. Their Chapter can truly be called Phoenix rising.
- 14** One of the biggest stories in the last few months has been the passage of AB71, the EV access Diamond Lane law. While it was front page news for CE in August-September we have heard little lately. This month the Diamond Lane Decal Status Report brings us up to date on what's going on and gives us some really great behind the scene views on how it got there.
- 16** Lots of people are unhappy about General Motors recall of generation I EV1 cars. Not the least displeased is the California Zero-Emission Vehicle Alliance. Leading the way to encouraging GM to replace them with Gen. II EV1s, the alliance is publishing a contact list to help EV activists to get organized. We happily reprint their list and give the alliance our full support.
- 20** News in Brief - Six more pages of the most interesting news releases we could find.
- 29** Member Want Ads - Why lease an expensive new EV when you can find a real bargain through our want ads?

PHOTO CREDIT - COVER

Scott Cornell's DC to DC converter shown as a two module unit.

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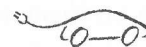
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Letters to the Editor

Dear Editor:

Here goes, I'll give it a shot. We folks (computer, E-mail, Fax non-users are not only in the minority but largely generally ignored.

I'm an EV owner who recently completed a conversion of a pick-up. However with rare exceptions I was on my own. Initial attempts to get info. And/or literature from about eight sources resulted in one reply. That has been the general pattern. VERY difficult to get meaningful aid of any kind from any source.

I would have to say "jawbone" conversion is the norm. I ran into so much aggravation I was amazed. I'd have to say it takes a lot of determination to complete the process. Experts assume we amateurs have knowledge that we don't. Even when info. And diagrams are available, they are at times very sketchy and/or confusing. Don't tell me I can do it any of several ways, surely one way is more desirable.

I have an operable EV mostly in spite of the obstacles. I can see why few try this. I was lucky and did encounter a couple of sources that enabled me to make it. Pure good fortune on my part. Of the several publications I pursued, some were oversimplified and some much to technical. I'm not to interested in the internal workings of a battery.

Well I've vented my feelings realizing snail mail is not the favored method of communications.

Charles N. Davis
10820 E. La Salle St.
Apache Jct. AZ 85220-7029

Dear Editor:

I'm a fairly new member, and about to begin an upgrade of a 1980 Lectric Leopard. I want very much to do the work

properly. I believe I've read about conversion guidelines published by a respected source, but I can't locate anything. (EVAA says they have no such guidelines.) Is such a document available from EAA? I am also applying for a Pennsylvania alternative Fuel Incentive Grant, and committing to an accepted standard should improve my chances for acceptance.

Thanks for your help,
Chris
<Chris.Tromley@iac.honeywell.com>
(Chris Tromley)

Dear Chris,

Through the years the EAA has considered coming out with it's own official converters guild but as of yet we have not done so. Probably the closest thing to such a document would be Mike Brown's "Convert It". Mikes been in the electric car movement for many years now and the approach he describes is probably the most popular direction of choice. - KB

Dear Editor:

May I comment on the article on how to make your own battery cables - cheap.

My converted V W Rabbit has been on the road for three years and has been running great. My battery cables and jumpers started out using the Thomas-Betts crimp on terminals at better than \$2.00 each and the \$30.00 crimping tool. With these lugs you have to use the bolt and wing nuts on the top of the battery terminals. Having been told that the bolts will "creep" in the lead battery post when tension is applied, I checked the tightness of the wing nuts at least once a week (yes there were lock washers on each bolt) but lo and behold my "Battery Bunny" let me sit one day.

The Problem proved to be a loose bolt and the heat melted the lead post off the

battery. Bypassing the battery got me home. Two weeks later, the same thing happened with another battery. Since then I replaced all the cable ends with replacement "heavy duty terminals" gotten from Sears for \$1.29 each. These are the normal auto cable terminals designed to clamp on the end of the cables with a bolted strap. 2/0 cable fits and the clamp bolts around the battery terminals tightly. These may not be as cheap as the copper tubing terminals, but they do not suffer the "creeping bolt syndrome" and the batteries are happier. I have had NO problems with the terminals since.

By the way, I had my battery shop "burn on" new terminals on the two Trojan 105's and both leaked and were not satisfactory after the failure. Therefore, I do not recommend this type of repair. Really enjoy Current EVents please keep it coming. More how to articles? ? ? ?

Best wishes.

George Moyer
Wilmington, De.
scottym@delaware.com (scotty moyer)

Dear Editor:

Great issue. Can you please include our website for the Washington, D.C. chapter next issue? It is <http://www.evadc.org>, check it out. We have some really neat stuff there thanks to our webmaster, Chip Gribben.

Speaking of chapters. It occurs to me that we need to expand our chapters. To wit, we have chapters on the west coast in Washington, California, Arizona, New Mexico, Texas, Colorado, Nevada, Utah. Who is the obvious next addition? Oregon ! Oregon members: please form a chapter! In the South, we have North Carolina, Virginia and Washington, D.C. Where is Florida, home of the Sun Day EV Challenge? Florida members: Please form a chapter! And how about Georgia?? I know there are some EV

Letters to the Editor - Continued on page 13

A simple 84-144V input, 13.5V 100W output DC to DC converter for EV use for under \$35.00 (Continued from page one)

extend the operating time and life of the existing 12V battery in the vehicle.

For those who may be new to EVs, a DC to DC converter is a device that takes some power from the EV's main battery bank, and charges the 12V accessory battery, like the alternator or generator does on a gasoline or diesel powered car. It keeps the main battery bank electrically isolated from the car's chassis, while allowing the vehicle's 12V battery to use the chassis as a ground, or return path for most of it's circuits (lights, horn, windshield wipers, radio, etc.).

The basic building block of this DC to DC converter is a modular DC to DC converter that was originally designed for use in telecommunications equipment (36-72V (48VDC nominal) input, 12VDC nominal output), and is available at a very low cost through a surplus mail-order catalog company. There may be other similar modular DC to DC converters available - the concepts presented in this article may enable you to design your own from some of the other modules available.

Since most EVs on the road today have a main battery voltage greater than 48 volts (84 to 144V seems to be very common), we'll use 2 of the DC to DC converter modules, each connected to 1/2 of the main battery pack (42 - 72 V on each half) so the drain on the main battery pack is uniform across all of the batteries. Although this unit can be used in a vehicle with an odd number of main batteries, I wouldn't recommend it since the load on each section of the main battery pack won't be the same. The outputs of the 2 modules will be connected in parallel, and connected

to the 12V battery.

Now for the specifics. The DC to DC converter module I've worked with successfully is a TDK/Kepco Power Supply model FPD12-4.2-48. It's 2 1/4 inches wide, 4 1/2 inches long, and 5/8 of an inch high (including connecting pins), and they have lots of built-in safety and ease-of-use

locally, or through catalogs listed at the end of this article.

The DC to DC converter module's connections are clearly labeled on the input and output ends of the unit. The input end has pins labeled +, -, SG, COM, RC, OC1, OC2, and GATE. We'll only use the input pins labeled + and - to connect to the halves of the main battery pack (through fuses and a switch), all other input pins will be left unconnected. The output end has pins labeled +, -, +S, -S, RV1, and RV2. We'll use the + and - pins to connect the outputs to the 12V battery (through diodes to prevent discharging the 12V battery when the unit is off), and the +S, and -S pins to set the output voltage to 13.5V (the correct operating voltage for most 12V lead/acid batteries). The other output pins will be left unconnected.

Tricking the DC to DC converter to put out 13.5 volts (instead of it's designed 12.0 volts) is easy. There are voltage sense inputs on the output side of the module to assure that the output voltage is correct for the application. If we put a set voltage difference between the output pins and the voltage sense pins, the module will adjust it's output voltage up until it thinks it's putting out exactly the 12 volts

it's designed to. To do this, we will connect the - output (-) pin to the - sense (-S) pin, and we'll connect a string of 3 1A 50V silicon diodes in series (a voltage drop of 2.1 volts) from the + output pin (+) to the + sense (+S) pin (anode toward the +S pin). This will trick the module into putting out about 14 volts at the output pins. We'll then connect

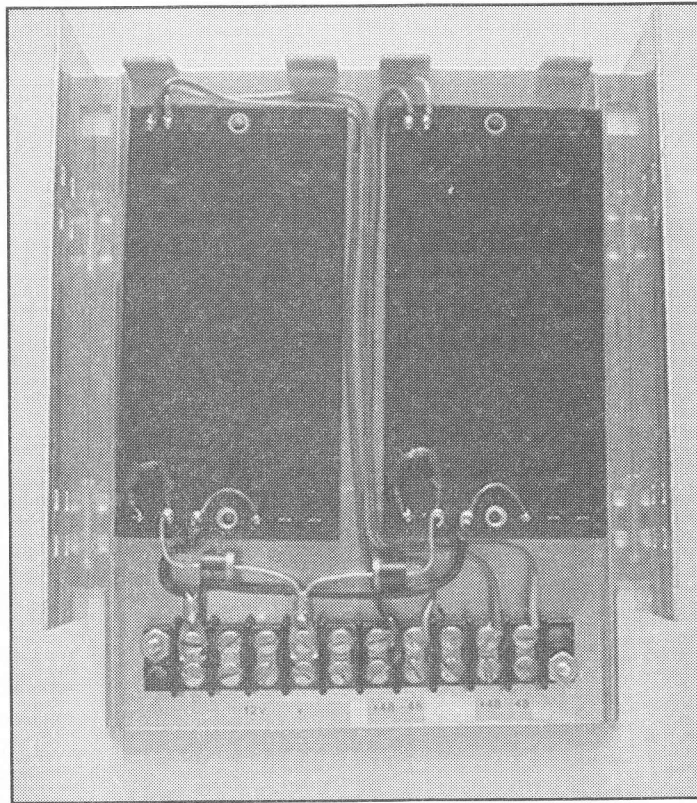


figure #1

features (current limit, over-voltage shut-off, over-temperature output reduction). They're available for \$9.95 each (you need at least 2) plus shipping from MECL. The only other parts that are needed are some small diodes, some fuses, and a double pole single throw switch (or relay, your choice). You can obtain the diodes, fuses, and switch

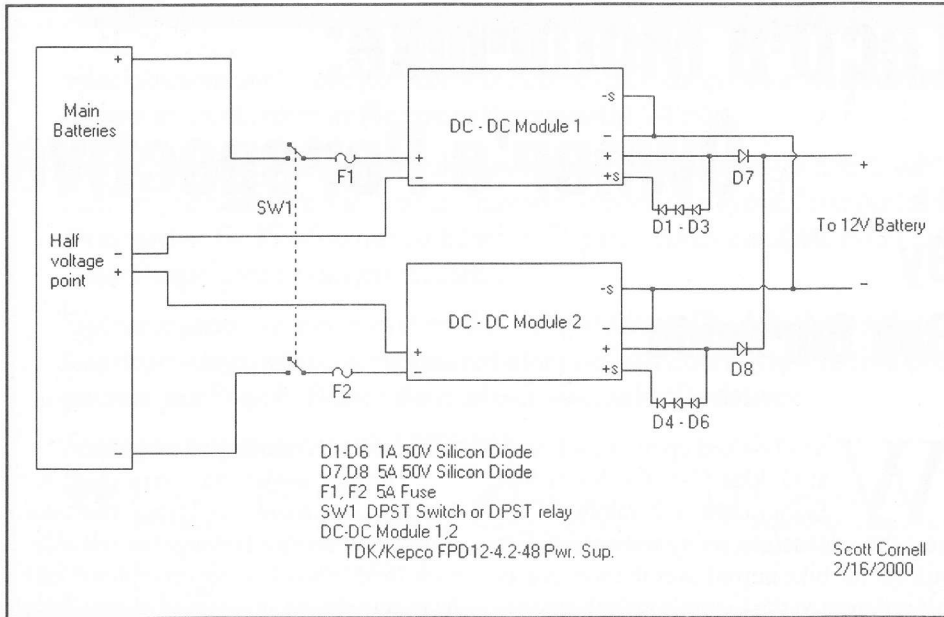


figure #2

the outputs through 5A 50V silicon diodes to the 12V battery (the diodes provides a 0.7 volt drop, and prevents the battery from discharging through the DC to DC converter modules when the unit is off).

