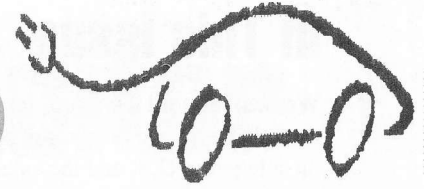


CURRENT EVENTS



April-May'00

Promoting the use of electric vehicles since 1967

Vol. 32 No. 4&5

Prius Hybrids For Sale 50,000 People Register At Toyota Website

By Sparks

As of July 14th 2000 Toyota's Prius hybrid car went on sale in the U.S. market. Interest in the vehicle has already exceeded industry expectations. By the first week of availability more than 1,300 orders have been taken and over 50,000 people have signed-up at Toyota's website with interest in the vehicle. Toyota's U.S. sales success is built on top of several years of successful sales in Japan. Since 1997 Toyota has sold over 40,000 units in Japan.

A number of factors have contributed to the Prius' early market success. Unlike the Honda Insight, that is still doing well in sales, the Prius is a true four door family car. The Prius is, in fact, the first hybrid in the

U.S. market that can carry four passengers, this allows it to take the widest possible market share. Another factor that has helped launch the Prius to date is Toyota's pricing policy. For an advanced high technology car the Prius comes with a very competitive price. Toyota's manufacturer's suggested retail price is only \$20,450. Toyota has also avoided confusing the buying public with a multitude of options. Prius comes equipped with the most popular features. All a buyer needs to choose is color. The initial offering is in a single-spec trim level. All Prius vehicles will feature standard equipment that includes Anti-Lock Brakes, automatic transmission, Climate-control air conditioning, power windows, door locks and mirrors, AM/FM/cassette stereo, an eight-year/100,000-mile battery



and hybrid system warranty, and free seven-day/24-hour roadside assistance.

A look under the hood really sets this vehicle in a class by itself. Prius' primary power is provided by an efficient all-aluminum 1.5-liter gasoline engine. Peak power for the engine in U.S.-spec trim is 70 horsepower at 4,500 rpm (versus 58 hp at 4,000 rpm for Japan-market Prius vehicles), with

Continued on page 16

In This Issue

- 1** We were all told it was coming, but it seemed to take forever to get here. Finally though the hybrid revolution is here at last. As of July 14th the Toyota Prius went on sale in the U.S. and the sales have skyrocketed. The Toyota Prius, the second hybrid vehicle design to come from Japan, is certain to solidify a trend that will sweep across the country. Now with Prius' success the big U.S. auto companies can not be far behind. This month CE takes yet another look at the Prius.
- 3** With all the hybrid activity taking place in the new car marketplace today we forget that many of us with EV conversions can still "add on" the new technology. Letters to the Editor this month gives us a quick look at Bill Hinds Chevy pickup and a overview of the practicality of adding an APU to his system.
- 4** In the early days a great many people had to build their own controller if they wanted one, but times have changed. EAA members like Steve Post set out to make the PWM controller an off the shelf item. Despite the number of good choices available today a few hardy souls still find satisfaction in building their own controller. For those who want to roll their own CE makes available Mark Hanson's, well proven, 800 amp, 120 V controller design.
- 6** Following the lead news of Prius' entering the U.S. market, John Paul "The Car Doctor" gives us a first hand view of Toyota's new hybrid car. John covers five main modes of operation and their amazing seamless transition. After reading what the "Car Doctor" has to say, you won't want to wait for your next Prius "Ride N' Drive".
- 10** Out on the West Coast the big event is the Silicon Valley Rally, but back East there is no doubt that NESEA's American Tour de Sol is king. This year we are especially privileged to present a special photo essay by John Helwig and co-authored by Nancy Hazard for the 2000 NESEA. These four pages of "you are there" coverage are the next best thing to going back East.
- 18** It seems like CE readers can't get enough information on the California diamond access lanes. So in keeping with reader demand we present another Diamond Lane Status Report.
- 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

Toyota's new Prius hybrid electric vehicle

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The deadline for articles is the 1st of every even numbered month for the next issue of CE. Articles received after this date will be retained for future issues of CE. Contact the editor for more information.

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Letters to the Editor

Dear Editor:

I am writing to ask for help in the use of a generator to extend range. I have been asked to take my converted S-10 pickup to Ferris State University for their auto mechanic's course on High School Senior Day. This trip is 140 miles one way. Would it be practical to use a generator, or to just rent a truck to do it? Also if I used a generator, how do you hook it up, through the on board charger? I have a K&W BC-20 and a LB-20 transformer. Your advice would be appreciated. I have enclosed my truck specs and pictures. The truck is set up using Bob Batsen's method.

Truck Specs

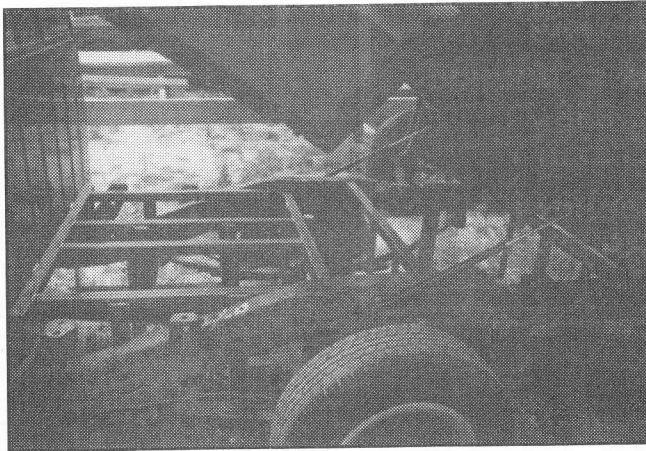
1991 S-10 Chevy pickup
 FBI-4001A 9" Advanced DC motor
 1221B-7401 Curtis controller
 2-SW200/12V coil Albright contactors
 Sevcon 128 Volt DC/DC converter
 PA6 Curtis throttle control
 K&W BC-20 charger
 K&W LB-20 transformer
 Gast DOA VIIIJH vacuum pump
 Nason vacuumswitch
 Webasto fuel fired heater
 20-9G 6 volt East Penn Batteries
 P205/75R14 Tires
 Battery Heaters, 2-50 Watt, 2-80 Watt

Bill Hinds
 3493 Powers Road
 Alanson, Mich. 49706

Dear Bill:

Using a generator to extend an EV's range can be very practical. This is especially true for a pickup where you have the extra room in the bed to place a genset or

APU (auxiliary power unit). The ability to carry a genset around with you when you really need the extra range especially makes sense when you can't afford to insure two cars at a time.



Some people have tried to run a standard 60 cycle AC genset powering a battery charger, but have found this a poor approach. It might be technically easy to do, but it is very heavy and bulky for the little power it puts out. Probably the simplest

approach is to mate a 16 HP to 20 HP IC engine to a military surplus aircraft 120 volt DC generator. This setup puts out directly the full battery pack DC voltage that you need and reduces the voltage regulation to a simple field controller. If you can't find the right DC aircraft generator you might look at military surplus AC alternators. With Mil. Spec. alternators you are now talking about bridge rectification and a somewhat more complicated voltage regulation scheme depending on the design of the alternator. When you look at the variety of alternator/generator technologies available there becomes a world of endless design approaches available.

There are also a number of companies that offer or are developing APU's for electric vehicles, such as Phasor Corp in Hangar 20, the Alameda EV Hatchery. Maybe one of our readers would like to send in an article covering their own design approach that we might print in the next issue of CE. - **KB**



Roll Your Own Controller

By Mark Hanson

800 Amp 120V Motor Speed Control Circuit Theory by MEH for "motrol"

I placed four bulk caps on the rail to smooth out inductive buss spikes, the two 5000uf caps can be 10 ea 1000 uf caps soldered to the 1/2" smashed flat buss bars. There are two 2uf poly caps to help with peaks soldered to the buss ends. A led/bleeder is across the buss for safety to indicate when live. The two back emf power rectifiers may also be 30 ea 200V 30 amp TO-247 devices soldered to the rails with short #16 wires. Both configurations work. The constant current source PNP MJE9780 supplies 30 ma for 15V FET bias gate switching supply. A standard 7805 is used for the uP MC68HC705P9 which PWM's at 2kHz. This frequency prevents road kill. A reset power-up safety MC34064 is required so no glitches occur on power-up which of course would be disastrous.

Interrupt Circuit

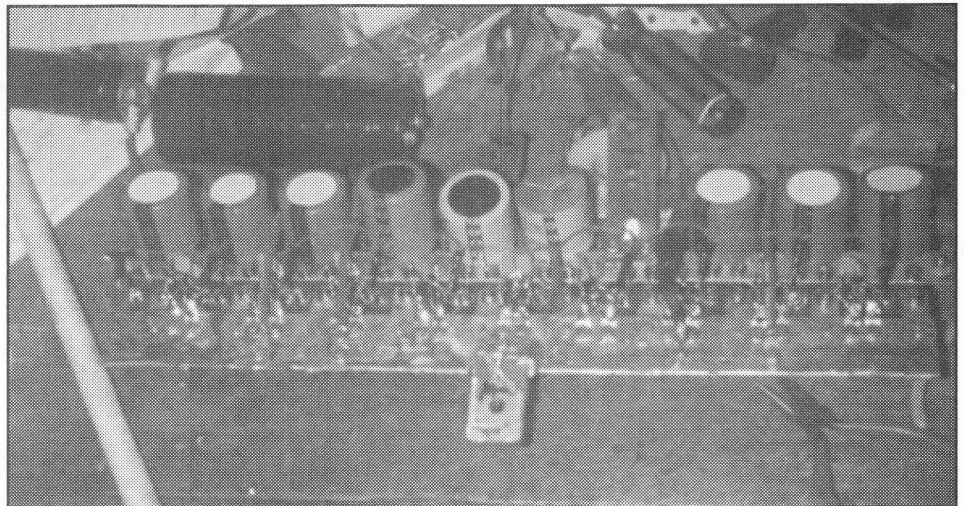
A current indicator led is mounted on the dash from pin 4 on the uP to indicate when the control goes into interrupt current limit. A standard desat circuit detect interrupt circuit is used with $T=L/R$ timing to anticipate desat 10 usec prior to FET overcurrent due to the inherent interrupt delay (About 600A to trip at 800A).

Two 2N4401's are used for hard turn-off and turn-on. Although 10ea 47 ohm gate resistors are used for reduced slew rate and S-D overshoot, 10 ohms would be preferred for reduced switching losses if busses are tightly coupled. Both have worked well but if the frequency is turned up to 15kHz then 10 ohms is required.

Additional snubber clamp zeners are used across the S-D of the MOSFET's for safety. The RCD snubbers are helpful at high motor stall currents. Two damper circuits were used at either ends of the 18" heat sink.

Packaging

The entire assembly was placed in a 6" square by 18" showbox aluminum enclosure.



sure with a 12V 3" muffin fan (Radio Shack) on the fire wall side. The fan may be 40C thermostat activated or operate continuously. A bi-fold baffle cowling was used on the front of the control to deflect rainwater and a clear acrylic conformal coating was sprayed on the uP and FET drive circuitry. The uP control board was mounted on top of the shielded enclosure in a separate plastic (phone interface radio shack) box.