Mounting of the modules and other components isn't critical, but there are a

few items to consider. First, the high voltage connections need to be carefully insulated from each other, and from any possible contact with the vehicle chassis or any roving human parts. Next, the diodes should be mounted on a piece of perforated board (pre-drilled circuit board, or equivalent)

and secured. Also, the bottom of the DC to DC converter modules should be mounted to a piece of metal (preferably aluminum) to act as a heat sink - if the modules get too hot, their output will decrease. The circuit diagram (figure #2) shows the (simple) circuit used.

The Photo (figure #1) shows my test unit, built on a scrap piece of aluminum. It would be better to fully enclose the unit, especially if it is to be mounted where it is exposed to the elements.

Connecting the unit to the vehicle's batteries is easy. Connect the 12V output to the 12V battery (through a fuse for safety). Connect each of the 48V inputs to one half of the main battery pack. If your car uses relay switching to change the main propulsion voltage (such as the Letric Leopard, or Bradley GT electrics), you'll need to be careful to connect the leads at the center tap of the pack to the individual battery terminals that comprise the ends of each half of the pack, since those two batteries may not always be connected together (such as when low voltage drive is selected). If there's a big jumper between the two batteries at the center of the pack, both of the center point wires can be connected to either end of that jumper.

This unit can be left connected to the batteries all of the time. When the 12V battery is charged up all the way, the unit will draw less than 100mA from the main batteries. This is an almost insignificant amount of current, but if you're going to leave the car un-used for a while, it would be better to disconnect the high-voltage side of the unit. - SC

Circuit technical specifications:

DC input: 36 to 72 VDC per input section (2), 1.3A max.

DC output: 13.5 VDC, 8.4A max. (around 100W)

Parts and sources:

DC to DC converter modules - MECI part number 500-0152 \$9.95 ea.

1A 50V silicon diode - MECI part number 520-0289 \$0.08 ea.

ALL part number 1N4001 - 15 for \$1.00

R/S part number 276-1122 - 10 for \$1.19

5A 50V silicon diode - ALL part number D620 - 2 for \$0.90

R/S part number 276-1661 - 4 for \$2.29

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Call / Request for Technical Articles

A new emphasis will soon be placed on technical articles in Current Events. Anyone who would like to share their design ideas, or experience in hardware are encouraged to submit articles to CE. For those interested, please contact Kurt Bohan at (510) 814-1864 or Fax at (510) 864-9293.

A Call for Letters to the Editor

Read something in CE you would like to comment on? Do you feel something is being left out? Send us a "Letters to the Editor". You can E-mail us, Fax us or use snail mail at the addresses below:

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Lectra Motorbike: Owner's Perspective

By
Bob Burnside

When I picked up my new Lectra at Golden Gate Cycles in San Francisco it was raining. I always thought that electricity and water didn't mix but the bike purred over the wet streets as I got used to the Lectra's unique characteristics.

I appreciate knowing that there are not a lot of complicated parts between me and the road. Smooth electric power makes a lot of sense for stop and go city driving, especially when you consider that you are recharging the batteries when the rear brake is used. There is no warm up period.

A lot of thought went into the Lectra's design. Not only is it stylish, but its design is practical. The type of people that the bike attracts are usually share the values that attracted you to the bike: environmental concern, forward thinking, interested in new technology and willing to try something different. They are generally people with whom you can exchange useful and interesting information.

It's a bit odd to wait at a light silently and then to spring into motion when the light changes. I like the noise that the Lectra makes when it accelerates. It's like the noise made by San Francisco's electric buses.

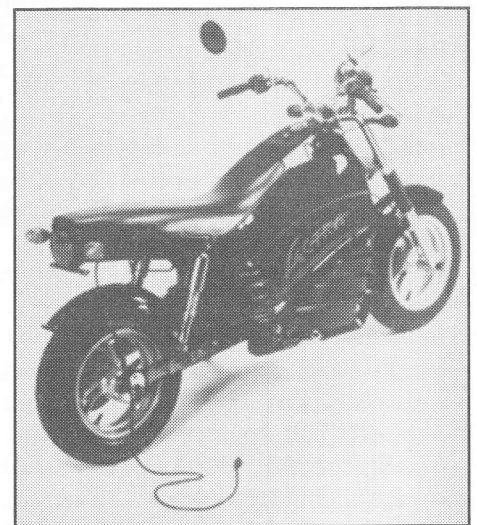
The Lectra smoothly accelerates up San Francisco's hills. Stop-and-go driving and hills somewhat decrease the bike's range. I use mine mostly for errands and getting to the office, all trips are less than ten miles. The bike is plugged in whenever I return to my garage so the range is adequate for my use within the City. Because I never run the batteries all the way down, my charging time is considerable less than

the four hours recharging can take.

Though EMB has arranged with McGraw insurance to insure the bike I found their service lacking. For instance, it took them a week to return a phone call. I have introduced my carrier of motorcycle insurance, National General from Ohio to the Lectra. They offer better rates and service. They can be reached at 1-800-325-1190. If you get a person unfamiliar with the bike, they can refer to my policy for the necessary information.

Electric Motorbikes Inc. has done great job with the very difficult task of bringing the first production electric motorcycle to market. Lectra is distributed by zapworld.com.

Bob Burnside <bobdavid@sirius.com>



(See page 29 for ad)

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THEORETICAL BENEFITS OF ELECTROLYTE RECIRCULATION

or

IS ELECTROLYTE RECIRCULATION WORTH THE COMPLEXITY?

by Paul Brasch

Electrolyte recirculation is any method of mixing or circulating the electrolyte in an electrochemical battery system. Since the well-known lead acid system is the most cost effective and available battery today, as it has been for the last 125 years, we should consider any idea that might aid it's performance. The electrolyte serves two purposes: it acts as a reservoir for the chemical reactants, and it provides a route for ions to flow between the electrodes (plates) so that they can act as charge carriers forming a path for conduction. The electrolyte is composed of water and sulfuric acid. Pure water is an insulator. The higher the concentration of charge carrier impurities (the stronger the acid), the greater the ease of charge flow (the higher the conductivity or the lower the resistance). Obviously the stronger the acid the better, up to the point of destruction of the active material and paste.

Now lets consider what happens in a battery as it is discharged. Most of the current will flow through the path of least resistance. This will be where the acid concentration is the strongest. And where is that?

Think of how the batteries are tested for charge, by using a hydrometer, because sulfuric acid is more dense than plain water. This is because it also has heavy sulfur atoms (atomic weight 32) in it besides light

hydrogen (atomic weight 1) and oxygen (a w 16) atoms in it. Chemically H_2O is atomic wt 18 and H_2SO_4 is a w 98 or about 5 times the weight of water on a molecule for molecule basis.

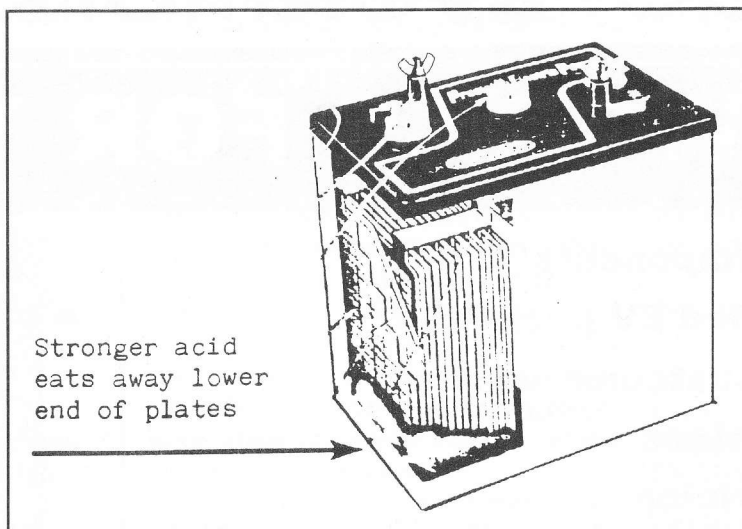
This means that the sulfuric acid will settle to the bottom of each cell and the weaker electrolyte concentration will rise to the top. This will occur as the battery discharges even if the electrolyte was well mixed before the start of discharge due to

material) than further up the plate. Gradually the area of greatest discharge rate will work its way up the plate area but it does this through a weaker and weaker acid mix.

Now what if the acid solution is stirred or recirculated (mixed) via a pump? The effective resistance of the electrolyte should be very uniform over the entire plate surface. This should greatly decrease or eliminate the "current hogging" effect described above. This means that the plate surface should be evenly used throughout the discharge. It should also discharged through a lower resistance due to the mixing of the acid with the entire volume of acid. This means that more energy could be withdrawn before the terminal voltage drops. This is what DOES happen, the range IS increased with recirculation. And because the whole plate is used more evenly, the battery should last longer. This is only the effect on discharge. The same principles apply on recharge, and are probably even more important for life extension of the battery.

So this is why electrolyte recirculation allowed more en-

ergy to be drawn from a lead acid cell. The recirculation produces mixing which allows the entire plate to be equally and evenly discharged due to the homogeneity of the electrolyte and its resultant consistent conductivity throughout its volume. No longer does the stronger, more conductive acid have the time to settle to the bottom of the cell due to its greater density. Thus producing a discharge pattern of greater depth of discharge toward the bottom and



PbA battery side as cut-out, showing where stronger acid eats away lower end of plates

recharging. As the battery is discharged the stronger acid continues to settle to the bottom causing a tendency to discharge the cell plates faster there as the resistance is less. As the solution is weakened at the bottom due to discharge, the weaker / lighter solution floats to the top and is replenished with fresher / stronger acid from the sides and bottom. This process will continue until the effective resistance to discharge is higher at the bottom (due to depletion of usable active

lesser toward the top of the cell. Due to a much more even depth of discharge over the whole plate surface and a higher conductivity during discharge, (due to mixing with the acid from around the outside area of the plates), the total energy withdrawn before the cutoff voltage is reached IS increased.

Since one is able to get more energy out of a battery utilizing recirculation, one might worry that the battery is being worked harder and therefore its life might be shortened. I believe that the opposite is true. This is because the battery is not being stressed more but is being stressed more **EVENLY**. Now nearly all of the paste and acid is evenly participating in the discharge reaction. Therefore when a battery or cell is not able to hold a charge or deliver its energy, it is probably due to the entire plate surface being exhausted rather than just the sides and lower portions of those plates. Thus I expect that the useful life should be increased.

Now lets consider what happens in a non-recirculated cell during charging. From the discussion on discharging in PART 1, you can see that the discharged battery or cell has its strongest (though now weak) acid at the bottom of the cell. And plates that are perhaps at 100% depth of discharge over the bottom half or third with some remaining non-reacted material in the upper portions. This means that once again that the higher current density should be at the bottom of the plates due to the lower resistance to current flow there. As the plate charges, the acid in the electrolyte gets stronger but this time it is already down at the bottom of the cell. This time there is **NO** density inversion to produce density convection flow. The solution gets stronger and stronger at the bottom, even though the paste there is becoming more charged in a polarity to oppose the applied voltage.

As the opposing voltage increases and the active material approaches complete conversion in the lower regions, the opposition to current flow forces more current to flow in the upper, weaker acid regions of the plates. Also once the conversion is nearly complete but there is a charging voltage that is sufficiently greater than the cells

opposing voltage, then dissociation of the water in the electrolyte starts to take place. This is the gassing stage and it finally forces a mixing of the electrolyte as the bubbles rise. This allows the upper regions to complete their charging and mixes the acid. in preparation for discharging. This part of the theory is supported by the fact that without some gassing, one cannot obtain a full charge on a battery, and charge differences between cells progressively get worse.