Integration

This was set up with an Advance DC 8" motor but should run a 9" also. Keep the #00

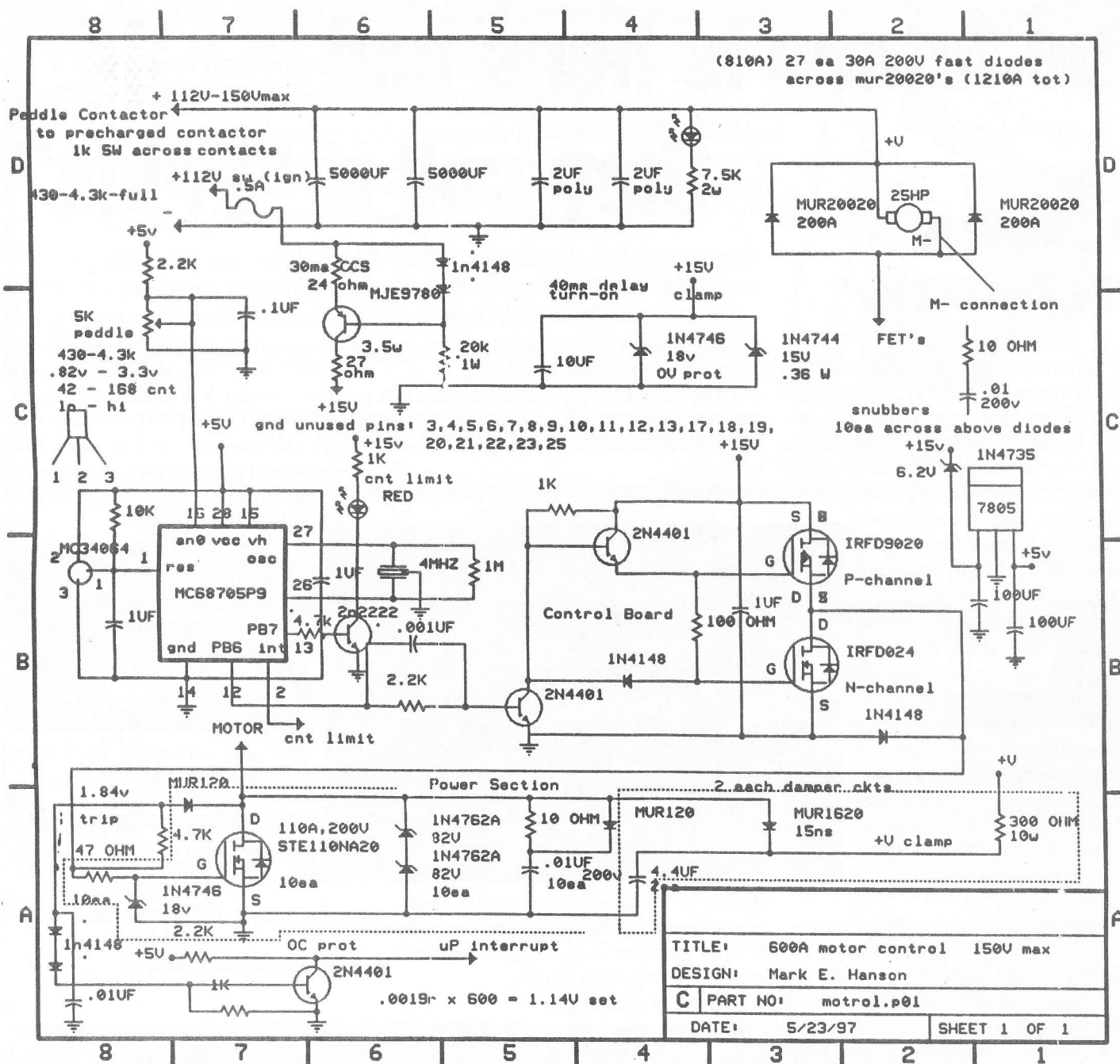
cables to the motor as close as possible and make sure the battery through the engage contactor hits the controller first. Ty-Rap power cables (together to cancel EMI) under the right side of the car together and the signal lines under the left side if you like to listen to the radio. The battery cables can be about 1/2 the size of the motor cables, like #1 depending on the average battery current used. Put a 1k 5W pre-charge resistor across the main engage contactor connected to the

microswitch on the 10k 3-wire pot. Solder the 3rd wire out if you have a Curtis 2-wire. This results in a smooth start with the uP program used. Some Curtis controls are logarithmic in the reverse direction resulting in jerky starts.

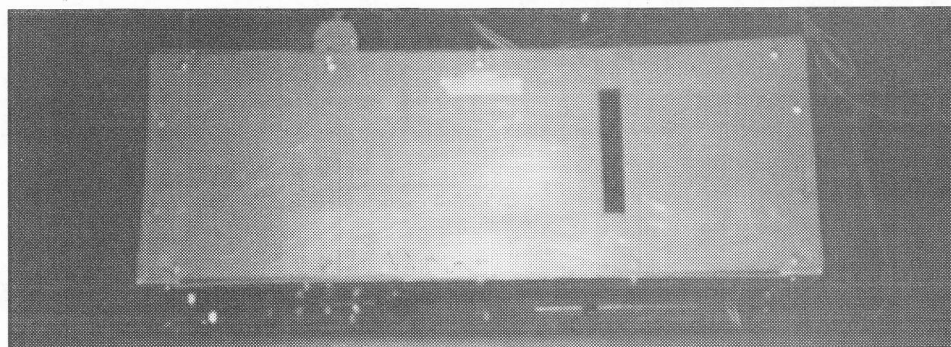
Contactors

Use an accessory contactor in addition to the main contactor for heater loads & DC-DC converter supply. The engage contactor is required for safety and pulls in each time the throttle is depressed. There is also a bypass contactor (but not necessary)

Continued on page 14



External box or packaging of Hanson controller as seen in vehicle (photo right). Shown, inside view of Hanson controller (photo opposite page)



The future is here and they call it "Prius"

by John Paul
"The Car Doctor"

To be introduced in mid July of 2000 is Toyota's Prius, a hybrid powered vehicle. The hybrid drive system utilizes a clean burning, high efficiency internal combustion engine with a silent and efficient electric vehicle power system.

The Prius uses its combination of a gasoline engine, nickel-metal hydride battery, electric motor and generator to achieve nearly double the fuel economy of a conventional gasoline powered vehicle. Estimates of fuel economy are 60 miles per gallon and a estimated range of nearly 800 miles between fill-ups.

Over the road, the 1.5 liter four cylinder engine provides the main power. Power can also be supplied by the electric motor and the electric generator, and in high load situations, both power units can operate simultaneously.

There are five main modes of operation:

When pulling away from a stop or under a light load, only the electric motor powers the vehicle.

In normal driving, engine power is divided by a power split device between the wheels and the electric generator. The generator runs the electric motor to provide additional power to the wheels.

Under full throttle acceleration, the electric motor is supplemented by power from the batteries,

During deceleration or braking, the motor functions as a generator to recharge the batteries. The batteries never need recharging from an external source. The gas

engine also shuts down creating zero emissions and using no fuel.

The battery is regulated to maintain a constant charge. When the charge is low, the electric generator routes power to charge the battery.

The key to the system is the power split



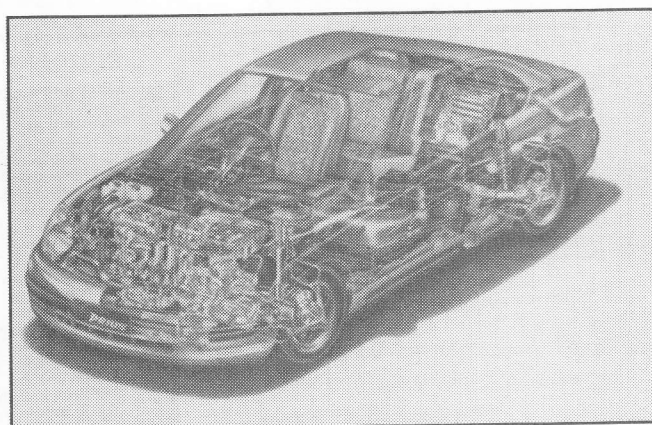
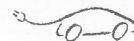
device in the transmission which sends engine power directly to the wheels or to the electric generator controlling the electric motor or battery state of charge.

What is amazing is that during all of these modes the driver feels nothing other than typical small car performance with one exception. During a stop the gas engine shuts off and the car becomes eerily quiet. While accelerating away from a light, you are using battery power, then at approximately 15 miles per hour the gas engine seamlessly starts and

you're underway, using the highly efficient gasoline engine. Although most electric cars have gotten a bad reputation for being very slow, this is not the case with this hybrid, 0-60 miles per hour is accomplished in just under 11 seconds. The ride is surprisingly smooth and comfortable equal to that of a much larger car.

As a small car the Prius is quite practical, there is comfortable seating for four adults with seat belts for five. Storage is well thought out with a decent sized glove box, cubbies for maps, change and sun glasses. The trunk should accommodate a weekend's worth of luggage and can easily hold eight grocery bags.

Available in Japan now and selling extremely well, the Prius should be a hit when it arrives here in mid July of 2000. —JP



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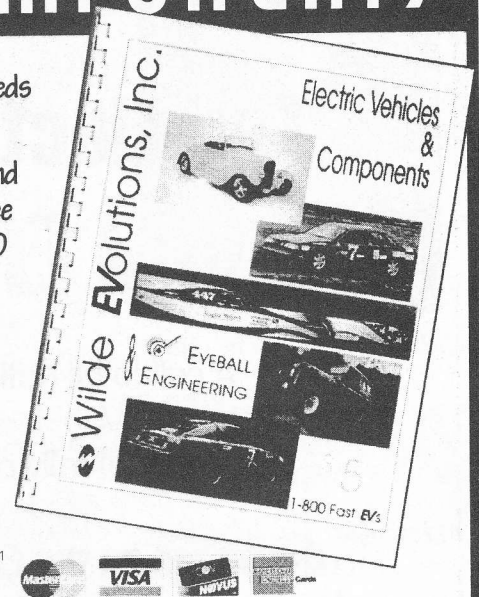
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Official Notice of The Electric Auto Association's National Endurance Range Rally

A call to all national members for a chance to win and hold the historic EAA perpetual trophy. Help us return to the spirit of the early EAA national rally competition for ultimate range and performance.

Organized by the East Bay Chapter's Special Events Committee.
To be held on the East Bay Chapter's traditional rally date of:

10:00 am, Saturday, August 26 2000

at: Pacific Bell, 2600 Camino Ramon, San Ramon, CA

How to get there:

From highway 680 heading north through San Ramon - exit at Bollinger Canyon Rd and head to the right (east), then turn left (north) on Camino Ramon (about 1/4 mi.). Pacific Bell Building is on the left about 1/4 mi. north on Camino Ramon. Turn in at Pacific Bell sign, and head immediately to the right.

From highway 680 heading south through San Ramon - exit at Bollinger Canyon Rd and head to the left (east), then turn left (north) on Camino Ramon (about 1/3 mi.). Pacific Bell Building is on the left about 1/4 mi. north on Camino Ramon. Turn in at Pacific Bell sign, and head immediately to the right.

Public Transit - From either Walnut Creek or Dublin BART stations, take the County Connection route 121 bus (\$1.25) and get off at the San Ramon Transit Center just off Camino Ramon. Cross Camino Ramon heading west, and walk south on Camino Ramon, the Pacific Bell building is the only building on the right (west) side of Camino Ramon on that block.

Facilities available: Very limited charging (2 EVI 100s - new models so some cheater cords won't work). Restrooms are available in the building. Fast food restaurants are located on Camino Ramon about 1 mile north of the site or on Bollinger Canyon Rd about 2/3 mile south of the site. Lots of parking for tow vehicles, friends, etc. Trees in parking lot offer some shade.

Rally route: 3 miles, mostly flat surface streets. Speed limits from 25 to 40 MPH. Vehicle sign-ups start at 9:00 am

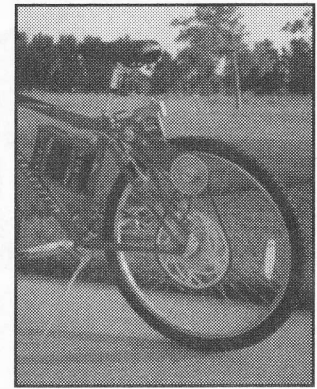
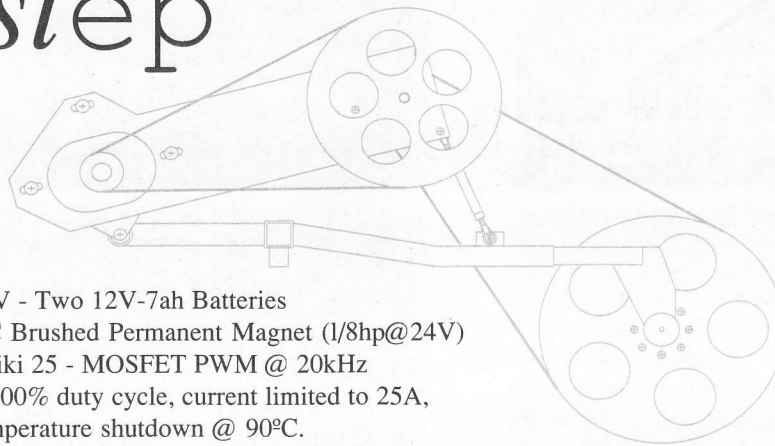
for more information, contact:

Anna Cornell, Special Events Coordinator

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- Price: \$599.00 + shipping (8.25% tax for CA residents)

• Easy bolt-on system to standard mountain bikes with 26" rims or hybrid bikes with 700c rims (~27" diameter rims).

• Kit is a "direct-drive" system and not a friction drive.

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.

Order from:

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540-473-1248

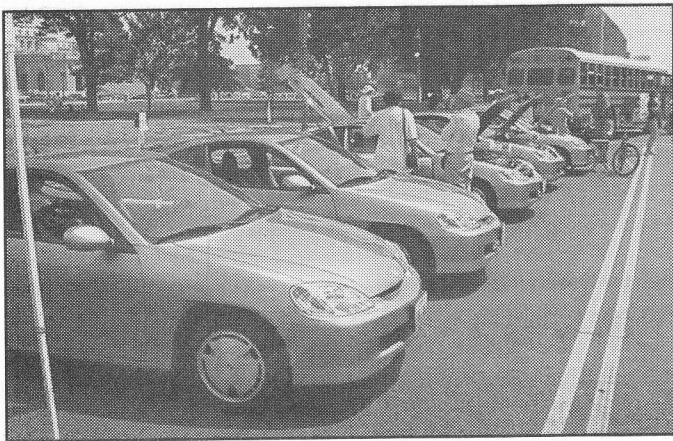
For Sale - Circuits Published in DEVC

- ◆ DC-DC Converter, 300 W buck converter, non-isolated-used in Commuta-Car.....(3 pgs)
- ◆ PPM variable frequency motor speed control used in Commuta-Car, tractor.....(4 pgs)
- ◆ Individual Battery Charger, used on Electro-Metro to keep batts at + or -0.1(5 pgs + micropr)
- ◆ Commuta Car Speed Control 2, 60V controller for tractor, NEV, or golf.....(5 pgs + micropr)
- ◆ LiteBar, LED lightbar for brake lights, etc, using HP ultra-brights.....(1 pg)
- ◆ Solar Heating System_Controller, controls Grundfos circulating panel.....(3pgs. + micropr)
- ◆ Metro-Charger and dashboard display, batt gauge, tach, temp, amps etc....(6pgs + micropr)
(uses PFC Ferro-Resonant transformer, or individual secondary transformer)
(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)
- ◆ 1800W Switching charger with PFC, if into pain, lotsa parts.....(5pgs + micropr)
- ◆ 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)

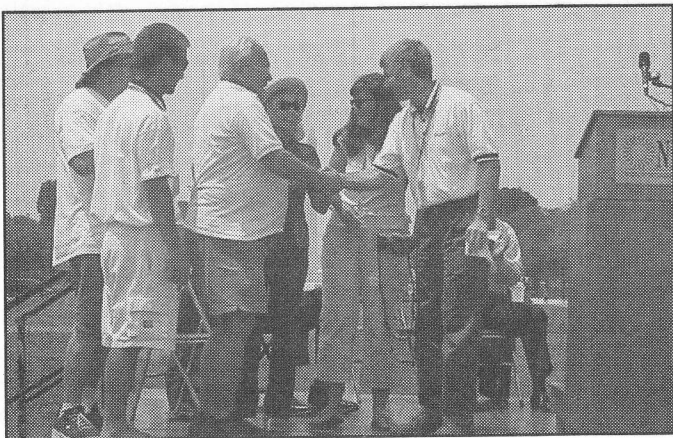
2000 NESEA American Tour de Sol

Photo Essay by John Helwig, NESEA Volunteer in his 8th year of service, Co-Authored by Nancy Hazard, Director of the ATdS.

1.) More than four-dozen electric, hybrid-electric vehicles drove from New York City to Washington, DC, during Clean Air Week, May 12-19, 2000. Thousands of people, including over 6,000 students came to see the vehicles at one of the many festivals held in New York, New Jersey, Maryland and Washington, DC.



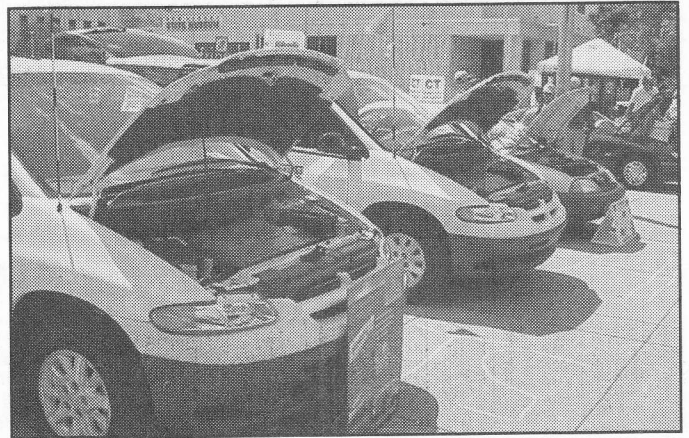
2.) The Honda Insight, the first gasoline-electric hybrid vehicle on the U.S. Market, was shown off by American Honda Motor Company and 10 Insight owners. Here a group of Hondas are shown on display in DC.



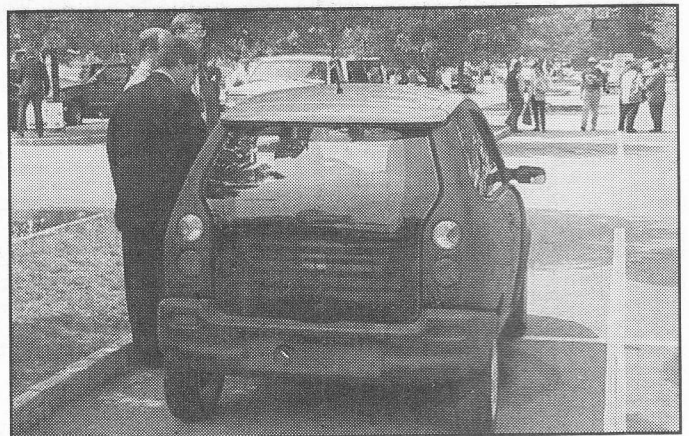
3.) At the finish line ceremonies in DC, Mr. Robert Bienenfeld, Director of Alternate Fuels Marketing and Sales of American Honda congratulates Mr. Dempsey and several of the other drivers on the Honda Insights in the 2000 ATdS.



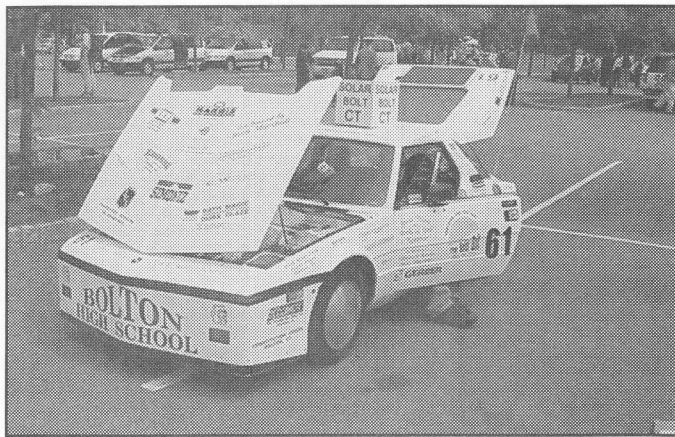
4.) General Motors' second generation EV1, a battery-electric vehicle using GM Ovonic nickel metal hybrid batteries, took a very close second place. While its very respectable driving range of 224 miles did not match the Insight's range, the vehicle earned high points for low greenhouse gas emissions, which were half that of the best hybrid vehicles. This vehicle was driven by its owner, well-known NASCAR racecar driver, David Swan.



4.) DaimlerChrysler's electric EPIC minivan was voted the winner of the "Consumer Acceptability Award" by a panel of distinguished judges representing the press, for the second year in a row. DaimlerChrysler also displayed their pre-production hybrid Darango, a sport utility vehicle.



5.) In NYC, Ford displayed their Th!nk, a Neighborhood Electric Vehicle, with a plastic body.



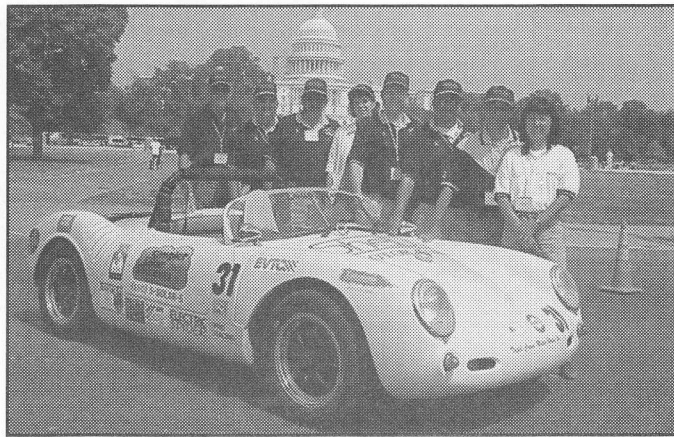
6.) In the Battery-Electric category, thirteen teams from around the country competed. The Bolton High School Team (Bolton, CT) captured ALABC's prize for the best car using lead acid batteries. They also set a new event range record of 165 miles for a vehicle using a lead acid battery, and tied for first place in their category.



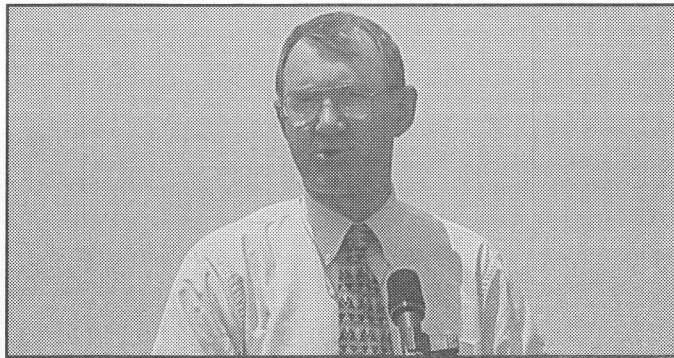
7.) The Sungo, New Hampshire Technical Institutes' purpose-built sedan, tied for first place. NHTI is the only team that has competed every year since the NESEA Tour began in 1989.