If recirculation is utilized during charging then the electrolyte is mixed and the charge current should be distributed over

draw less energy per charge. And what about gassing?

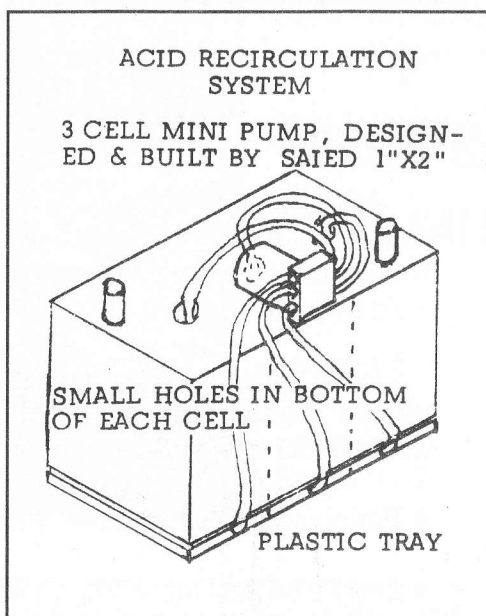
We are told that a small amount of gassing is good as it mixes the acid. But we have also been told by many battery experts that overcharging is the almost universal cause of battery failure. Could it be that **ALL** gassing is bad and that the more the worse? But electrolyte mixing is mandatory on charging so some gassing must be tolerated. Gassing evidently causes a loosening of the paste (active material) from the supporting-grid. Just as frost and ice keeps chipping away at a shear rock face, the bubbles expanding on and in the rough surface of the paste loosen minute particles.

With recirculation, gassing is not needed for mixing. And because the charging current is spread over the whole plate, the current density should be lower for any unit area. This means that the charge current to the whole cell (or battery) could probably be raised significantly before any gassing occurs. This is also true because the lower region of the cell is not being overcharged while the upper region is still waiting for stronger acid to start or finish charging as in a non-recirculated cell.

What this implies is that you should be able to charge your batteries in less time without gassing. As soon as you get any gassing that should be a sign that the whole cell is fully charged. It has been reported that Saied Motaei can recharge his battery pack in only 4 hours instead of the usual 10 hours by use of recirculation. That would seem to support this part of the theory.

If gassing is the major failure mechanism of overcharging, and it can be all but eliminated through the use of recirculation, then this should also increase the life of the battery. This coupled with an evenly distributed discharge and charge cycling should yield a significant increase in the life of the battery system. Remember that if the life is extended then the amortized cost of the batteries goes down.

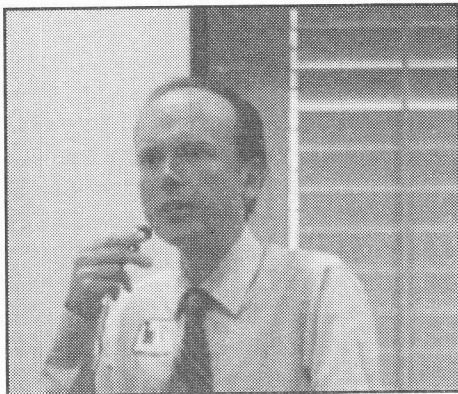
Now what are some of the disadvantages? First of all there is the complexity of keeping the electrolyte separate for each cell while still pumping the fluid. This is necessary to prevent shorting out the cells to



Three cell mini pump acid recirculation system design.

the entire plate, especially if recirculation was used during discharge. If recirculation was not used during discharge then the same layering effect of depth of discharge would probably produce an increased current flow in the lower more discharged regions of the plates. But this should be much less extreme than before. By now we can see that the usual process of charge and discharge is an inherently uneven one in a common battery system. This unevenness probably results in premature death of the battery due to deep cycling of the lower regions even when the battery as a whole is not deep cycled. It also allows us to with-

each other. Second there are a lot of cells in a battery system and the separation and pumping must therefore be repeated many times. Thirdly there is an increased risk of acid spillage due to broken pumps, tubing or whatever. Forth the energy to run the pumps must come from the batteries themselves. And fifth some control and monitoring system would be very useful to run the pumps at only the needed speed or to cycle them on and off and to monitor their operation and the cells performance to detect failures early.



Paul Brasch

These are truly a lot of hurdles to obtain improved battery performance. But if the cycle life is also improved it may well be worth it. We know now that range is extended by perhaps 20% and that charging time can be cut by 60%. We do not know what the cycle life effect is.

The above thoughts are based on individual facts and theory drawn from them. They can not be considered a scientific study. I would enjoy doing such a study and am considering such an undertaking. But for now we have only theory. However Globe-Union has done some studies of recirculated electrolyte batteries. But they never have offered any for sale, I am told. Could it be that the life was increased so much that it would have cut sales or were there other problems? Until I or someone else publishes such a study, or we get several years of life on a set, we can only be sure of increased range and decreased charging time versus the complexity added. That has to be the decision at this point. But remem-

ber that applying recirculation is something new and surely ways of simplifying and improving those methods used will be forthcoming. Other areas of research-needed include the minimum flow rates needed for both charge and discharge rates, long term reliability of pumps and tubing, and development of the monitor and control circuitry. And so the art advances.



Editor's Note:

Globe Union did offer a recirculated electrolyte battery in the 1981-82 time frame. A very few of these batteries actually made it into vehicles. Unfortunately this was to take place in the beginning of the Reagan years which produced a temporary hibernation of electric vehicle technology. This article which was written by the late Paul Brasch originally appeared in the February and March 1984 EAA Newsletter, Vol XVII No 2. - KB

Off Topic

G.M. vs Microsoft

At a recent Expo, computer guru Bill Gates reportedly compared the computer industry with the automotive industry, stating: "If General Motors had kept up with technology like the computer industry has, we'd all be driving \$25.00 cars that would go 100 miles to the gallon."

In response to Bill's comments General Motors issued a press release stating: "If GM had developed technology like Microsoft, we would all be driving cars with the following attributes:

- ◆ For no reason whatsoever your car would crash twice a day
- ◆ Every time they repainted the lines on the road you would have to buy a new car.
- ◆ Occasionally your car would die on the freeway for no reason, and you would just accept this, restart and drive on.
- ◆ Occasionally executing a maneuver such as a left turn would cause your car to shut down and refuse to start, in which case you would have to reinstall the engine.
- ◆ Macintosh would make a car that was powered by the sun, reliable, five times as fast and twice as easy to drive, but it would only run on five percent of the roads.
- ◆ The oil, water temperature and alternator warning lights would be replaced by a single "general car fault" warning light.

Some car humor from: Ed Thorpe <ethorpe@jps.net>



GUZZLING GAS

U.S. motorists have put OPEC back in the driver's seat

◆ U.S. gas consumption increase, 1990 vs. 2000: 25%

◆ Half the increase is due to escalating total driving (vehicle miles traveled). Half is due to SUV and other "light truck" exemptions from car fuel-economy standards.

WORLD GAS PRICES

(\$ per GALLON) MARCH 19, 2000

New York Region 1.79	Buenos Aires 4.56
London 5.64	Jerusalem 4.07
Paris 4.34	Tokyo 4.00
Berlin 3.87	Hong Kong 4.50
Rome 3.82	Seoul 4.50

John Helwig
john.helwig@spcorp.com

**Don't Miss The
Rocky Mountain Electric Drags
MAY 27 th 2000
Bandimere Speedway, Denver Colorado**

National Electric Drag Racing Association
Bill "Wiseneimer" Dube' (National Technical Director)
BillDube@killacyle.com
(303) 497-3933 work, (303) 355-4275 home, (303) 377-5664 fax

**SHOP
AT THE
EAA STORE
SEE PAGE 31**

Phoenix Chapter Meets at McDonald's



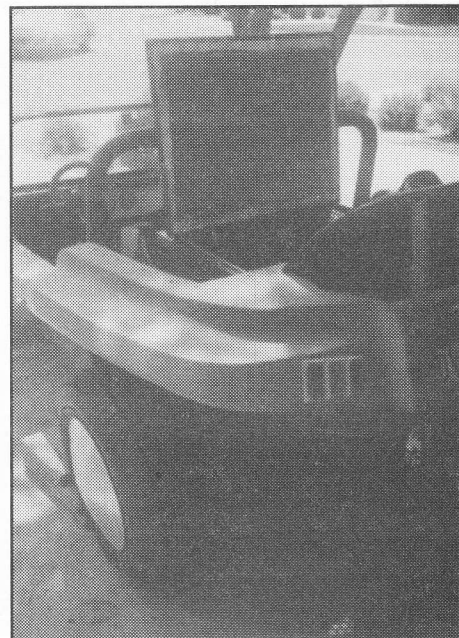
Sam DiMarco and his junk yard Scooter

March weather in Phoenix is delightful, every Saturday afternoon at the Scottsdale's McDonald's, at the Pavilion Shopping Center, street rod builders get together to show off their work. What better place is there to showcase our EVs. This was our 1 St. attempt. We had five cars in all, one from new Mexico and Sam DiMarco's scooter built from junk yard parts and batteries.

Soon coming under her own power to this event will be my DV8BUG. DV8 BUG was borne in Germany as a 1963 Karmann Ghia, brought to the US by a GI, where I acquired her at Fort Bragg North Carolina. In Boise Idaho she underwent unexpected modification by a Buick. Thus the first metamorphosis to 36 HP dune buggy with top, heater and a ski rack. Under this configuration we went to Sun Valley skiing at -40 degree below, to the Oregon coast and Seattle, where it served as an airport commuter.

Next came a 356 Porsche engine and a

move to Las Vegas for extended duty as an airport commuter. In 1980 "BUG" moved to Phoenix to chase coyotes and take my son to high school. After 20 plus years "BUG" was getting pretty tired, so in 1998 we started the last metamorphosis to all EV.



Shown is the battery box for the eight batteries in back



Hot Rod fan looks over our EV events & Info. display



DV8BUG has four batteries in front (in place of fuel tank)

If all goes well she should be operable in the fall of 2000. I used an Advanced DC motor from "Wilde Evolutions" powered by 12 Optima batteries from Sunbelt Batteries and tech help from the Phoenix Chapter on the electrical circuit design. "BUG" weighed in at 1800 lbs with the Porsche engine and top so she should be about the same weight as an EV.

This has been a fine project for an old retired throttle bender as myself, especially sense time is not a factor. It also lead to a lot of new friends, a computer and who knows what ! - RT



No, BUG is not going to become a Schwimmwagen but the Prop in the back gets lots of attention..

Roy Thompson, President
Phoenix EAA, (480)991-5075

7710 Gainey Ranch Road, #155
Scottsdale, AZ 85258
E-mail: DV8BUG@aol.com

FEEDBACK

FEEDBACK - Continued from page 3

Clubs that are not affiliated with EAA, but in the spirit of brotherly/sisterly support, I think we should mention them, even if we use smaller type style, so that our members in those cities/states can join up with people of similar interests. I am thinking of Philadelphia and the Mid-West (Chicago, Detroit). We need a New York Chapter, since they have the CA EV Mandate still on their books, and are home to the most recent American Tour de Sol EV race. Let's build our national network.

Last item: How about some coverage of East Coast events, like the Tour de Sol and the Sunrayce 99. Lots of press releases on their web sites. Just lift them.