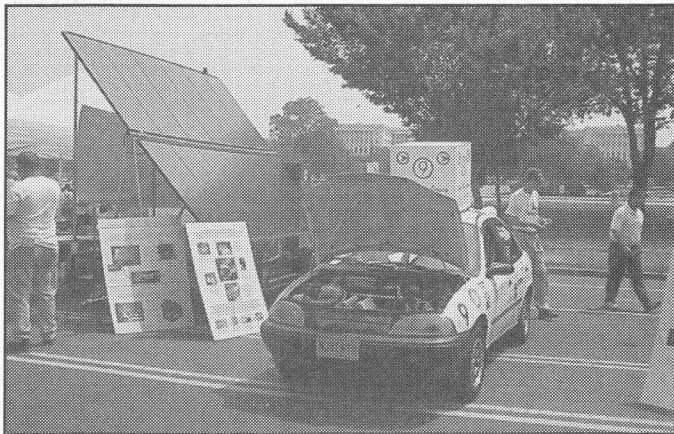
8.) In the USDOE Hybrid category, six student teams participated. The complexities in fuel measuring made scoring complicated and difficult. Top honors were given to several vehicles built by Lawrence Tech (MI) (Photo), the University of Tulsa (OK), Deer Valley High School (AZ), and Naugatuck Valley Community Technical College (CT).



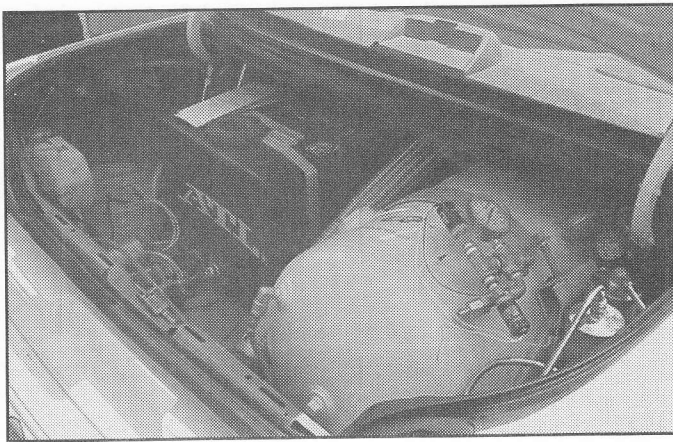
9.) Another top placing Battery-Electric vehicle was entered by Team Arachnids.



10.) "As each car in this competition shows, mobility and clean air are not a contradiction." "Think about the choices (of battery-electric, gasoline-electric hybrid vehicles) when you are buying your next vehicle. After all, your vehicle choice is the most important environmental decision you make." Kenneth R. Wykle, Administrator, Federal Highway Administration



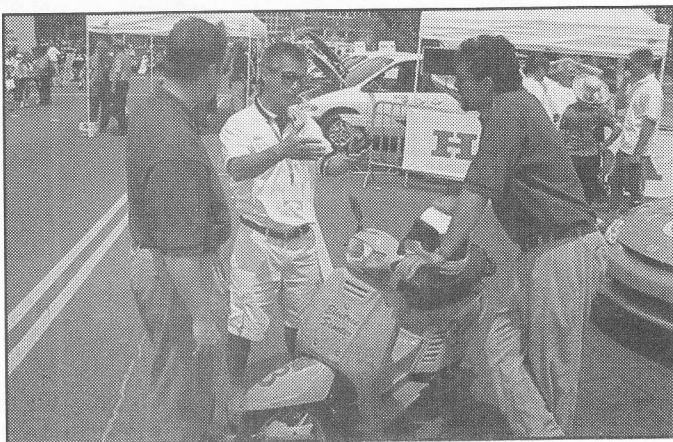
11.) Team New Jersey, demonstrated their cutting edge fuel cell vehicle. They also demonstrated their ability to travel the course using only renewably produced electricity and hydrogen! The vehicle captured the prize for the "Greenest Sedan," and first place in the new Renewably Fueled vehicle Category. NESEA presented a "Sustainable Transportation Award" to the State of New Jersey for its work with advanced transportation vehicles. The photo below shows the NJ Venturer and its transportable solar charging panel.



12.) This year Team NJ designed a second fuel cell vehicle powered by a larger fuel cell. A borohydride storage unit was designed by Millenium Cell to supply the hydrogen. Construction was almost completed in less than a year too; but unfortunately, they came up about 3 weeks short. (Photo shows the borohydride storage unit in the trunk)



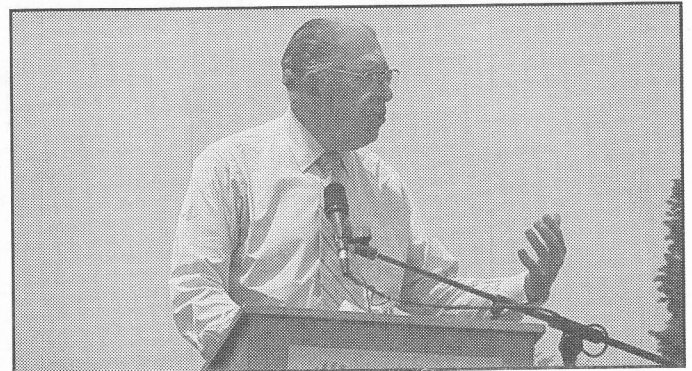
13.) The University of Maine's Solar Black Bear captured first place in the Solar-Electric vehicle category for the second year in a row.



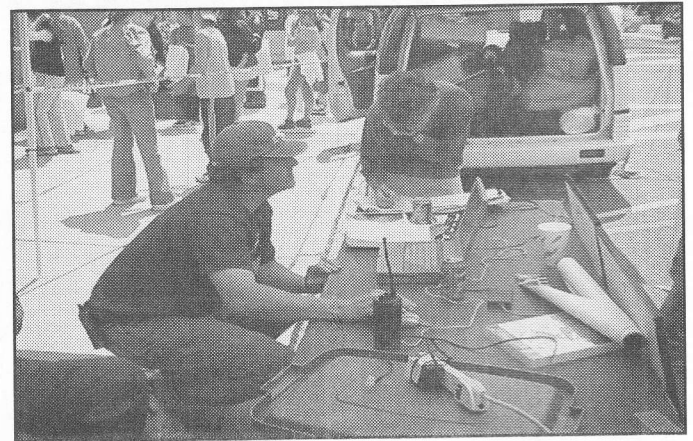
14.) The Ovonc Scooter, the only corporate entry in the One-Person category, took first place. This electric scooter, entered by the Ovonc Battery Company, demonstrated an amazing efficiency of the equivalent of 302 miles per gallon. Its driving range was 65 miles.



15.) Energy Conversion Devices, the parent company of Ovonc Battery Company, also had their batteries in other top placing vehicles including the EV1, Sungo, and Lawrence Tech's entries, which combined captured three firsts and one second!



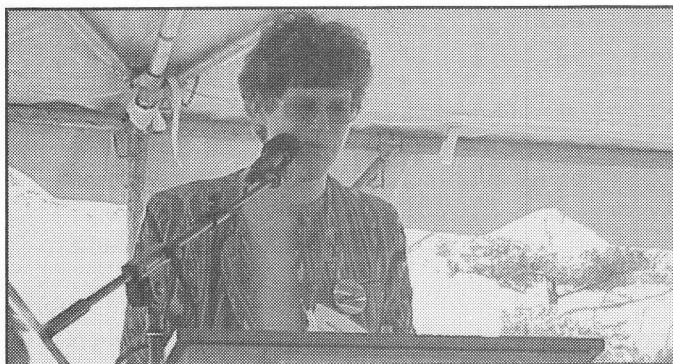
16.) Robert Stempel, Chairman of Energy Conversion Devices, and board member of the Electric Vehicle Association of the Americas joined the event in Washington, DC, to congratulate the teams on their successes.



17.) ENSCO, Inc., joined us for the first time this year as the official NESEA Tour Scoring sponsor. They are working on automating the scoring system. They also installed several GPS sensors in key cars, so that we could all watch the progress of the event in "real time" on the web! Thanks to AirLink Communications and others for their equipment donation. Staff from ENSCO, Inc., capture the time of the vehicles as they arrive in Chesapeake City, MD.



18.) The tour isn't all serious... here a group of NESEA volunteers celebrate after riding in the electric school bus during its run in the autocross.



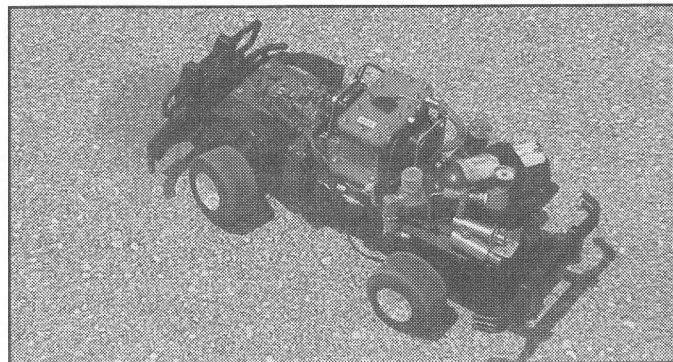
19.) The 2000 NESEA American Tour de Sol was dedicated to the memory and vision of George Bradford, an avid environmentalist, and to his love of learning and teaching. He participated in the NESEA Tour from 1990-1999, first as entrant, as Champlain College's team advisor, and later as the Technical Co-Director of the event. Nancy Hazard makes the announcement of the dedication.



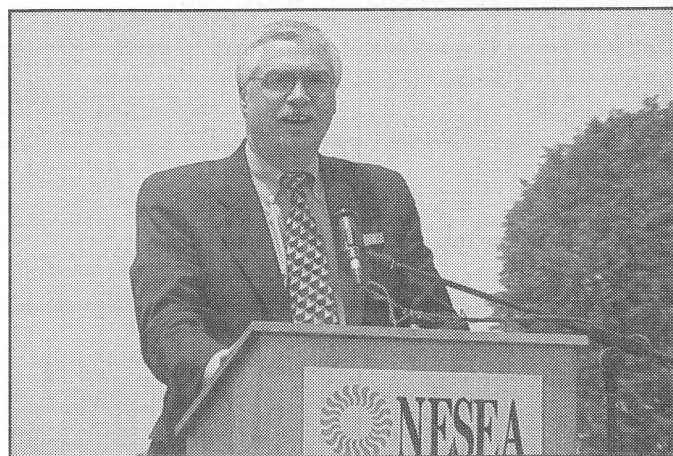
20.) His wife (Photo) and daughter, as well as numerous relatives joined us for the dedication. Topher Waring, inspiring and enthusiastic science and shop teacher received the first annual Bradford EV Teacher Award. The Blue Sky Award, which is given to a team that shows exceptional team spirit and sportsmanship, was also dedicated to George's memory this year. The top Blue ky Award was given to the Vermont Tech team.



21.) Volunteers and staff who traveled with the entire event join for a final celebratory photo at the awards banquet.



22.) Fuel cells were also demonstrated in an RC (radio controlled) car which was seen zipping around the display area.



23.) "An American can make a difference by choosing a cleaner vehicle, and importantly, these cleaner vehicles are for real. For most Americans, choosing what you drive, and how you drive it, could be the most important environmental decision you make." "Let me salute NESEA for taking that message to the American People." "Let me congratulate all of the contestants that have come from across the country to participate. You are proving to America that we can have cleaner vehicles, that will allow America to grow without harming the environment," said Robert Perciasepe, EPA Director of Air and Radiation, at the 2000 NESEA American Tour de Sol finish line ceremonies in Washington, DC on May 19, 2000.

Roll Your Own Controller *Continued from page 4*

which pulls in when the peddle goes down to the second microswitch as a back-up in case the controller fails. This control has operated for the last 50k miles flawlessly since I blew up two store bought ones (Curtis 1221B) at 10k miles each. (The Curtis 1231C's are more reliable nowadays).

Unlike An EV1

A center-tap battery ferro PFC charger was used through a 30A breaker to the frame. A sonalert with bridge is used for an audible ground fault indicator. This allows a battery tap through a 13V regulator to kick in if the DC-DC craps out or the Aux battery dies so the main contactor (vehicle can be started) pulls in regardless unlike the EV-1.

MEH - 5/23/97

Electric Vehicle Computer

- motor speed control

Name: metrol.asm

update 6/24/97 600A

Copyright 1995 Mark E. Hanson

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Set up Port names to be recognized in program

```
Porta equ
Portb equ
Portc equ
Portd equ
```

```
0 1 2  Porta is register 0
3      Portb is register 1
      Portc is register 2
      Portd is register 3
```

```
ddra equ 4 5 6  data direction registers
ddrb equ 7
ddrc equ
ddrd equ
```

Port line pin definitions

```
*      Flags
*      NS
pot    equ    $20

*      OUTS
led    equ    7
pwm    equ    6

*      Mode button is interrupt line

motor temp a-d

Portb led for interrupt current
limit Portb pwm output

cop    equ    $1ff0  COP register reset location
```

RAM register locations

```
atod    equ    $21    a/d
acr      equ    $1e    a/d control register
arr      equ    $1d    a/d result register

*      equ    129    firmware timer delay registers
RAM      equ    130
:         equ    131    time on pwm time
dell     equ    132    off pwm
de12     equ    133
de13
ton
toff
```

Set up vector registers for reset/interrupts

* Timer vector set

```

org    $0900
byte   $01
org    $1f00    0900 is P9
byte   $03      turn on cop and low level int trigger

org    $1ff8
fdb    $0850    timer interrupt vector
fdb    $0850    external interrupt vector
fdb    $0850    SWI same as timer
fdb    $0100    reset vector
    
```

* External Interrupt Routine

```

org    $0850
bclr   pwm,Portb
bset   led,Portb
rti
    
```

* Timer Interrupt Routine

Main Program

* Initialize port bits

```

org    $100
clr    Porta    clear port data registers
clr    Portb
clr    Portc
clr    Portd

bset   led,ddrb    set ddrb led to output
bset   pwm,ddrb
bset   led,Portb    blink led
1da    #$20
sta    acr          turn on a-d converter

1dx    #10          1/2 sec delay activate interrupt
cli
    
```

* Program

```

Wait   stx    de13
        clrx
        stx    cop
    
```

```

1dx    #249    223 for 3.8 mHz or 249 for 4 mHz
stx    de11
flip3  1dx    #65
stx    de12
flip2  1dx    de11
flip1  dex
bne    flip1

stx    cop
1dx    de12
dex
stx    de12
bne    flip2
over   1dx    de13
dex
stx    de13
bne    flip3

Peddle bclr   pwm, Portb
ad      bclr   led,Portb
        1da    #pot    read pot
        sta    acr
anal    brclr  7,acr,anal
        1da    arr
        stx    cop

cmp     #15    if pot below lim then off
blo     Peddle
cmp     #242   if pot above lim then wire broken =
off     bhi     Peddle

sub     #7
sta     ton    set ton pwm 4 kHz 2usec per count
1da     #169
sub     ton
sta     toff   set toff pwm
back    deca
        nop
        bne    back

bset    pwm,Portb
1da     ton
back2   deca
        nop
        bne    back2
        1da     arr
        cmp     #166    check for full on
        bhi     ad
        bra     Peddle

*       That's all Folks!
        end
    
```


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

Prius Hybrids For Sale *Continued from page 1*

peak torque of 82 lb./ft. at 4,200. The engine is equipped with variable valve timing, which helps maximize efficiency across the full rpm range and minimize emissions.

The U.S.-spec Prius will benefit from a more powerful, more compact, and lighter battery pack. Peak battery-pack power has been increased by 20 percent to 25 kilowatts (kW), or 34 horsepower. Each of the 38 modules within the pack is only three-quarters of an inch thick and 20 percent lighter in weight than the units in the Japan-version Prius. The new lighter batteries will reduce battery pack volume by 40 percent

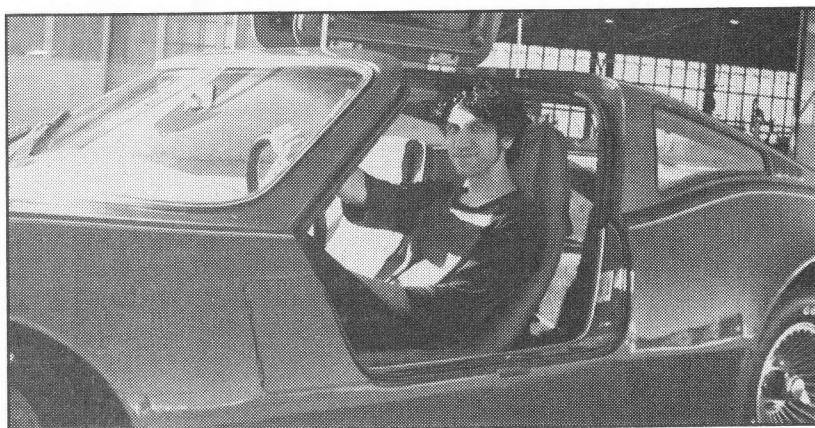
and will allow for more cargo area in the trunk.

Prius is projected to have an EPA label fuel economy rating of 52 miles per gallon in the city and 45 highway. It also will carry SULEV emissions certification, which is about 90 percent cleaner than ULEV for smog forming exhaust gases.

All in All the Prius is a good solution for EV'ers who can't plug in or must have unlimited range. With a SULEV rating the Prius takes one more step in the direction of true ZEV.

EAA Fundraising

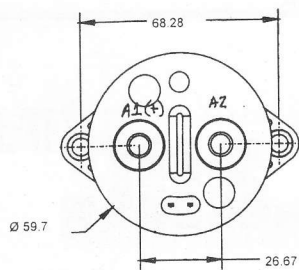
EAA Bradley Auction closes at \$7,100.00



The EAA's first Internet auction leveled off at \$6,600 until 30 minutes before the bidding closing date. During the last 30 minutes the bidding raced up to \$7,100 in a classic bidding war. After the dust settled the high bidder was Dan Port, the founder of iPal, an innovative dot com startup company out of Marina del Rey in Southern California. Dan's company has developed a product that connects users to the information and people they want instantly, without searching (such as electric vehicle technology). See: www.iPal.com After he tests the Bradley out completely he plans to drive it to the EAA LA chapter meetings at Cal Tech. We hope to print more Info on how he is doing in the future.

I would like to thank everyone who helped make this auction such a success. This one fundraising event raised the signal largest amount of cash in EAA history

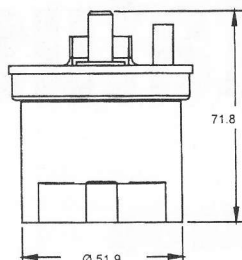
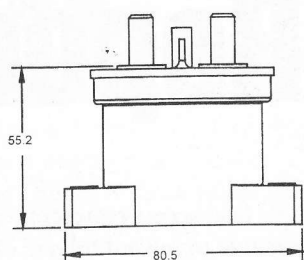
Thanks, Kurt Bohan



New from Kaylor Energy Products

KILOVAC Czonka 3

High Power Switching Contactor



All dimensions in millimeters unless otherwise specified.
Tolerances: 0.X = $\pm 0.77\text{mm}$ 0.XX = $\pm 0.26\text{mm}$

Kaylor Energy Products
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Boulder Creek, CA 95006

Tel. (831) 338-2200
E-mail:
kaylor@access1.net

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- ◆ 320 Volts
- ◆ 200A Continuous
- ◆ 2000A Maximum
- ◆ 12 Volt Coil
- ◆ Make & Break at 250A
- ◆ Uses less than 1/10 Ampere
- ◆ Magnetic & Gas Arc Quenching
- ◆ Hermetically Sealed: arc contained
- ◆ Weighs Less Than One Pound
- ◆ Size less than 2.58" X 2.83" X 3.16"
- ◆ Mounting hardware provided

\$69.95

+\$5.00 S&H

+8.25% tax in CA

Mike's E-Bikes

30 miles at 25+ MPH
for only a nickel

Glide by traffic

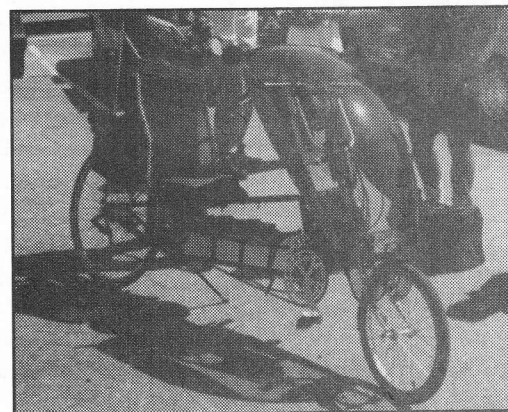
No parking hassles

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Use the **E-BIKE** for "no-sweat" commuting! Whatever your normal bicycle performance, the **E-BIKE** will add 20 miles to your range, and will add 10 MPH to your average speed. You can use your **E-BIKE** for errands, nature rides, shopping, and recreation.

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Tel. (650) 493-7633
E-mail: saari@aol.com

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

Diamond Lane Status Report

By **Jamie Knapp**

**Drivers of Zero-Emission Vehicles
Gain HOV Lane Access July 1. Begin-
ning June 15, Drivers May Apply for ID
Stickers**

Drivers of electric vehicles (EVs) and compressed natural gas (CNG) vehicles in California will be able to drive in carpool (High Occupancy Vehicle or HOV) lanes and diamond lane on-ramps without passengers beginning July 1 - as long as their vehicle displays special decals.

Beginning June 15th drivers of EVs and CNG cars can apply for the ID stickers from the Department of Motor Vehicles, at DMV field offices or on its web site. The one-time cost is \$8. Vehicle owners must fill out the application, then go to their local DMV office to ensure that the vehicles qualify. Owners will receive their decals a few weeks later.

HOV lane access represents an important incentive to reward drivers of cleaner cars and to encourage consumers to purchase or lease these vehicles. Caltrans estimates that the value of HOV lane access can be as much as \$5,000 annually in time not spent in commuter traffic. This incentive is expected to increase the market for zero-emission and other very clean vehicles.