Charlie Garlow, EVA/DC 202-564-1088
GARLOW.CHARLIE@epamail.epa.gov
(CHARLIE GARLOW)

Report on Hydrogen Potential of Powerballs

Salt Lake City, UT-based Natex Corporation and joint partner Powerball Industries recently announced that a report prepared for the Department of Energy's (DOE) Office of Power Technologies Hydrogen program is ready for public release. The report concludes that the Powerball Technology — which uses fuel pellets that can be produced from natural gas — would be a competitive future hydrogen infrastructure fuel. The future cost of powerballs could drop to \$1.56 per gallon of gasoline equivalent, and even much lower if energy-efficient, high volume production is attained. "The onboard equipment for the powerball process is estimated at about 46 cents per kilogram of hydrogen, compared to the capital cost of a pressure vessel, \$750, which equals about 88 cents per kilogram of hydrogen stored over the life of a vehicle," according to the report. A gallon of powerball pellets can store an estimated 17.8 kilowatt-hours of energy in the form of hydrogen.
(NATEX RELEASE)

Diamond Lane

Decal Status Report

Letter from
Susan Frank and
David Modisette
February 17, 2000

Dear Club Members,

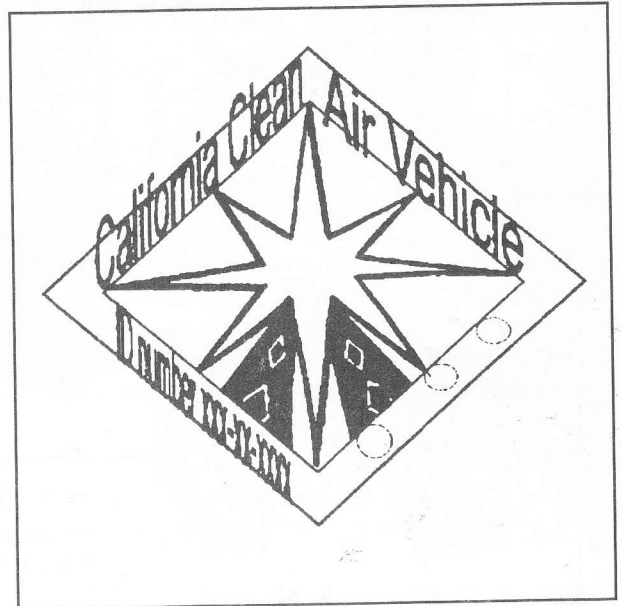
As you know, there has been recent discussion and debate about design, size and placement of "distinctive decals, labels,

or other identifiers" placed on vehicles eligible for HOV lane access as a result of the passage of AB71. Our involvement in this issue stemmed from a commitment of the Kirsch Foundation (whose founder, Steve Kirsch, was a major proponent behind AB71) and the California Electric Transportation Coalition (CalETC) to ensure that the best possible design, location, and size be agreed upon by those affected.

We would like to share with you the most recent efforts - on your behalf and that of future electric vehicle drivers throughout the state - regarding the stickers proposed by the CHP and DMV. As you read through this, keep in mind that throughout this last part of the process, the concerns of EV drivers were foremost in our minds as we worked toward a resolution.

The Designs

The first set of designs submitted by CHP/DMV were half-moon shaped, and measured 10" by 7" for the rear quarter panels and 5" by 3-1/2" for the rear bumper (Version A). The Cali-



Version B. CalETC submission. The Electric Transportation Coalition's more creative diamond shaped look.



Version A. Initial DMV/CHP design. Rear sticker size is 5" X 3-1/2", side panel sticker size is 10" X 7".

fornia Electric Transportation Coalition (CalETC) submitted a variation that included a diamond-shaped design with a more creative look (Version B). As a result of that design, CHP/DMV submitted their latest and final version, a diamond-shaped design measuring nearly 11" by 11" for the rear quarter panels and 5" by 5" for the rear bumper (Version C).

It was at this point that the Kirsch Foundation got involved and determined that the best interests of EV drivers were not being met. After many phone calls to CHP/DMV to allow us to submit a new design as



Version C. Most recently proposed designs by DMV/CHIP. Rear side-panel sticker size is 11-7/8" X 11-7/8". Rear bumper sticker size is 5" X 5".

well as to meet with us face-to-face. The Kirsch Foundation then hired a private design firm and, in one week's time, a dozen designs were produced and then nar-

rowed down to three possible for submission to CHP/DMV.

The Meeting

On Friday, February 11, both of us, along with Kelly Milton of Assembly Member Jim Cunneen's office (AB71's author), met with a dozen officials from CHP and DMV. It was clear at the outset of the meeting that we had an opportunity to reach an agreement that met most of our needs, although compromise was going to be important. The CHP/DMV compromised on both the design and size, by accepting one of our proposed designs (Version D) at the 2.5" by 5" size.

They were not, however, willing to compromise on the side/rear quarter panel location, but were willing to consider a significantly smaller size of 3-5/8" by 7". To summarize the CHP's reasoning for side decals, they felt that for

enforcement and visibility reasons as well as to decrease the possibility of "road rage" (from drivers who don't understand why a solo-occupant vehicle is in the carpool lane), a side decal was critical. Given that they enforce from center dividers, unmetered and metered ramps (both on foot and in their vehicles) as well as from all highway lanes, CHP felt that a front and rear bumper sticker combination would be insufficient in achieving proper enforcement.

The Resolution

We know that many of you disagree with the CHP's reasoning, and overall, object to putting anything on your vehicle that is both permanent and potentially unattractive. The bad news is that we weren't successful in getting CHP/DMV to agree to front and rear bumper decals only. The good news is that a wonderfully improved design, at a much more reasonable size, has been approved by the agencies charged with enforcement. Further, the new decals will serve an important purpose of educating the public about clean vehicles, and one of the many benefits of driving them.

While your comments - both supportive and critical - are welcome, whatever your perspective, we hope you will agree that a bad situation was made considerably better. Thank you for your interest in this issue and for your continued commitment to electric vehicles.

Sincerely,

Susan E. Frank

Program Officer, Environmental Grants & Issues

Steven & Michele Kirsch Foundation
sfrank@cfsv.org

David L. Modisette

Executive Director

California Electric Transportation Coalition (CaETC)
dmodis@ns.net



Version D. Final design (Kirsch foundation). Size is 3-5/8" X 7" for the sides, and 2-1/2" X 5" for the rear.

Reprinted From <http://ev1-club.power.net/ab71/letter.htm>

Help EAA Grow
Support
Cars for
Clean Air
Donate a car
and receive a
tax deduction

EAA has already received its first donated gasoline car (in Sacramento), made \$700 on it and generated a handsome tax credit for its owner. Help continue this program by finding other cars. Donate your own, persuade a friend or relative, or talk to your local mechanic, who often has customers that decide not to repair a car and need to get rid of it. Do yourself a favor by knocking something off your income tax while helping EAA.

Contact information:

For the San Francisco Bay Area:
Kurt Bohan
EAA, Hangar 20
2701 Monarch St. Suite 142
Alameda, CA 94501
Tel. (510) 814-1864
Fax (510) 864-9293
E-mail: eaanews@aol.com

For the Sacramento area:
Tim Loree
7428 Wisconsin Dr.
Citrus Heights, CA 95610-7432
Tel. (916) 967-3044
Fax (916) 863-0303
E-mail: loreet@2xtreme.net

California ZEV Alliance

Response to

GM Announcement About

EV1 Recall

The California Zero-Emission Vehicle Alliance is surprised and saddened by General Motors' announcement today that it is recalling all of its first generation EV1, and 1997-1998 Chevy S-10 Electric Vehicles due to a safety problem with the vehicles' charge ports. Alliance representatives are available to comment on this announcement:

Obviously safety has to come first, and this is GM's decision. We applaud GM for looking out for its customers.

Drivers are devastated by the news and don't want to give up their cars, because they love them. They want GM to replace the recalled EVs with new, Generation II EVs. This will put pressure on GM to meet an already tight market for electric vehicles. There were long waiting lists for these cars before this announcement - these cars have not been easy to get.

We hope it will encourage GM to produce more Gen. II EV1s and Chevy S-10s, which don't have the charge port problem. We encourage GM to provide both battery options that have been available in recent months - the Panasonic advanced lead-acid, and the Nickel-Metal Hydride batteries.

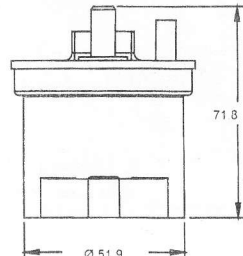
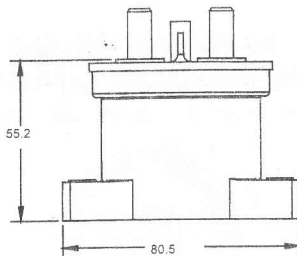
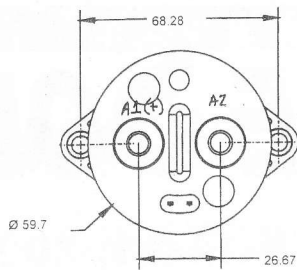
Zero-emission electric vehicles are an important part of California's plan to address our serious air quality problems in this state. This is one automaker's decision about its first generation product, and does not impact the newest EVs that automakers have made.

Contacts:

Janet Hathaway, Natural Resources Defense Council - 650-738-5707
Tim Carmichael, Coalition for Clean Air - 310-441-1544 ext 322
Ken Smith, American Lung Association - 916-961-3090
Andy Weisser, American Lung Association - 818-757-1440
Cece Martin or Dave Modisette, CalETC - 916-552-7077
Sandy Spellicy, Planning & Conservation League - 916-313-4513
Michael Pancook, Union of Concerned Scientists - 510-843-1872
Jamie Knapp, California ZEV Alliance - 530-756-3611

Jamie Knapp

J Knapp Communications
jknapp@mother.com
530-756-3611 - phone
530-756-3635 - FAX



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Tolerances: 0.X = $\pm 0.77\text{mm}$ 0.XX = $\pm 0.25\text{mm}$

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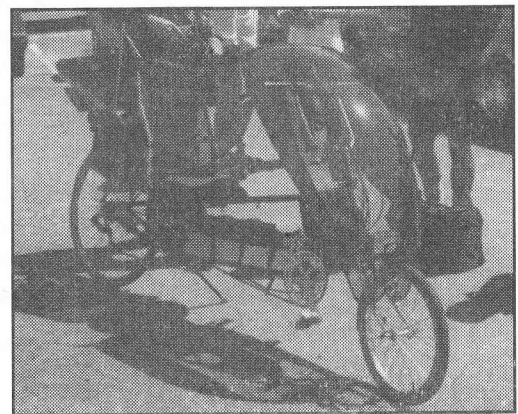
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A CALL FOR LETTERS TO THE EDITOR

Read something in CE you would like to comment on? Do you feel something is being left out? Send us a "Letters to the Editor". You can E-mail us, Fax us or use snail mail at the addresses below:

E-mail: eaanews@aol.com

Fax: 510-864-9293

-or- Snail mail at:

EAA/Current Events, Hangar 20,
2701 Monarch St., Suite 142
Alameda, CA 94501

Call for builder write-ups

Proud of your car ? Would you like to share what you have done with others ? Why not send in photos and a short (or long) written description to CE so we can print it. For the last 30 years the EAA has grown strong by members sharing with members the technology they have used in creating their cars. Help continue this tradition. Take some pictures of what you think stands out most about your vehicle and send it in with a description (photo essays are OK). Don't forget to send your contact information, including, telephone number, mailing address, and E-mail if you have it, to:

Kurt Bohan
EAA Current Events
2701 Monarch St., Suite 142
Alameda, CA 94501
Tel. (510) 814-1864
Fax (510) 864-9293
- or E-mail to -
EAANEWS@AOL.COM



AMERICAN TOUR DE SOL

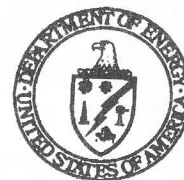
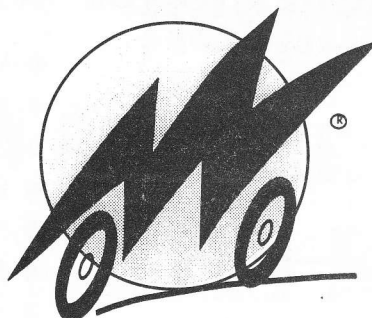
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<http://www.hondaev.org/chg.html>