Contacts:

Dave Modisette, CalETC, 916-552-7077
Susan Frank, Kirsch Foundation, 408-278-2278

Andrew Weisser, American Lung Association, 818-757-1440

Jamie Knapp, California ZEV Alliance,
530-756-3611
926 J Street, Suite 612, Sacramento, CA
95814
ZEVAlliance@aol.com
<http://www.cleancarpledge.org> 916-444-8726



Events Calendar

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

August 26

EAA National Endurance Range Rally. Hosted by the East Bay chapter of the Electric Auto Association. To be held in San Ramon, CA. Event runs on a 3-mile endurance course, just like the old Silicon Valley rallies. Shade trees, too! Public hours: 10am -4pm. Limited charging available; lots of trailer room. Contact Anna Cornell at (925) 685-7580 10am - 4pm M-F. Or E-mail Anna at ebeaa@juno.com

September 11-13

Intertech Hybrid Electric Vehicle Conference, Windsor, Ontario, Canada. Automotive and fuels executives and technologists will appraise the recent developments in hybrid electric vehicles (HEVs) from market, technical and investment perspectives. Contact: Intertech, 19 Northbrook Drive, Portland, Maine 04105. Tel. (207) 781-9800 Fax: (207) 781-2150 E-mail: info@intertechusa.com Web: www.intertechusa.com

September 17-19

Hyforum 2000 - The International Hydrogen Energy Forum 2000, Munich Germany. International forum on the use of hydrogen and hydrogen technologies as an alternative fuel and energy source including a discussion on technologies, economics, policies, and potential investment in hydrogen-related businesses. Contact: Sandra Hoderlein, Congress Manager Tel. +49 (0) 228/9 59 56-0 Fax: +49 (0) 228/9 59 56-50 E-mail: energie.forum@t-online.de Web: www.zukunftsenergien.de

September 19-20

EPRI - Electric Bus Users Group Workshop, Norfolk, Virginia. The second EPRI Electric Bus Users Group Workshop of 2000. Contact: Layla Sandell, EPRI Tel. (650) 855-2756 Fax: (650) 855-2737 E-mail: lsandell@epri.com

September 23

Silicon Valley EAA Rally, 10:00 a.m. - 4:00 p.m. The big yearly EV rally! Stanford University, Palo Alto, in front of Encina Hall & Burnham Pavilion (just south of Hoover Tower on the corner of Galvez & Serra). Contact: Will Beckett BeckettW@corp.hp.com 650-857-3859 Website <http://www.evcl.com/ea-sv/>

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 1-3

CAATS 6th Annual Meeting: E-Transportation - The California Advantage, Palm Springs, California. Information technology and e-commerce solutions for mobility and safety. Contact: Randi Dixon Tel. (916) 325-0473 Fax: (916) 325-0471 E-mail: Randi_Dixon@caats.org

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

October 16-18

Convergence 2000, Dearborn, Michigan. Annual conference by the Convergence Transportation Electronics Assn. that features speakers, panels and exhibits in the field of automotive electronics. Contact: Ravi Rajagopalan, Delphi Automotive Systems. Fax: (781) 828-9992 Web: www.convergence2000.org

October 18-20

New Visions in Transportation - Accelerating Emerging Technologies and Innovative Designs, Aspen, Colorado. The purpose of the conference is to help build a new consensus and advance innovative transportation systems. Contact: Bill Flanigan, NVT Tel. (970) 963-6824 E-mail: flanigan@sopris.net

November 6-7

7th World Congress on ITS: From Vision to Reality, Turin, Italy. An international forum on the latest in ITS technology developments. **CALL FOR PAPERS** Contact: Mrs. Kip Stacy Ports, Congress ITS Tel: (202) 484-4542 Fax: (202) 484-3483 E-mail: kstacy@itsa.org Web: www.itsa.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.

GM, Giner to Develop FCVs

General Motors Corporation (GM) and Giner, Inc., a developer of fuel cell technology, recently announced that they will combine efforts to accelerate the development of fuel cell vehicles (FCVs) under the name Giner Electrochemical Systems (GES). Through the newly formed partnership, GES will conduct both fuel cell and electrochemical research and development efforts at its Waltham, MA location. According to Giner, proton exchange membrane (PEM) fuel cells are considered ideal for automotive applications because they are able to start up quickly and provide high power in a compact size. "This agreement will help lead to world-class, zero-emission powertrains," said GM Vice President Larry Burns. "The teaming of GM's global research organization that is working on fuel cell development and that of Giner's gives us the ability to increase the pace of fundamental technology development." GM said Giner's 40-member team has developed electrochemical PEM fuel cells and related technologies for NASA, the U.S. Navy and medical companies. (GM RELEASE: 5/22)

Kline to Publish Study on Lithium Ion Batteries

Kline and Company, Inc. recently announced it will publish a lithium ion and lithium ion polymer battery manufacturing cost outlook and market assessment for the period between 2000 and 2007 early next year. The company said the study will include cost models for world-scale lithium ion and lithium ion polymer manufacturing based on manufacturing cost assessment, technological review, market realities, and the two technologies' position in relation to other battery technology. Although lithium

ion technology has been commercially present for nearly 10 years, lithium ion polymer batteries, which many claim are lighter, thinner, safer and more flexible in design than lithium ion batteries, are providing increased competition. Kline and Company said lithium ion battery manufacturers are responding by matching the benefits of these lithium ion polymer products. The report will also include a seven-year future cost and demand outlook based on such factors as the availability and continued cost reduction of key raw materials and technology, current product development activities, new patents, performance issues, and economies of scale. Kline and Company is a global consulting firm offering a broad range of services to the battery and related materials industry.

(KLINE AND COMPANY RELEASE: 5/22)

BMW Introduces FCVs to Boost Infrastructure

German automaker BMW recently unveiled 15 new hydrogen-powered sedans in an effort to promote the market debut of its fuel cell vehicles (FCVs) at the Expo 2000 world's fair in Hanover, Germany. In addition, the introduction of the vehicles was intended to encourage the German government to begin funding the development of alternative fuel vehicle (AFV) fueling infrastructure in the country. Currently, there are only two hydrogen fueling stations in Germany. "It's a bit of the chicken-or-the-egg dilemma," said Deutsche Shell official Fritz Vahrenholt. The company is collaborating with BMW and other German automakers to commercialize the fuels needed to power AFVs, including fuel cell-powered vehicles. Germany authorities believe it is too early in the development of FCVs to offer tax exemptions for hydrogen-powered vehicles or state funding to build fueling infrastructure. Industry observers said any government-funded projects would automatically offer an unfair advantage to the company with the most advanced FCV and hydrogen technology. An official with Germany's Ministry for Economics and

Technology noted that the federal government has already invested \$70 million in hydrogen technology.

(LOS ANGELES TIMES: 5/19)

Fuel Cells Will Dominate Market by 2010

Allied Business Intelligence (ABI), which follows emerging technological trends, recently reported that by 2010, fuel cell vehicles will corner at least 4%, or 608,000 vehicles, of the total U.S. automotive market. The report noted that the market for these vehicles could even reach as high as 7.6%, or 1,215,000 vehicles. ABI predicted that 80% of all fuel cell vehicles sold will be proton exchange membrane (PEM) fuel cells by 2010. ABI predicted that mass production of fuel cell vehicles will be achieved once production levels can start at 100,000 units. According to ABI, this will reduce the costs associated with making fuel cell vehicles, which has been the primary challenge for manufacturers, making them competitively priced with standard internal combustion engine vehicles. The biggest challenge to fuel cell developers is climbing the "learning curve" in order to achieve high volume production. ABI said automotive fuel cells will gain market share in Japan and Europe following market penetration in the U.S., reaching 4.5% and 3.7% market penetration, respectively, by 2010.

(BUSINESS WIRE: 5/19)

EVAA Lauds AFV Tax Incentive Act

Senators Jim Jeffords (R-VT) and Orrin Hatch (R-UT) recently introduced federal legislation to encourage the transportation sector to use alternative fuel vehicles. The Electric Vehicle Association of the Americas (EVAA) recently announced that it has endorsed the legislation, known as the Alternative Fuels Tax Incentive Act. "EVAA joins our friends from the natural gas, propane, methanol and hydrogen industries, as well as vehicle manufacturers and our friends in the environmental community in endorsing the Jeffords/Hatch legislation, and — together — we will press for enactment of

the bill before Congress adjourns this fall," said EVAA Executive Director Kateri Callahan. The Jeffords/Hatch legislation provides several tax credits and tax deductions to businesses and consumers to encourage the purchase and use of vehicles powered by electricity and other alternative fuels.

(EVAA RELEASE: 5/18)

Tino Hybrid Being Sold in Japan

Nissan's Tino hybrid EV is not scheduled for marketing in the U.S., unlike the Honda Insight and the Toyota Prius. One hundred Tinos were purchased recently during a 14-hour sale over the Internet. The company said that almost 60% of the sales were to individuals and the remainder went to companies and government fleets. The Tino has a 1.8-liter dual overhead cam, four-cylinder gasoline engine combined with an electric drivetrain powered by two 17-kilowatt AC electric motors. Other features include a lithium ion battery pack and regenerative braking. The electric motor in the Tino only functions alone when the internal combustion engine is working inefficiently — during start-up or while traveling at low speeds. The engine automatically shuts off when the vehicle is stopped. The Tino can accommodate five adults and has space for luggage. The car sells for \$30,000 but government subsidies for business consumers and personal use may reduce the cost by \$7,250 and \$4,650, respectively.

(GREEN CAR JOURNAL: APRIL 2000)

NV Company Receives Patent for Battery

Las Vegas, NV-based Power Technology, Inc., a developer of power generation and power storage fields, recently announced that it has been awarded patent number 6,060,198 for its newly developed electrochemical battery structure. In an effort to increase the surface area to provide a stronger current, Power Technology's battery is comprised of rigid, reticulated foam plates instead of traditional lead plates or grids. The company said it is actively seeking original equipment manufacturers to com-

mercially develop and market lead-acid batteries using the reticulated foam plates. The electrochemical structure can be used in nickel cadmium, nickel metal hydride, silver oxide zinc, and nickel iron batteries. Currently, Power Technology is working with B.C. Research, Inc., which is creating working battery models for use in various applications. Using less lead than traditional batteries, the battery structure is capable of both deep cycle applications, including golf carts and EVs and lighter applications, including automotive starting, lighting, and ignition. (POWER TECHNOLOGY RELEASE: 5/15)

Insight Passes Crash Test

The National Highway Traffic Safety Administration (NHTSA) recently gave Honda's hybrid EV, the Insight, a four-star front-crash rating. It was the first time that the administration had tested a hybrid vehicle. The Insight has an aluminum frame which makes the car 100 pounds lighter than the next-lightest vehicle, General Motors' Chevrolet Metro. Weighing 1,868 pounds, the Insight received four out of five stars for protection in head-on collisions for both passengers and drivers. The Environmental Protection Agency (EPA) rated the Insight as the most fuel-efficient vehicle in the U.S. The car achieves 70 mpg in highway use and 61 mpg in city driving. The Insight combines a nickel metal hydride battery and a one-liter, three-cylinder gasoline engine. During the front-crash test, the vehicle is driven into a fixed barrier at 35 miles per hour. There are currently no plans to perform a side-impact test on the Insight.