<http://www.evc3.com/charging sites.html>

<http://www.smud.org/evs/ICS.html>

<http://www.calstart.org/fleets/rechargerefuel.html>

Events Calendar

May 3-5

Environmentally Sustainable Transport, Vienna, Austria. The conference will discuss policies, strategies and instruments for achieving environmentally sustainable transport (EST) by presenting the main results of the OECD project. Conference will provide a forum for dialogue with different stakeholders and discuss best practices and innovative approaches to EST. Contact: Peter Wiederkehr, OECD Environment Directorate. Tel. 33 1 45 24 78 92 Fax 33.1 45 24 78 76

E-mail: peter.wiederkehr@oecd.org
Web site: www.oecd.org/env/ccst/est/

May 7-10

National Clean Cities Conference, San Diego, California. The 6th National Clean Cities Conference as a forum for advanced transportation industry representatives, government stakeholders, and fleet managers. Contact: National Clean Cities Program. Tel. 800-CCITIES Web site: www.ccities.doe.gov/conference.shtml

May 11-12

SAE/NESEA Hybrid-Electric Vehicle Conference, New York, New York. A two-day TOP-TECH symposium will present operational experience and the latest technology and research on heavy-duty hybrid-electric vehicle technology. Focus is on buses and trucks. Contact: SAE Tel. (724) 772-7148

May 18

Rocky Mountain Electric Drags, Bandimere Speedway, Denver Colorado. Event organized by the National Electric Drag Racing Association. Contact: Bill Dube' (303)497-3933 Work (303)355-4275 Home (303)377-5664 Fax

May 12-18

12 th Annual Tour de Sol, New York, New York. The annual electric vehicle championship from New York to Washington, D.C. Entries are built by major OEMS, students, individuals from around the world. Contact: NESEA Tel. (433) 774-6051 Fax (413) 774-6053 Web site: www.nesea.org

May 28-31

The Hydrogen Millennium, Trois-Rivieres, Quebec. Conference focuses on the opportunities for hydrogen energy systems and applications. Contact: Canadian Hydrogen Association. Tel. (819)376-5139 Fax (819) 376-5164 E-mail: IRH@UQTR.Uquebec.ca

June 18-22

2nd International Urban Environmental Infrastructure Forum: Mobile Sources and Transportation Planning Issues, Salt Lake City, Utah. A forum to discuss and hear actual strategies and approaches adopted by urban communities faced with real-world mobile source-related air quality problems. Contact: Mike Roy, Air & Waste Management Association. Tel. (412) 232-3444 ext 3144 Fax (412) 232-3450 E-mail: mroy@awma.org Web: www.awma.org

June 20-21

Removing Market Barriers to Zero and Low Emission Mobility, Stockholm, Sweden. The conference will focus on how cities can break down the market barriers that hinder the widespread use of zero and low emission vehicles. The conference also reviews the final report on one of Europe's largest demonstration projects ZEUS - Zero and Low Emission Vehicles in Urban Society in the field of clean transportation and improved energy efficiency. Contact: ZEUS Project. Tel. +46 8 508 28800 Fax: +46 8 508 28993

E-mail: zeus@environment.stockholm.se
Web Site: www.zeus-europe.org

June 28 - July 1

EV China 2000, Shanghai, China. Technical conference on and exhibit of diverse electric vehicles such a buses, cars, motorcycles, scooters, and bikes as well as electric vehicle component parts. Contact: Organizing Committee Tel. 0086 21 6507 8564 Fax: 0086 21 6507 9449 E-mail: broex@public9.sta.net.cn - or - inquiry@broex.com

July 23-28

8th International Energy Forum ENERGEX 2000, Las Vegas, Nevada. An international forum on all energy disciplines and energy related issues. Contact: Suzanne Ulrich, NTS Development Corp. Tel: (702) 317-0777 Fax: (702) 257-7999

August 21-23

2000 Future Transportation Technology Conference, Costa Mesa, California. SAE annual conference discussing the latest developments in vehicle technologies. Contact: Karin Bolcschazy, SAE Tel. (724) 772-7179 Fax (724) 776-1830 E-mail: karinb@sae.org

September 25-29

ISATA 2000, Dublin Ireland. International Symposium on Automotive and Transportation Technology. Contact: ISATA Tel. +44 1372 720 620 Fax +44 1372 720 101 E-mail: isata@compuserve.com

October 16-18

International Electric Vehicle Symposium, Montreal, Canada. EVS-17 will be hosted by the Electric Vehicle Association of the Americas. Contact: EVAA Tel. (415)249-2690 Fax (415)249-2699 E-mail: ev@evaa.org

For more information, or to add an EVENT to this calendar, please call Anna Cornell (925) 685-7580 (10 AM to 4PM, PST only, please!)

News in Brief

Compiled by Ruth M. Shipley from information supplied by ENR Publishing. If reprinted, please credit CE and Ruth Shipley.

CA Budget Includes Funds for EVs

California Governor Gray Davis unveiled his FY 01 budget earlier this year, requesting a record \$88 billion in expenditures. In addition, Davis proposed millions of dollars in funding that would support EVs and EV infrastructure. The FY 01 budget proposal includes \$81.9 million for an initiative that would "nurture alternative fuels programs in their infancy" while increasing California's use of alternative fuel vehicles (AFVs). The budget provides \$14.4 million for the California Department of General Services to purchase AFVs and the necessary refueling infrastructure for state fleets and garages. Another \$5 million will be given to the California Energy Commission (CEC) to create a vehicle efficiency incentive program that would extend funding for CEC's zero-emissions vehicle (ZEV) incentive program. Under the proposed budget, CEC would also receive \$1.5 million to study and develop hydrogen fueling infrastructure. The California Air Resources Board (CARB) would receive \$5 million to purchase fuel cell-powered buses for transit agencies statewide. Additionally, CARB would receive another \$50 million for grants to local air pollution control agencies that would help school districts replace pre-1977 diesel-powered school buses with less polluting alternatives, such as electric and hybrid electric buses.

(EV CALIFORNIA: WINTER 2000)

Green Algae Can Produce Hydrogen

Green algae may soon be able to produce clean, efficient hydrogen gas to fuel cars. The algae, known as *Chlamydomonas reinhardtii*, has the ability to split water into its component parts, hydrogen and oxygen. "The microscopic plant uses the energy of

the sun to produce hydrogen," said Tasios Melis, a professor of plant and microbial biology at the University of California-Berkeley. The algae rely on sulfur to grow and photosynthesize and when scientists deprive the algae of sulfur, they switch into hydrogenase mode. Instead of using light to make carbohydrates out of carbon dioxide and water, the algae uses hydrogenase to break down energy stores. Typically, plants will give off oxygen as a by-product but when they switch to the hydrogenase cycle they emit hydrogen. Melis's team lets the algae grow naturally first, letting them use sunlight and water to photosynthesize and then they deprive them of sulfur. This forces the algae to switch into hydrogenase mode (after about 20 hours), and they begin to produce hydrogen. After about five days, the algae have used up their own protein and must be allowed to photosynthesize again. Melis said that a small pond full of green algae could produce enough hydrogen to operate a dozen cars for a week.

(REUTERS: 2/21)

CEEE Announces Green Car List

The American Council for an Energy Efficient Economy (ACEEE) recently published its list of the automotive industry's "greenest" vehicles. The group said the most environmentally sound vehicles on the road today are low production volume EVs, while the "meanest," or most polluting vehicles are large sport-utility vehicles (SUV). The cars that scored the highest in the "greenest" category are General Motors' EV1, and Nissan Motor Company's Altra EV. The most environmentally damaging vehicles include such popular SUV models as GM's Chevy Suburban or Ford's new Excursion. Other vehicles on the "greenest" list are Honda's Civic GX and Insight hybrid car. Toyota's RAV 4EV SUV and Ford's Ranger electric pickup truck were also included on the list. Vehicles on the "meanest" list include the Toyota Landcruiser, the Lexus LX470, the BMW Land Rover Range Rover SUV and GM's Cadillac Escalade. Also on the list are the Chevrolet Tahoe, GMC Yukon and the Dodge B2500 van or wagon.

(REUTERS: 2/16)

Book Discusses EV Markets

Footnote Publications recently announced it has published a new book on EVs which offers a complete "anatomy" of the EV industry, including information on commercial EVs, industrial EVs, leisure EVs, military EVs, the EV parts industry and servicing EVs. The book, titled "Electric Vehicle Markets, Players, Forecasts," was written by Peter Harrop, former CEO of Mars Electronics and current chairman of several advanced technology companies in Europe. The book explores the various markets available for EV technologies, such as electric golf carts, scooters, bicycles, and wheelchairs. Harrop said EV companies have demonstrated startling sales figures and commercial successes by making EVs in several applications. The book breaks down the EV market by sector, focusing on markets such as Heavy Industrial EVs, Light Industrial and Commercial EVs, and Two-wheel EVs. Each chapter includes a definition of the EVs in the market sector, information on market sector drivers, profiles of leaders in the market sector, a list of manufacturers, the size of the market sector, and future trends. "Electric Vehicle Markets, Players, Forecasts" costs \$800. For more information, contact Footnote Publications, phone +44-0-1256-862163, e-mail byword@zetnet.co.uk.

(EIN STAFF: 2/11)

CARB, Automakers Battle Over ZEV Program

California and automakers have reached a crossroads. While California has committed to rules requiring a percentage of all new cars sold to be ZEVs, automakers are diverging from all-electric vehicles, and concentrating on hybrid vehicles and improved internal combustion engines, both of which produce emissions. CARB is warning automakers that such a divergence will be to their "detriment." In 1990, California passed its Low Emission Vehicle (LEV) I program, which called for the introduction of ZEVs by 1998 and 10 percent of all vehicles sold in 2002 to be ZEVs. CARB waived the

requirement for 1998, but the 2002 mandate is still on the books. In 1998, California's LEV II program was passed, offering automakers partial ZEV credits for vehicles that meet Super Ultra Low Emission Vehicle (SULEV) standards. "Car manufacturers can't meet all of their ZEV requirement using partial ZEV credits," said CARB spokesperson Rich Varenchik. CARB estimates that out of approximately 1 million in new car sales annually, 40,000 would have to be true ZEVs by 2002. Currently, the only vehicles in California that are eligible for ZEV partial credits include Nissan's Sentra CA, Honda's internal combustion Accord, and Ford's compressed natural gas (CNG) F-series pick-up. CARB will review the ZEV mandate in September. (OCTANE WEEK: 2/3)

Ranger EV Receives Five Star Safety Rating

The National Highway Traffic Safety Administration (NHTSA) recently awarded a five-star safety rating for frontal crash performance to the Ford Ranger EV. NHTSA said the 2000 model year Ranger EV received the rating for both the driver and passenger positions. Under its New Car Assessment Program tests, NHTSA crashed the Ranger EV into a fixed barrier while traveling at 35 miles per hour (mph), an impact which produces the same amount of force as two vehicles colliding head-on, each traveling 35 mph. Test results are reported in a range of one to five stars, with five stars indicating the best crash protection. Other Ford vehicles that received the five star rating include the company's Taurus model and the Mercury Sable. The vehicles feature Ford's personal safety system, which includes an advanced restraint system with a dual-stage air bag system. In addition, the vehicles have a "central brain," known as the restraints control module, that analyzes certain information in order to determine whether an air bag needs to be deployed.

(FORD RELEASE: 2/4)

Korean Automakers Look to Fuel Cell Industry

The buzz in Korea is that some automakers are making the move towards fuel cell vehicles. Both Hyundai Motor and its affiliate Kia Motors recently reported that they intend to spend \$8.92 million this year alone on fuel cell research. Daewoo Motor has reported that it will embark on a fuel cell research and development program with a state-run laboratory. Even the local oil-refining companies are joining in. SK Corporation and LG-Caltex Oil plan to launch their own fuel cell research. However, in the auto industry, Korean automakers are not regarded as leaders in the fuel cell industry, despite the technological advances around the world. In order to combat this image, Hyundai Motor formed a fuel cell task force at its research and development center located south of Seoul in Yongin. "By 2003, Hyundai will make its final decision on whether it will mass produce fuel cell cars or purchase fuel cells from abroad," stated a Hyundai official. SK has reported that it will make its fuel cell transformer, which combines hydrogen and oxygen, available for road-tests to both Hyundai and Daewoo. Despite recent commitments to the fuel-cell market however, some analysts say Korea may be too far behind.

(THE KOREA HERALD: 2/8)

San Diego Post Office Gets EPIC Minivans

DaimlerChrysler will deliver 45 all-electric Dodge EPIC minivans this year to the U.S. Postal Service (USPS) in San Diego. Counting the USPS minivans and other commitments, DaimlerChrysler has leased all of its existing crop of production electric minivans. The minivans will be delivered to the San Diego USPS during the first quarter of 2000. DaimlerChrysler expects to unveil its next generation electric vehicle in 2002.

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The company also has fulfilled its agreement to disperse electric vehicles under the memorandum of agreement with the state of California. USPS will use 62 EPIC minivans at its facilities in San Diego, Huntington Beach, and Harbor City. In addition, the Xpress Shuttle in Los Angeles, University of California-Los Angeles and UPS will also use EPICs in minivans. The EPIC minivan can travel about 80 to 90 miles on a single charge, at speeds of up to 80 miles per hour with a payload of as much as 925 pounds. Recharging can be completed in as little as 30 minutes.

(DAIMLERCHRYSLER RELEASE: 2/4)

Steen Axle Well-Suited for EVs

Steen Products has newly patented a rear axle drive assembly. It has a primary rotatable housing with an internally mounted hub, and the primary housing is mounted to the vehicle frame. This new axle is said to be particularly suited to EVs. EV Challenge director Eric Ryan helped to promote the Steen axle. Used in a replica of the Porsche Speedster, he explains that the two axles are mounted "in opposing disposition and can be rotated at independent velocities in response to the primary housing rotation."

The Porsche replica with the Steen axle was shown in Atlanta recently. The two belt drive system with magnetic clutches is activated with a switch on the dashboard. (FLEETS AND FUELS: 1/31)

LAWA Installs More Charging Stations

Los Angeles World Airports (LAWA) recently announced that its board of airport commissioners has decided to accept a grant of \$64,200 from the South Coast Air Quality Management District (SCAQMD) for 12 EV charging stations. LAWA said the charging stations will be installed in Parking Structure 6 at Los Angeles International Airport (LAX), which is slated for completion later this year. The stations will add to the 10 existing charging stations located in LAX's Parking Structure 1, making a total of 22 EV charging stations in the airport's Central Terminal Area. LAX also has charging stations in one of its long-term parking lots. All of the charging stations provide free recharging and parking. Under an agreement with SCAQMD, the airport authority must finish installing the charging stations by November 5. Separately, LAWA announced that its board also awarded a contract to Miracle Ford for seven compressed natural gas-powered vehicles that will be used by the LAX Airport Police Bureau. (LAWA RELEASE: 2/1)

Impco to Provide Cylinders for SNL Testing

Impco Technologies, Inc. recently announced that Sandia National Laboratories (SNL) has awarded the company a contract to supply on-board vehicle hydrogen storage cylinders for test and evaluation. Under the contract, Impco's Advanced Technology Center will provide hydrogen cylinders for the SNL program to take place this month. "To have a Department of Energy national laboratory such as Sandia participating in technology development and evolution is clear recognition that we are moving closer to a hydrogen-based economy," said Vice President and General Manager of the

company's Technology and Automotive Original Equipment Manufacturer (OEM) Division Syed Hussain. Impco recently delivered several prototype hydrogen storage cylinders to automakers in the U.S. and Europe for fuel cell-powered cars. The company said the new cylinders will significantly extend the range of these vehicles, while providing hydrogen fuel with an energy density approaching that of liquid hydrogen. Impco is a leading supplier of alternative fuel systems to the OEM market and aftermarket, providing gaseous fuel management and storage systems as well as components that allow internal combustion engines to operate on alternative fuels such as natural gas and propane. (IMPCO RELEASE: 1/27)

DOE, SCE Complete Pomona Loop Testing

The Department of Energy's (DOE) Field Operations Program and partner Southern California Edison (SCE) recently completed Pomona Loop performance testing on a number of EVs featuring advanced battery technologies. Twelve EVs featuring nickel metal hydride (NiMH), lithium ion and lead-acid battery technology have been tested over the past two years on the Urban and Freeway Pomona Loop in Southern California. Vehicles were evaluated over a series of four Urban Loop and four Freeway Loop range tests, in an effort to determine the range for each vehicle under "real world" operating conditions. Vehicles tested under the program were manufactured by Toyota, General Motors, Ford, Chrysler, Nissan and Honda. Testing was conducted by SCE. Results for each of the 12 vehicles tested are available on the World Wide Web at <http://ev2.inel.gov/sop/sce/index.html>. (DOE NEWS RELEASE: 1/26)

NECAR 4 Running in Munich Airport

DaimlerChrysler recently began a trial of its fuel cell-powered vehicle, NECAR 4, in Munich, Germany. The vehicle will be used by the Munich airport to shuttle flight crews,

airport employees and other visitors. The company said the project is intended to promote hydrogen technology and new transportation concepts, while enabling the automaker to evaluate the NECAR 4 and its performance. The Munich airport is home to the first public liquid and gaseous hydrogen filling station. The car can reach speeds as high as 90 miles per hour, and has an operating range of about 280 miles. The vehicle also features a 55 kilowatt electric motor which provides "high levels of comfort and driving performance." DaimlerChrysler said the project is co-sponsored by the Bavarian State Ministry of Economics, Transport and Technology, as well as Munich airport operator Flughafen Muenchen GmbH. (DAIMLERCHRYSLER RELEASE: 1/26)

EV Rentals Earn Blue Sky Award

WestStart-CALSTART recently awarded Budget EV Rental Cars, a joint venture between Budget Rent a Car and EV Rentals, its Blue Sky 2000 Merit Award. Budget EV Rental Cars was recognized for its efforts to promote alternative vehicles that reduce air pollution. Servicing Los Angeles, Beverly Hills, and Sacramento, California, Budget EV Rental Cars give customers a choice of electric and natural gas vehicles (NGV). The company's EVs can travel up to 100 miles on a charge, while its NGVs have a range of approximately 300 miles. Southern California has more than 300 charging stations and 125 NGV fueling stations. Budget EV Rental Cars announced that its rental fleet will soon offer the Honda Insight Hybrid. Budget EV already offers Ford's 2000 Taurus sedan, which has a flexible fuel engine that can accommodate 100% unleaded gasoline, E85 — a blend of 85% ethanol and 15% gasoline — or a combination of the two. EV Rentals began offering alternative rental vehicles in 1998. Currently, it has a fleet of almost 50 vehicles and is based at Los Angeles International Airport (LAX). (BUDGET RENT A CAR RELEASE: 1/26)

WestStart-CALSTART Announces Award Winners

WestStart-CALSTART recently awarded Ford Motor Company its 4th annual Blue Sky Award for the company's contributions to the clean transportation marketplace, specifically for the introduction of its Th!nk EV and winning a contract with the U.S. Postal Service to manufacture 500 electric-powered delivery vans. WestStart-CALSTART presents the Blue Sky Award each year to recognize outstanding marketplace contributions to advanced, sustainable transportation that improves air quality and energy efficiency. The group also gave its special Blue Sky Innovation Award to the California Fuel Cell Partnership. The partnership is made up of public and private organizations working to develop a fuel cell market by increasing public awareness of fuel cell-powered vehicles. WestStart-CALSTART also announced winners of its Blue Sky Merit Awards. The awards are presented to individuals and organizations who help bring clean-fuel vehicles to market. This year's winners include Jeff Grosco, speaker of the Arizona House of Representatives, Advanced Vehicle Systems of Chattanooga, TN, and EV Rental Cars.

(WESTSTART-CALSTARTRELEASE: 1/20)

GM Unveils Triax Concept Vehicle

General Motors (GM) has unveiled the Chevrolet Triax, a concept vehicle that provides a glimpse into GM's vision for the future of transportation. The Triax, which debuted in Tokyo, Japan with help from GM chairman and CEO John F. Smith, Jr., will allow drivers to choose from four-wheel-drive electric, four-wheel-drive hybrid-electric, and two-wheel-drive internal combustion propulsion options. "The beauty of the Chevrolet Triax is its flexibility," said Smith. "It's a clean-sheet design approach intended to meet the demands of customers while demonstrating GM's resolve to address environmental issues." The Triax features the third generation of electric drive and control technology developed by GM,

and benefits from lessons learned with the EV-1. GM is working with Japan's Suzuki Motor Corporation on the Triax, and the vehicle's hybrid and gasoline-powered versions feature Suzuki small engine and transmission technology. The Triax is designed to meet the needs of many different customers in many different markets.

(GM RELEASE)

Winning Insight Team Uses Ingenuity

A team of editors from Car and Driver magazine recently averaged 121.7 mpg at an average speed of 58 mph in a Honda Insight hybrid electric vehicle on a route from Columbus, OH to Detroit. The Car and Driver team participated against other teams from the automotive press in an effort to highlight the real-world fuel efficiency of the Insight. The Insight has an Environmental Protection Agency (EPA) efficiency rating of 61 mpg in city driving conditions and 70 mpg on the highway. The Car and Driver team achieved its impressive average by using a specially-outfitted Ford Expedition to "draft" the Insight along the course. The Expedition featured a metal, plywood and rubber wind break that was mounted to the vehicle's trailer hitch. Second place was captured by the team from Popular Mechanics, which averaged 83.4 mpg at a speed of 59 mpg. Both teams earned a \$5,000 check from Honda to donate to their favorite charities. The Columbus-to-Detroit journey will be covered in the January 2000 issue of Car and Driver.

(CAR AND DRIVER RELEASE)

Lockheed Reports Successful Charging Technology

A newly-patented charging method has been developed for lengthening the cycle life of batteries powering electric motors. It can be used on either hybrid or battery-only EVs and involves a method for equalizing the voltage of modules in a battery pack. Voltage differences on batteries hooked up in series can impair their efficiency and shorten their life. The onboard device takes voltage measurements of each module during op-

eration of the powertrain. During acceleration, when power is flowing out of the battery pack, the batteries with low voltages are identified, while batteries with high voltages are identified during deceleration when the power is flowing back into the pack from regeneration. Equalization is reached by raising the voltages of the low-voltage batteries and lowering the voltages of the high-voltage batteries during operation. Once equalization ends, the whole process starts over again, and the procedure continues until all module voltages are within a tolerable range of the module voltage averages.

(EVNEWS)

Prius Engineer Gets Royal Society Award

The United Kingdom's Royal Society has given its Esso Energy Award to Takeshi Uchiyamada, the former chief engineer for Toyota who developed the Prius hybrid electric vehicle. Uchiyamada, who is now a director at the company, was granted the award for the Prius' application of science, engineering and technology leading to a more efficient mobilization and conservation of energy resources. The Prius — the first gasoline-electric hybrid car in mass production — utilizes the Toyota Hybrid System, which seamlessly switches between the vehicle's gasoline engine and electric motor to match the power needs of the driver. For example, when the car is pulling away from a stop or driving at low speeds, the vehicle only uses electric power. But when the vehicle is cruising at normal speeds, the gasoline engine takes over, while the engine charges the batteries so that no outside charging is ever needed. Since the vehicles were introduced in December 1997, some 27,000 Prius models have been sold in Japan. The automaker said about 20,000 per year will be sold in Europe and North America starting in the next model year.