(BLOOMBERG NEWS: 5/9)

LAWA Adds Insight to Fleet

The Los Angeles World Airports (LAWA) recently added the Honda Insight to its fleet of more than 235 alternative fuel vehicles (AFVs). The first hybrid-electric vehicle sold in the United States will be delivered to

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Los Angeles International Airport (LAX). The Insight achieves a rated fuel economy of 61 mpg in the city and 70 mpg on the highway. LAWA said its fleet is made up of more than 235 AFVs that run on compressed natural gas, liquified natural gas, propane, electricity and now hybrid electric propulsion systems. AFVs represent 35% of LAWA's fleet at LAX, and the group hopes to reach 50% by 2003. "LAX has become a proving ground for alternative fuel vehicles that are helping to better the quality of our air," said LAWA Executive Director Lydia Kennard. "The airport represents an excellent showcase for modern transportation methods, and will continue to take a leadership role in demonstrating the viability of alternative fuel vehicles, including hybrid electric vehicles, to meet numerous transportation needs cleanly, quietly, and efficiently." LAWA has received the Clean Air Award for its use of AFVs and a certificate of achievement from the California Natural Gas Coalition in recognition of its dedicated use of alternative fuels. LAWA has also been recognized for its participation in the Department of Energy's Clean Cities Program. (LAWA RELEASE: 5/11)

Maxwell Receives Orders for Ultracapacitors

Maxwell Technologies, Inc., a manufacturer of energy generating ultracapacitors for various mobile applications, including electronics and transportation, recently announced that it has begun to receive high volume purchase orders for its PowerCache Ultracapacitors. The company said it currently has an order backlog for ultracapacitors that exceeds \$6 million. Maxwell president and CEO Carl Eibl said the company's PowerCache Ultracapacitor is in its advanced stage of design and the company anticipates that as many as one million of the energy storage cells will be produced monthly by 2001. "We are working with original equipment manufacturers on applications ranging from consumer electronics, including wireless communication devices, to uninterruptible power supplies (UPS) and other commercial systems, fuel cells, and both hybrid and electric vehicles," said Maxwell Electronic Components group President Richard Balanson. Maxwell's ultracapacitors come in four sizes, from thumb nail-sized cells to soda can size, and can deliver power 10 times that of traditional batteries.

(MAXWELL TECHNOLOGIES RELEASE: 5/8)

BCC Publishes Report on Fuel Cell Markets

Business Communications Company, Inc. (BCC) recently published a new report that estimates the market for fuel cells will reach nearly \$1.3 billion by 2003. BCC said the report is intended to "keep readers abreast of the rapid technology developments which characterize the entire fuel cell sector." The report found that the total market for fuel cells in 1999 was \$448 million, and with an average annual growth rate (AAGR) of 30.4% over the next three years, that market could expand to nearly \$1.3 billion. Solid polymer fuel cells will account for the largest part of this market with an AAGR of 41.6% and a total market of \$450 million by

2003. BCC said the report provides information on major fuel cell technology, including alkaline, molten carbonate, phosphoric acid, solid oxide and proton exchange membrane, as well as industry news from the past year. This includes news on key patents, regulations, catalysts and reformers, transportation developments, utility applications, portable power, and energy policy. The report is a compilation of data and news stories obtained by the company's editors throughout the year. The stories have been organized into areas of interest and supported by additional appropriate market and technical data.

(BCC RELEASE: 4/18)

Ford Moves TH!NK Operation to Southern CA

Ford Motor Company's TH!NK Group, its new electric vehicle business, recently announced that it will be moving its headquarters from Dearborn, MI, to San Diego, CA. The company said the move will allow the TH!NK Group to be closer to its customers and business partners, including the California Fuel Cell Partnership. The TH!NK Group is comprised of two divisions: TH!NK Mobility, which manufactures a line of EVs, and TH!NK Technologies, which conducts research and development on electric drive systems, including fuel cells. The TH!NK Group manufactures the electric-powered TH!NK city, which is currently being sold in Norway, as well as TH!NK bike fun and TH!NK bike traveler — both of which will be released in the U.S. later this year. The group also produces the TH!NK neighbor, a low-speed EV slated for release later this year.

(FORD RELEASE: 5/8)

Reveo Develops New Fuel Cell Technology

Reveo, Inc. has developed a new fuel cell technology that provides power using metals such as aluminum or zinc. The company's Revolutionary Power Cell (RPC) uses oxidation to convert aluminum into aluminum oxide. The energy released by the reaction is

used to power items ranging from cellular phones to vehicles to homes. In order to recharge the RPC, the aluminum oxide is converted back to aluminum. Sadeq Faris, founder and chairman of Reveo, said the RPC could become a low-cost substitute for conventional batteries. He said the technology is expected to deliver power at a rate of \$100 per kilowatt, compared to \$1,000 per kilowatt for natural gas- and liquid fuel-powered fuel cells. In addition, the RPC can be shaped according to the demands of individual products. Faris said the RPC technology will become available early next year. He said the RPC could power an EV for up to 600 miles, compared to hydrogen fuel cells which can only power an EV for about 120 miles. The RPC will be marketed and manufactured by Reveo subsidiary Evonyx, Inc.

(EARTH TIMES: 4/19)

Canadian Officials Test Drive P2000

Federal officials in Canada recently had the opportunity to test-drive Ford's hydrogen fuel cell-powered P2000 concept car. The vehicle features fuel cell stacks developed by Vancouver-based Ballard Power Systems, Inc. and uses Ford's electric powertrain to deliver about 100 horsepower. Natural resources minister Ralph Goodale, industry minister John Manley, environment minister David Anderson and transportation minister David Collenette were given the opportunity to drive the fuel cell vehicle around Parliament Hill in Ottawa. The P2000 is Ford's first "drivable prototype" and is expected to be in showrooms by 2004. Ford of Canada President and CEO Bobbie Gaunt noted that Alcan Aluminum Ltd. has invested nearly \$200 million to develop special alloys for the P2000's body and many structural parts. The P2000 uses Ford's advanced Ecostar Electric Drive System, an electric induction motor and electric power inverter that weighs about 90 kilograms and produces up to 90 kilowatts of power. The inverter converts DC power generated by the fuel cells to AC that powers the electric motors and turns the vehicle's wheels.

(CANADIAN NEWSWIRE: 5/4)

Borealis Receives Patent for Chorus Motor

Borealis Technical Ltd recently announced it has received a patent for its "Poly Phase Induction Electrical Rotating Machine" from the U.S. Patent and Trademark Office. The company said other patents related to its Chorus Motor technology and polyphase motors are currently pending. Borealis said the Chorus Motor technology substantially increases the efficiency of AC motors. The patent uses new windings and controllers and will be available on the World Wide Web next month at <http://www.chorusmotor.com>. The Chorus Motor has a high start-up torque and increased efficiency, and is able to operate within standard temperature limits. Furthermore, tests have illustrated notable improvements in comparison to standard AC motors. "Chorus is the ideal solution for many fixed load and traction applications, including electric and hybrid-electric vehicles," said Borealis President Isaiah Cox. He said the company's new patent represents a significant advance in electric motor technology. (BUSINESS WIRE: 4/25)

Toyota Names U.S. Price for Prius

At the recent New York Auto Show, Toyota announced that its new hybrid EV, the Prius, will sell for \$19,995. The Prius, the first production-level gasoline-electric hybrid, will be offered for sale in the U.S. this summer. Toyota already has sold more than 35,000 of the new vehicles in Japan, where sales began in December 1997. The U.S. version of the Prius will feature an improved battery pack and an engine with a peak power rating of 70 horsepower at 4,500 revolutions per minute. "It will be a success in the U.S. for the same reason it has been a success in Japan," said Don Esmond, group vice president and general manager of Toyota Motor Sales, U.S.A.'s (TMS) Toyota division. "Prius is a real car." The Prius has a fuel economy of close to 50 mpg, and has been certified to Super Ultra Low Emission Vehicle standards. Toyota deal-

ers in the U.S. will offer a Prius demonstration program beginning in June. In addition, customers will be able to place pre-orders on Toyota's website — located on the World Wide Web at <http://www.toyota.com>. The first orders to be placed through the site will be delivered in August.

(TMS RELEASE: 4/19)

Prius Hybrid Honored By Sierra Club

The Sierra Club, an environmental organization with more than 600,000 members, recently awarded its Excellence in Environmental Engineering award to Toyota Motor Corporation for its hybrid-electric Prius vehicle during the New York Auto Show. "Just in time for Earth Day, the Sierra Club is proud to honor the Toyota Prius, which provides a fuel-efficient choice for our families and our future," said former Sierra Club president Robbie Cox, who presented the award to Toyota. "We believe the Prius will take us down the path of curbing global warming and cleaning up smog that blankets too many cities." Toyota's hybrid Prius is powered by an internal combustion engine paired with an electric motor. The vehicle can be refueled at any conventional gas station, and is able to achieve 50 miles per gallon. The hybrid also meets California's strict Super Ultra Low Emission Vehicle (SULEV) air quality standards. Sierra Club said its Excellence in Environmental Engineering Award is generally presented to those products which make a substantially sound impact on the environment.

(SIERRA CLUB RELEASE: 4/19)

Japan Standardizes Hydrogen Intake Systems

Japan's Ministry of International Trade and Industry announced recently that the Japanese government hopes to encourage the manufacture and sale of fuel cell powered cars. The government plans to standardize hydrogen intake systems for fuel cells by FY 02. Officials hope to mandate a specific format for supplying hydrogen to fuel cells as opposed to the variety of means currently

being used. Companies such as DaimlerChrysler and General Motors are submitting data requested by the ministry on the performance of their prototypes. Sources said that the government will use the most effective means of hydrogen supply based upon fuel costs, durability and fuel economy. Hydrogen is thought to be an effective fuel for use with fuel cells. However, if the hydrogen is poured directly into the fuel cell, it may result in an explosion, said industry sources. Currently, several methods for filling fuel cells with hydrogen are employed including "pooling hydrogen into a special alloy that can be loaded to cars and installing a compact, removable device for chemically decomposing materials to generate hydrogen." By FY 05 the Japanese government plans to have hydrogen stations in operation. Furthermore, by 2010, it plans to have 2.2 million kilowatts of electricity generated by fuel cells.

(KYODO: 4/19)

Ovonic, Rare Earth Begin JV in China

Energy Conversion Devices, Inc. (ECD) recently announced that its subsidiary Ovonic Battery Company, Inc., has received government approvals and terms of letters of credit have been finalized for Ovonic's joint venture with Rare Earth High-Tech Company, a subsidiary of Baotou Steel Company of Inner Mongolia, China. ECD said the joint company, Rare-Earth-Ovonic Metal Hydride Company, will begin construction on its first production facility later this year. ECD said the total value of the equipment, license fees and services that will be provided for the nickel metal hydride (NiMH) battery joint venture will exceed \$100 million. Ovonic will supply production equipment for converting Rare Earth's mineral resources into value-added products. The company has also licensed advanced NiMH battery technology and will provide technical training, engineering services, installation support and its manufacturing "know-how" to Rare Earth. Under the joint venture, Ovonic will assist Rare Earth in producing hydrogen storage alloy powders, advanced nickel hydroxide materials and batteries. Rare Earth is the largest producer

of rare-earth elements in China and is a principal supplier of rare-earth raw materials to NiMH battery producers worldwide. (ECD RELEASE: 4/19)

Honda Increases Availability of Insight

Honda's hybrid electric vehicle, the Insight, is the first of its kind to be sold in the United States. The company recently announced plans to increase the availability of the vehicle by 50%. Increasing the availability of the Insight to 6,500 vehicles in 2000 is a reflection of the vehicle's popularity. It went on sale in December with a sales goal of 4,000 in the year 2000. There are currently waiting lists due to high demand. "Consumer interest and demand has far exceeded our expectations," said American Honda executive vice president Tom Elliot. "Some buyers want to be the first on their block with the new hybrid technology. Others are looking to improve their fuel economy and make a positive impact on the environment." The two-seater coup is the most fuel efficient vehicle for sale in the U.S. Having won the Sierra Club's award for Excellence in Environmental Engineering, the Insight illustrates Honda's ongoing commitment to technological and environmental improvements, the company said. The Insight is able to achieve 61 mpg in city driving conditions and 70 mpg on the highway. Furthermore, the Insight meets California's strict vehicle emissions standards. The vehicle has a three-cylinder, one-liter engine and a ultra-thin electric motor that is powered by a nickel metal hydride battery pack. An integrated Motor Assist system automatically recharges the battery pack using energy generated during braking. (HONDA RELEASE: 4/17)

Modeling, Simulation Tools Spur HEV Designs

Engineers looking to create the next generation of environmentally sound vehicles have developed groundbreaking HEV computer modeling and simulation tools that are setting the standard for HEV design.