(BUSINESS WORLD)

Research Paves Way for New Energy Source

Randell Mills, CEO and chief researcher for Cranbury, NJ-based BlackLight Power, Inc., unveiled research in a new field of hydrogen chemistry at the recent 1999 Pacific Conference on Chemistry and Spectroscopy. Mills was joined by Johannes Conrads, the former chairman of the board and director of German low-temperature plasma physics research center INP. Using the so-called "BlackLight process," Mills and Conrads demonstrated the production of a plasma in hydrogen without using extreme temperatures or high voltage. "Essentially, we have shown we can produce heat, and therefore electricity, in a hydrogen plasma without power input," said Mills. The process is based on Mills' Grand Unified Atomic Theory, which he published in 1995. The theory states that hydrogen can exist in states lower than the ground state which is recognized by classical quantum physics theory. Among the potential applications that could be made possible by the new process are high-voltage batteries with 10,000 times the power of conventional batteries.

(BLACKLIGHT POWER RELEASE)

Honda Joins Fuel Cell Partnership

American Honda Motor Company, Inc. announced that it has joined the California Fuel Cell partnership to help demonstrate the future potential of fuel cell-powered vehicles. The partnership was established in April of this year to demonstrate the potential of fuel cell technology, identify issues regarding potential fuels and fueling infrastructure, and to increase public awareness of fuel cell technology. Honda currently is developing both hydrogen-fueled and methanol-fueled prototype fuel cell vehicles, with plans to make a fuel cell vehicle available by the year 2003. Other partnership members include automakers DaimlerChrysler, Ford Motor Company and Volkswagen, energy providers ARCO, Shell and Texaco, fuel cell maker Ballard Power Systems, and the California Air Resources Board.

Edison, SCE Reaffirm EV Commitment

Edison International and Southern California Edison (SCE) recently reiterated their commitment to EVs and other electric-powered automotive technologies, despite the closure of Edison EV. "Although we are ceasing operations with Edison EV, Edison International will continue to support the advancement of [electric transportation] — primarily through SCE," said SCE chairman and CEO John Bryson. "SCE will add to its fleet of nearly 300 electric vehicles, provide ongoing support for our employee incentive purchase programs, continue educating the marketplace about the consumer and environmental benefits of EVs, and generally supplement the commercialization of electro-drive technology through its utility activities." SCE founded its Electric Transportation Division in 1991 in order to develop a safe, reliable, efficient and cost-effective electric supply system for its customers with EVs. The division is primarily focused on EV infrastructure research, battery testing and evaluation, and customer education programs.

(CURRENTS: FALL 1999)

Questions Remain for Hydrogen Economy

The rapid development of fuel cell vehicle technology has many proponents predicting that economies could move from being centered around fossil fuels to a hydrogen-based model. Although experts agree that fuel cell technology will likely overcome any remaining technical obstacles, some questions remain concerning the viability of a hydrogen infrastructure. Since hydrogen is already produced in large quantities for chemical applications, production is not as serious an issue as distribution and safety. The relatively few number of large hydrogen production facilities could make it harder for vehicles to refuel. Rocky Mountain Institute research director Amory Lovins says some fueling problems may be solved by integrating power supplies for both vehicles and buildings. Buildings could use station-

ary fuel cells for their energy needs, generating hydrogen with a natural gas steam reformer or electrolyzer. Excess or off-peak hydrogen could in turn be used to fuel vehicles used by drivers working in the building or nearby.

(FINANCIAL TIMES)

GM's Stewart Faces Formidable Task

As the new brand manager for General Motors' EV1 program, Ken Stewart is responsible for the marketing, promotion and sales of the only all-electric EV available to consumers. With over half a billion dollars invested in the EV1 program and only about 600 of the two-seaters currently being leased, Stewart sees this challenge as a long-term proposition that is just beginning to bear fruit. GM plans to introduce its Generation II EV1 as soon as electronics for the vehicles are certified. The Generation II EV1s will feature either an advanced lead-acid battery with an estimated 30 to 50 percent greater range than current batteries, or nickel metal hydride (NiMH) batteries which effectively double the range of the vehicle to between 140 and 200 miles. The NiMH model will cost about \$12,000 more than the advanced lead-acid version, and recharging times will remain approximately six hours. The Generation II models will also feature an improved drive train that is significantly smaller, less expensive and uses less parts than the first generation model. Other refinements the company has made to the car include improved ride and handling and a better air conditioning system.

(EV WORLD)

Saft, USCAR Complete NiMH Battery Work

The U.S. Advanced Battery Consortium (USABC) and Saft recently completed work on a nickel metal hydride (NiMH) battery technology development contract. The final 12-volt NiMH EV module has met the program goals established under the contract. "This has been one of the most successful USABC programs," said USABC/

For folks interested in baking from scratch, here is a list of circuits of my '95 homebuilt Electro-Metro with associated experiments, published previously in the DEVC. The schematics are \$2 per page, and the software (3.5" floppy) for projects using a microprocessor is \$10. For those who want a pre-programmed microprocessor chip, they are \$25.

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(36% more power to batts with PFC <PF of .91> Ferro, 12A vs 7.5A <PF .64>)
- ◆ Metrol, 800A 120V motor speed control.....(2pgs + micropr)
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- ◆ 300W Individual Supply (one per battery) charger with PFC, if into pain.....(4pgs)
- ◆ Instructions for converting a microwave oven transformer to a battery charger.....(1pg)
- ◆ Log Annunciator, controls fan & plays "Put Another Log on the Fire".....(2pgs + micropr)
- ◆ Golf-Tractor speed control & charger 48V, 400A.....(3pgs + micropr)
- ◆ Battery Scanner, my favorite, displays all batteries & indicates bad batt.....(3pgs + micropr)
- ◆ Surround Sound Demystified, shows simple hook-up for surround sound.....(1 pg)
- ◆ 200 W Class-D amp 95% efficient audio amp for batt applications.....(2pgs)

Saft NiMH program manager Thomas Tartamella. "All the program goals were achieved and Saft has begun delivering modules to DaimlerChrysler for their EPIC electric minivan. As the USABC look to long-term technologies to meet [original equipment manufacturer] EV battery requirements, NiMH will be the mainstay advanced EV battery technology." The NiMH module features resealable vents in each cell to prevent gas pressure buildup in case of discharge. Liquid thermal management and a restraining system prevent the module from bulging during cycling. In February, Saft and USABC began a 36-month, \$14.4 million effort to develop lithium ion EV batteries. A three-phase program is expected to result in the delivery of full-size battery packs with control systems.

(USCAR RELEASE)

SAE, DOE to Host Future Car Congress

The Department of Energy's Office of Energy Efficiency and Renewable Energy

(EERE) and Office of Advanced Automotive Technologies will host the "Future Car Congress," April 2 through 6, 2000 at the Hyatt Regency Crystal City in Arlington, VA. The Society of Automotive Engineers (SAE International) will administer the conference. SAE said the Future Car Congress will focus on a collaborative approach to the development of new environmentally sound automotive technologies. The event is intended to serve as a forum to examine the future direction of automotive research and development, as well as address issues related to environmental impact and safety. The conference will also highlight the achievements of government and industry partnerships, provide an exchange of ideas between different factions, and promote public awareness of efforts to reduce air pollution and petroleum dependence. General topics will include clean and efficient fuels, advanced fuel-efficient and environmentally friendly vehicles, virtual reality modeling and simulation, supercomputer applications for combustion modeling, marketability and economic drivers for commercializing new technology, and advanced

transportation technologies workforce for the 21st century.

(EIN STAFF: 9/29)

EPRI Launches Working Group for Hybrids

EPRI recently announced it has launched a collaborative research effort to evaluate hybrid electric vehicles, with the goal of determining the technology that best meets a range of criteria, including consumer acceptance, energy efficiency, cost-effectiveness, and emissions reductions. The Hybrid Electric Vehicle Working Group includes stakeholders from the automotive industry, utilities, and state and federal regulatory agencies. The project will review promising hybrid architectures which may be available within the next eight to ten years. In addition, the group will analyze various hybrid systems that utilize combinations of onboard energy storage systems, as well as the size and configuration of the internal combustion engine (ICE) and how it is placed on the overall drive train.

(EPRI JOURNAL 1999)

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HomePage at <http://www.evcl.com/ea-sv>
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Hewlett-Packard Co., Corporate World Headquarters
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SOUTHEASTERN EVA

Lawson Huntly, President (704) 283-1025
PO Box 1025 Monroe, NC 28111-1025
Meetings: Call Lawson for date, time and location

TEXAS

HOUSTON EAA

Ken Bancroft, Contact Person, (713) 729-8668
4301 Kingfisher St., Houston, TX
Meetings: 3rd Thursday each month 6:30 PM - 8:30 PM
Citizen Environmental Center, 2nd floor, room 280
3015 Richmond, Houston, Texas (Take the Southwest Freeway to Kirby, go north to Richmond, turn left, the Center is on the left, three blocks down Richmond)

NORTH TEXAS EAA

Paul Schaffer, President (972)-437-1584
430 Ridge Crest, Richardson, TX 75080-2532
Email: pshf@cyberramp.com
Meetings: 3rd Thursday/mo, see www.engr.tcu.edu/ntea for time and location

UTAH

WEST VALLEY CITY EAA

Harry Van Soolen, President (801) 989-1130
3622 S. 4840 W., West Valley City, UT 84120
Meetings: Contact Harry for date, time and location

VIRGINIA

CENTRAL VIRGINIA EAA

Brian Murphy, President, (804) 530-7734
1902 Riggers Station Dr., Colonial Heights, VA 23834
Meetings: 3rd Wednesday/month, Richmond Technical Center,
Westwood Ave., Richmond, VA 23834

WASHINGTON

PORT TOWNSEND / NORTHERN OLYMPIC PENINSULA ELECTRIC CAR CLUB (NOPEC)

Karl Schreiber (360) 385-3532
11 Kanu Dr. Port Townsend, WA 98368
Meetings: 3rd Saturday/month, 10 AM
Port Townsend High School Shop

SEATTLE EVA

Steven S. Lough, President, (206) 524-1351, Fax (206) 526-5348
6021 32nd Ave., N.E., Seattle, WA 98115-7230
Meetings: Contact Steve for time and location
E-Mail: slough@halcyon.com
WWW Site: <http://www.halcyon.com/slough/seva.html>

WASHINGTON DC

ELECTRIC VEHICLE ASSOCIATION OF WASHINGTON DC (EVA/DC)

Dave Goldstein (President) (301) 869-4954
9140 Centerway Road, Gaithersburg, MD 20879-1882
E-mail: goldie.ev1@juno.com
Web at: www.evadc.org
Meetings: 2nd or 3rd Tuesday/month at 7 p.m.
National Institute of Health (NIH) Building 31-C, 6th floor
conference rooms, in Bethesda, MD. (Large white building near
Rockville Pike and Cedar Lane) Call for more information or
directions.