For example, the National Renewable Energy Laboratory (NREL) has developed the Advanced Vehicle Simulator (Advisor) and the Southwest Research Institute (SwRI) has developed the Partnership for a New Generation of Vehicles (PNGV) Analysis Toolkit. NREL's Advisor program displays the basic characteristics for both parallel and series powertrain configurations for HEVs. Advisor is able to model all HEV components and monitor their interaction and response. The program generates performance data for researchers, working backwards from the desired outputs to the component choices and configurations. In addition, Advisor uses different standard and custom driving cycles, such as the Federal Urban Driving Schedule and the Federal Highway Driving Schedule. The PNGV Analysis Toolkit includes a compilation of modular component libraries of engines, vehicles, mechanical couplings, driveline components, energy storage devices and a number of other essential HEV subsystems. The Toolkit allows researchers to design, test and prove their HEV designs without hardware prototypes. (ELECTRONIC ENGINEERING TIMES: 4/14)

Australia to Launch Hybrid EV

Australia will soon unveil a new hybrid electric vehicle, the aXcessaustralia, which is intended to cut fuel costs in half and bring about a 90% reduction in auto emissions. More than 80 Australian component manufacturers contributed to the making of the car, which operates on an electric motor charged by a fuel-efficient engine. "The low-emission vehicle project builds on the success of the first aXcessaustralia car unveiled to the world in 1998," said David Lamb, director of the Commonwealth Science and Industry Research Organization's (CSIRO) Australian Automotive Technology Center. The engine, developed by Australia's CMC Power Systems, is capable of powering the generator during hard acceleration. Otherwise, it runs minimally during vehicle operation. The car can also be charged overnight. In addition, the car is equipped with driver-seat and steer-

ing wheel sensors that warn the driver when the vehicle is being operated dangerously. The aXcessaustralia is set for debut in June. (AUSTRALIA REPORT: APRIL 2000)

Ford to Sell Hybrid SUV by 2003

Ford recently announced it will begin selling a gasoline-electric hybrid version of its Escape sport-utility (SUV) vehicle by 2003. The company said the Escape will be the first hybrid SUV to be produced by a U.S. auto manufacturer and the largest hybrid to go into production. Ford said its hybrid Escape will get nearly 40 miles per gallon under city driving conditions. The vehicle will pair a four-cylinder gasoline engine with an electric motor. The internal combustion engine will shut off when the vehicle is halted or idling, and can be restarted almost instantly by the electric motor. "This will be the most fuel efficient, cleanest SUV on the planet," said Escape project management supervisor Rick Eagle. "It's Ford's commitment to bring this technology to the heart of the American market through a vehicle that has mass customer appeal." The Escape hybrid reportedly will meet California's Super Low Emission Vehicle (SULEV) standards. Ford said the Escape will perform similarly to the conventionally powered V6 model Escape that will debut later this year. The hybrid Escapes will be manufactured at Ford's Kansas City, MO, plant. Ford will also sell the hybrid Escape in Europe under the Maverick name plate. (AP: 4/7)

Budget's Cars Not Affected By High Gas Prices

While many rental car companies are nervously awaiting the summer driving season with gasoline prices hovering around \$2 per gallon, Budget EV Rental Cars says it has managed to avoid the issue of rising gasoline prices altogether. The company recently added a Honda Insight HEV to its fleet at Los Angeles International Airport (LAX). Budget EV Rental Cars, a joint venture between EV Rental Cars and Budget Rent a Car, first began offering EV rentals in 1998. "The greatest advantage of

the Honda Insight is that it can travel from 600 to 700 miles on a single tank, and it never requires recharging from an outside source," said EV Rental Car president Jeff Pink. Budget EV Rental said it currently has a fleet of six Honda Insight coupes and plans to add another 40 to 50 over the next year. The company now offers an extensive range of environmentally sound vehicles, including Ford Ranger EVs, General Motors's EV1 and the Toyota RAV4-EV. The company said it was recently selected for a clean air award by the Coalition for Clean Air, an nonprofit organization dedicated to improving air quality in California. The award recognized Budget EV Rental for its efforts to introduce zero emission vehicles to the mass market. (BUDGET RELEASE: 4/5)

Nissan's Electric Hypermini Showcased in U.S.

Nissan Motor Company recently debuted its award-winning Hypermini EV during the 2000 Future Car Congress in Arlington, VA. The event was sponsored by the Department of Energy. Nissan said its Hypermini is a two-seater EV marketed as a commuter car. It was the recipient of New Energy Foundation's New Energy Grand Prize for its driving performance and for Nissan's ability to successfully market the car to the public. When tested in Japan, the Hypermini had a range of more than 70 miles and a top speed of 62 mph during one single battery charge. The Hypermini comes with a lightweight, aluminum spaceframe, neodymium magnet synchronous traction motor, and lithium ion batteries. By using a 200-volt alternating current charger, the vehicle can be recharged in four hours. In addition to the Hypermini, Nissan showcased its Tino hybrid EV with its Neo hybrid electric powertrain system. Introduced to the Japanese market in March, the Tino HEV is a tall wagon with a short body. During its U.S. debut, the Tino was equipped with Nissan's Neo hybrid electric powertrain system, which combines a gasoline engine with an electric traction motor. (NISSAN RELEASE: 4/3)

NEC Develops New Battery Chemistry

Tokyo-based NEC Corporation recently announced that it is developing a "maintenance-free" proton polymer electrochemical battery. The company said its new battery will compare to lead batteries in energy density, but will feature a current charge 20 times greater than lead acid batteries. The NEC battery is slated for release in October and is expected to rival the double-layer capacitor battery, another form of electrochemical power source. NEC said electrochemical batteries are favored by companies in the telecommunications and the electric and fuel cell automobile industries because the batteries deliver high power, long life cycles, and do not require charging. However, electrochemical batteries typically have a lower energy density than lithium ion or nickel metal hydride batteries. The company is currently working to circumvent this obstacle by using a polymer-based electrode paired with sulfuric acid, which relies on protons to transfer electrons. Thus, the proton polymer battery is able to deliver 10 times the energy density of double-layer capacitors, which makes it competitive with lead batteries. According to NEC, its electrochemical battery is recharged quickly through its proton carriers, which allows for long life and extended use. In addition, the batteries are environmentally friendly since they use carbon, hydrogen, and nitrogen, rather than metals or halogens. (ELECTRONIC ENGINEERING TIMES: 4/3)

"Green" Cars Can Use HOV Lanes

EV owners in California will no longer need passengers to use High Occupancy Vehicle (HOV) lanes. Thanks to a recent state law, all-electric, natural gas, or hybrid vehicles will be allowed to use the HOV lanes beginning this summer. State officials say car pool lanes are seldom used and they hope the new HOV law will be an impetus for drivers to purchase "green"

cars. For example, the 23-mile commute from Pomona to downtown Los Angeles along Interstate 10 can take an average of 48 minutes. In a "green" car, that same commute traveled in the HOV lane would be cut in half. Interstate 405, which runs through Los Angeles and Orange County, experiences even greater congestion, while the HOV lanes are often empty. Currently, Californians have their choice of five EVs, and by 2003, 10% of all new car purchases in California must be zero-emission vehicles, according to a 1994 ruling by the California Air Resources Board (CARB). CARB predicts that fewer than 10,000 EVs will use the HOV lanes during the first year of the new state law.

(WASHINGTON TIMES: 3/27)

Canadian Demonstration Programs for Th!nk City

Ford of Canada recently introduced its Th!nk "City" electric car. The City is a zero-emission, battery-powered vehicle and is part of Ford's line of environmentally sound vehicles. Ford said it would like to bring up to 50 of the City cars to Canada over the next two years via demonstration programs. Furthermore, the company recently introduced the Th!nk City to partners of the Montreal 2000 Electric Vehicle project. Officials with the initiative expect that Ford will import 700 of the City cars for use in North American demonstration programs. Last year Ford of Canada became the first automaker in Canada to begin selling EVs. Several Quebec customers including Hydro-Quebec and the city of Montreal bought a total of 16 Ford Ranger EV production models. The City is a two-seater with a single charge range of 85 kilometers. Its top speed is 90 kilometers per hour and it can go from zero to 50 kilometers per hour in seven seconds. The vehicle is powered by a liquid cooled three phase alternating current induction motor. The power comes from 19 nickel cadmium (NiCad) batteries. The majority of the vehicle is recyclable including its batteries and its body panels, which are made from thermoplastic.

(CNW: 3/30)

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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

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

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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.. 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

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
Snail mail:
EAA/Current Events
2701 Monarch St.
Hanger 20, Suite 142
Alameda, CA 94501

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

1980 Dodge Jet 007 Omni Hatchback Electric Car. 2dr 4 passenger with foldown rear seat. 120 volt with 20 Trojan batteries. 4 speed, PMC Controller, Invicta tires. White with blue interior. All original gauges work for electric indicators. \$3,500.00 (415) 388-0838

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

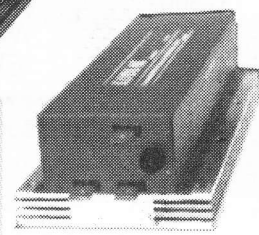
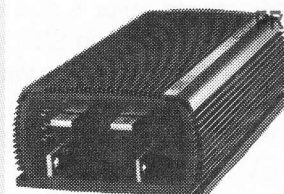
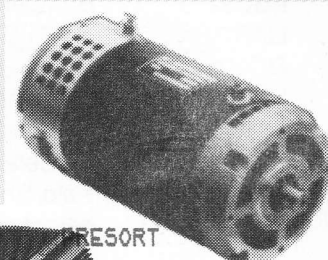
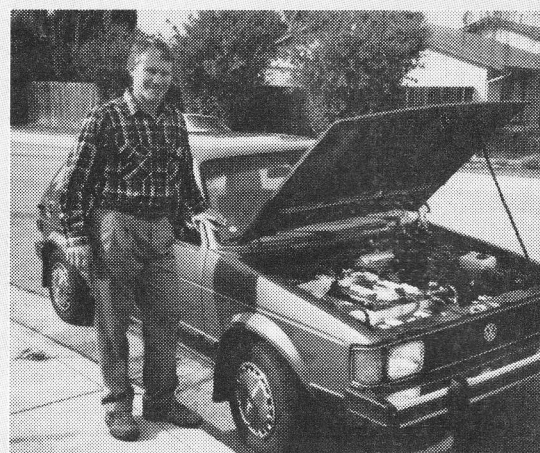
ELECTRIC VEHICLE

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
- ◆ CURTIS-PMC Motor Controllers from 24 V/175 A to 144 V/500 A
- ◆ AUBURN SCIENTIFIC Motor Controllers, 72-144 V/600 A to 192 V/700 A
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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
- ◆ BYCAN Battery Chargers for 48, 120-132-144 V
- ◆ 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
- ◆ Complete ELECTRATHON Drive & Instrument. Pkg.
- ◆ The latest in EV publications with a growing lineup of videos
- ◆ Project Consulting/Engineering Design
- ◆ 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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● Time Dated Material - Please Do Not Hold ●