CANADA

VANCOUVER ELECTRIC VEHICLE ASSOCIATION

P.O. Box 3456, 349 W. Georgia St., Vancouver British Columbia,
Canada, V6B 3Y4
Bill Glazier, Contact (604) 980-5819
3344 Baird Rd. North Vancouver, B.C. Canada V7K 2G7
HomePage at <http://www.veva.bc.ca/> E-mail: info@Veva.bc.ca
Meetings: 3rd Saturday/month 7:30 p.m., BC Transit Center
Cafeteria. (Located off of Kitchener between Boundary and
Gilmore in Gilmore in Burnaby)

EAA Chapter List

*Chapter contacts and meeting locations. Most verified as of
9/1/99. For information about the Electric Auto Association,
call 1-925-685-7580*

Board of Directors Electric Auto Association

Chair

Scott Cornell
60 Alan Dr., Pleasant Hill, CA 94523-1902
Tel (925) 685-7580,
E-mail: spcorn@pacbell.net -or- ebeaa@Juno.com

Vicechair, CE Editor/Publisher

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2 Smith Court
Alameda, CA 94502
Tel. (510) 864-0662 E-mail: ethorpe@jps.net

Treasurer

Stan Skokan
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Tel (650) 366-0643 Fax (650) 306-0137

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60 Alan Dr., Pleasant Hill, CA 94523-1902
Tel (925) 685-7580,
E-mail: ebeaa@juno.com

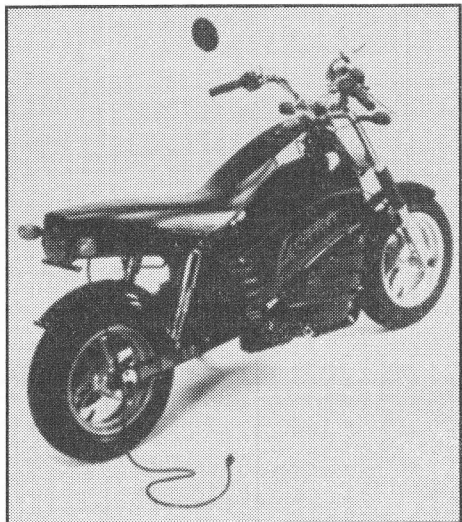
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Tel (480) 607-9053 H, (602) 968-8068 W,
Fax (602) 968 9838 E-mail: sunbeltJJ@AOL.com

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E-mail: kaylor@access1.net

Bruce Parmenter
331 E. Evelyn, Mtn. View, CA 94041
Tel (650) 694-2392
E-mail: brucedp@yahoo.com
-or-
brucedp@iname.com

- FOR SALE - MEMBER WANT ADS - FOR SALE -



Gray Lectra for sale, 2000 mi. new batteries, quick acceleration, 12-20 mi. range, 45 mph top speed. Large carry box. Extra stop lights. Great for errands, only \$3200. (new price \$5000-www.zapworld.com). Test drive-www.evworld.com. (415) 431-8428 Bob Burnside, 360 Castro #5, San Francisco, CA 94114
(See page 6 in this issue of CE)



1979 Cushman 3 wheeled "meter maid" vehicle. 72 volts, on board charger and DC-DC converter. Less batteries, 700 original miles, like brand new. \$1500.00, will entertain trades. Comes with all manuals. Value of the electronics alone exceeds \$2,500. Contact Anthony at: (415) 251-0985 or S2dee@aol.com

Wanted: Electric car conversion in good condition. Good batteries and good charger, under \$5,000. Send complete description, age of batteries, and miles as electric. Reply to Charles Poston. Fax: (408) 949-8297 - or - E-mail: CCPoston@juno.com

For Sale: 1981 Jet Electrica 007, New Batteries, 120 Volt System. All original. Low miles. \$4,000.
Call: Dan Lowry (415) 643-0817
-or- E-mail: dandasmann@hotmail.com

For Sale: 1980 Citi-Car/Comuta-Car by Sebring-Vanguard. Body white/white interior, excellent condition. (8) good batteries. Only runs in low + mid-range, needs hi-range contactor or Curtis controller conversion. 1300 original miles. Asking \$2500 as-is or \$4500 after conversion. Come see in Colorado. Call Charlie at (970) 879-5300 days or (970) 879-2408 even.

WANTED: ONE K&W BC-20 CHARGER AND ONE DC-DC CONVETER 108 VDC OR 120 VDC. CALL BRUCE AT (510) 864-9900

MEMBER WANT AD RATES

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

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

For corrections or updates, please send a written note or fax to EAA Want Ads at (510) 864-9293. Photographs of your vehicles may be submitted with your ad. If room is available, we run one photo each issue. These photos will not be returned. Send your Member Want Ad request and check payable to:

EAA Want Ads, Hanger 20
2701 Monarch Street, Suite 142
Alameda, California 94501

Electric Auto Association (EAA) Membership Application

New Member: _____
Renewal: _____

USA: _____
Canada: _____
Other Country: _____

Note: EAA membership dues are
tax deductible in the USA
as allowed by the IRS.

Date: ____/____/____

Name: _____
Street: _____
City: _____
State: _____ Zip: _____

Company: _____
Phone: _____ Hm-_____ Wk-_____
Fax: _____
Country: _____

If a new member, where did you hear about the EAA ? _____

EAA Chapter you attend or support: _____

I need chapter information: _____

Membership / Vehicle Information — Please complete if new or changed

Please identify your primary areas of interest relating to EAA
(Please rank your your choice with a "1" being most important, "2" second, etc.)

- 1: _____ Hobby / Builder
- 2: _____ Professional (EVs are a source of income for you)
- 3: _____ Competition (Rallies, Races, and Records)
- 4: _____ Environmental and Government Regulations for EVs
- 5: _____ Social (Rallies, Shows, Dinners, Other)
- 6: _____ New Technology and Research
- 7: _____ Promotion and Public Awareness of EVs
- 8: _____ Student or General Interest
- 9: _____ Electrathon / Bicycle / Off-road Vehicles
- 10: _____ Owner / Driver of Electric Commute Vehicle
- 11: _____ Other: Please Specify: _____

Number of total EVs you have ever owned ? : _____

Number of EVs you now own ? : _____

Please describe any Electric Vehicles you now own or are building: (if more than one, attach information on each)

Vehicle Lic#:	State:	Country:
Vehicle Type:	Make/Model:	Model Year:
Converted Yr:	Number of Wheels:	Motor Type:
Controller type:	Batteries: No./Type: _____ / _____	%Completed
Pack Voltage:	Avg. EV Mi./Week:	Avg. EV Trips/Week:
Other Features:	_____	
Comments:	_____	

Please make your check or money order for appropriate amount (see below), payable to the Electric Auto Association, fasten it to this form and mail it to :

Electric Auto Association
P.O. Box 6661
Concord, CA 94524

USA \$39 /yr (U.S. Dollars only)
Canada \$42 /yr International \$45 /yr

Note: All information and statistics in this application are for the exclusive use of the EAA. We never sell or loan our mailing lists.

ver 8/29/97

EAA Store Order Form

Printed materials

CE	Selected Current EVents (specify specific issue)	\$3.00 each issue
CEFY	Current EVents - Full year (specify specific year)	\$20.00 each year
PB001	Discovered: The Perfect EV Battery	\$2.00
FW001	Flywheel Energy Storage	\$5.00
PV 2000	1998 Preview 2000 by Electrifying Times (Nov./Dec. 98 CE)	\$5.95
BG 1997	1997 Buyer's Guide to Electric Vehicles (April 97 CE)	\$5.00
BG 1996	1996 Buyer's Guide to Electric Vehicles (Feb. 96 CE)	\$4.00
TT001	Team Tucson Land Speed Record Plans	\$5.00
IDX001	EAA Current Events Index - 10 Years!	\$4.00
XA100	EAA XA-100 Hybrid	\$5.00

Other EV items

BS800	Bumper Sticker with 800 number 3.75x15 inch	\$3.00
BS002	Bumper Sticker with "the Switch is On", 3.75x15 inch	\$3.00
CAP001	100% Cotton Cap, Forest Green with Yellow Ink	\$8.00
DC001	Decal - black and red, 3x9 inch, for Window	\$3.50
KC001	Key Chain with LED light and "30 Years 1967-1997"	\$2.50
MUG002	Thermal Mug	\$6.50
MUG003	Porcelain Mug	\$5.50
PS001	Polo Shirt w/ embroidered logo select shirt color & size: Teal Green, Forest Green or Navy (s,m,l,xl)	\$30.00
SS001	Auto Window Sun Shade with Logo	\$8.00
PN001	Ball point writing pen with EAA and 800 number	\$1.00
CS001	Current Solutions/Motor Show Video Tape (14 minute runtime)	\$15.00
WL001	Window Literature Holder (fits pages 8 5 x 11 inch)	\$25.00
PARK01	"EV Parking Only" Sign (18"x12") green icon	\$25.00

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

Name _____ Phone _____
 Address _____
 City _____ St, _____ Zip _____

Item #	Size/Color	Quantity	Item Description	Unit Cost	Amount

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

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

KTA SERVICES INC.

Number 1 EV Supplier over the years

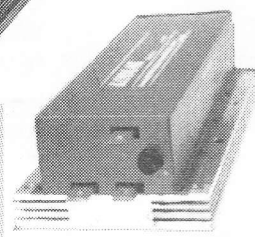
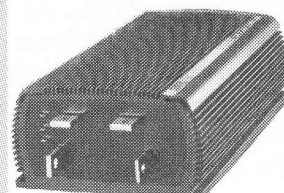
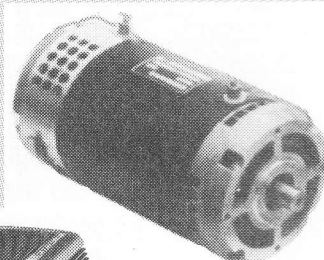
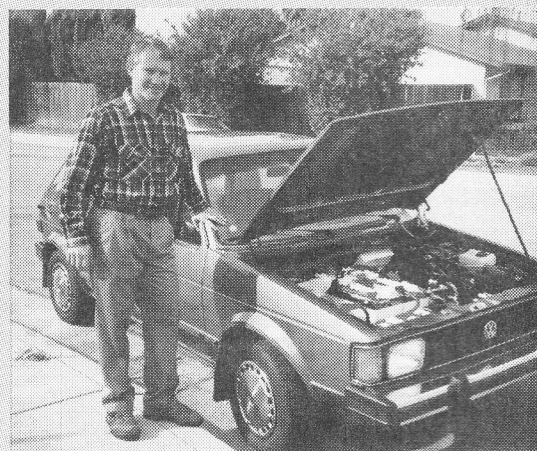
ELECTRIC VEHICLE

Components, Kits, Publications, & Design

Since our beginning in 1984, KTA SERVICES has been dedicated toward supplying the largest variety of safe and reliable components to our EV clients. We provide individual components or complete kits to electrify 2, 3, or 4 wheeled vehicles weighing from 200 through 10,000 lbs. total weight.

Our components and tech support have enabled hobbyists and others in 17 countries to create nearly 500 on-road electric cars, pickup trucks, motorcycles, and various racing vehicles. Our technology has found its way into electric powered boats, submarines, aerial trams, golf course mowers, amusement park rides, special effects apparatus for the movie industry, robots, and even a window washing rig. Nobody knows the components or their application better than KTA. All components are new, competitively-priced, and come with full manufacturer's warranties. We stock and sell the largest variety of the very best.

- ◆ ADVANCED DC Motors in 11 variations from 2.0 HP to 28.5 HP
- ◆ CURTIS-PMC Throttle Potboxes & Footpedals
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- ◆ DELTEC Meter Shunts in 4 models from 50 to 1000 A
- ◆ SEVCON, TODD, & CURTIS DC-DC Converters from 50 to 200 V input, up to 40 A out
- ◆ K & W ENGINEERING Onboard Battery Chargers and Boosters from 48 to 144 V
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- ◆ EVCC Adapter Plates, Couplings, Clamps, Brackets & Motor Mounts
- ◆ Electric Vehicle Heating & Air Conditioning
- ◆ MAGNA Welding Cable Lugs in 3 sizes from #6 to #2/0
- ◆ PRESTOFLEX Welding Cable in 3 sizes from #6 to #210
- ◆ Battery Cable Assembly Tools
- ◆ K & W ENG. TD-100 Tachometer Drive/Rev Limiter
- ◆ 5 Conversion Kits for vehicles from 500 to 5000 lbs. total weight
- ◆ 3 Conversion Kits for Go Karts — up to 90 MPH
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- ◆ Project Overview with Schematic & Recommendations
- ◆ Computer-Based EV Performance Predictions



*We want to be YOUR #1 source for EV components
For an information-packed 50-page Components &
Publications Catalog, send \$5.00 to:*

KTA Services, Inc.

944 West 21 Street Upland, CA 91784 USA

Tele: (909) 949-7914 Fax: (909) 949-7916

ELECTRIC AUTO ASSOCIATION

P.O. Box 6661, Concord, CA 94524

• Address Correction Requested •



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PERMIT NO.
420

• Time Dated Material - Please Do Not Hold •