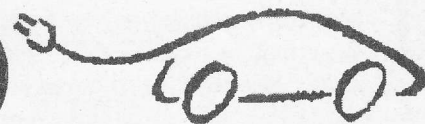


CURRENT EVENTS



Promoting the use of electric vehicles since 1967

February '97 Vol. 29 No. 2

APS Fiesta of Lights

BY KATHY WATSON

The Phoenix Electric Auto Association participated in the 9th annual APS Fiesta of Lights Parade that rolled silently down Central Avenue in Phoenix, Arizona at night on December 7th. This was Phoenix EAA's 5th appearance in the parade. Gene Cosmano led the procession of electric vehicles decked out in hundreds of miniature Christmas lights.

Mascot Keeps Going...

Our mascot was the ever-popular EverReady "Energizer Bunny," who keeps going and going. Since this was the Energizer Bunny's first time in this annual parade, we worried if he'd be able to keep strutting along the fast-paced 3-miles through downtown Phoenix. But it's true....."it keeps going and going..." Our thanks to "George" for being such a good sport with those heavy pink bunny feet! The audience and the kids, especially, got a kick out of hearing the bunny drums coming down the parade route.

Representatives from EverReady felt that the TV coverage and the EV-opportunity was fantastic. So much so, that next year they hope to do it up big for 1997 with the Phoenix EAA.

The media reported that an expected turnout of 350,000 attended the APS Festival of Lights parade and an estimated 50,000 watched it on television. —KW



Announcing the Corbin Sparrow

It is estimated that 87% of the population of the United States commutes less than 18 miles to work and back daily. The vast majority of these commuters do so alone! Not only does this practice create gridlock on America's freeways, it is also polluting the very air we breathe and the environment that our children will inherit. 68% of all inner city pollution is caused by motor vehicles. Every American recognizes this problem, but very few can offer any type of solution.

Currently new electric vehicles (EVs) are well above the price range of the average citizen. Few people have the budget to invest in an EV and those that do generally are not your everyday commuters. Additionally, freeways remain overcrowded, city parking is still very limited and mass transportation is limited by the cars that can park near their terminals. To aggravate the situation, most Americans require the convenience of having a vehicle at their disposal during working hours and their offices are not near a mass transit terminal.

The Solution

Inventor/Designer Mike Corbin has a solution. "The Sparrow is a niche vehicle its designed specifically for commuters. We're not trying to replace the family car" says Corbin, who is the largest aftermarket motorcycle seat manufacturer in the world and holder of twenty-five US patents.

continued on page 15

This issue is an example of the fact that the best laid plans of rodents, humans, and editors oft get screwed up. Feb. '97 was supposed to be Tech Focus on Regen #2, but since I didn't get quite enough contributions to fill a second issue, it isn't. However, I did get to attend the North American Electric Vehicle and Infrastructure Conference in San Diego. It was quite an EV Feast and this issue has some of the choicer morsels. The APS Festival article adds to the Lighter side and with the EVerReady Bunny on the cover... This one's for fun — enjoy!

1 APS Festival of Lights - Phoenix EAA's Gene Cosmano and the drumming bunny help to make the spirit right. Shortie but sweetie by Kathy Watson

4 OK, we jump right into tech specs, but they're good tech specs and a neat little commute-mobile. Unique Mobility of Colorado and Pinninfarina of Italy have created the NiMH-powered Ethos 3. For an actual article on the Ethos, see News in Brief, p. 19.

6 How to spread the word about EAA to the people who matter - the auto editors of your local newspaper. Don Gillis, San Jose EAA

8 Who's in charge here? You are, with the help of this tech article from Phoenix EAA and Jim Piper. What to look for or put in a good charger.

10 0-60 in 4.9 sec? They call it T-Zero. "They" is AC Propulsion. "It" is a little bundle of trouble. 'Nuff said.

12 NAEVI Ride and Drive. "It was ground-level flight complete with G-force..." Your editor gets to play with the EV1 and the AC Propulsion Honda. EV1 pix by Stan Skokan.

15 Solectria - The On-Road Experience. Whose cars have racked up 2 million customer miles and are now being sold through a Chevrolet dealership? My notes on a NAEVI presentation by Mark Dockser, Solectria Co.

16 EV Truckers, this one's for you. Ford announces their 1998 Ranger EV with an AC drivetrain. Skokan-supplied pix, editor-supplied remarks. (If you can't wait 'til '98, EcoElectric has their Desert Lightning....).

PHOTO CREDIT - PAGE 1

Made in the shades - Gene Comano and his EV and the Ever Ready Energizer Bunny march in the Dec. 7th APS Festival of Lights.

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Article Submissions

The deadline for articles is the 25th of each 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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Membership/Address Changes

For information on new membership or change of address, please send your requests to:

EAA Membership
2710 St. Giles Lane
Mountain View, CA 94040

Ethos3

Vehicle type - Four-passenger hatchback sedan, styled as soft aerodynamic cube. Though designed on a restricted rectangular base, it is wide and tall enough to provide capacity and comfort. Styling accentuates the wedge-like shape. Expansive window area for best visibility.

Dimensions and Weights

Length	3,365 mm (132")
Width	1,660 mm (66.5")
Height	1,470 mm (57.9")
Wheelbase:	2,300 mm (90.5")
Front track	1,556 mm (61.3")
Rear track	1,430 mm (56.3")
Tires	165/60 R15
Wheel rims	15" 5.5
Curb weight	1,180 kg (2,600 lb.)
Weight distribution	53% front, 47% rear Cd = .31
Access	Four doors open to 80 degrees, tailgate splits into two parts, which simplifies loading in tight quarters.
Seating	Passenger, driver, 50/50 split seat-backs in rear.
Frame	Welded aluminum extrusions, total weight, 90 kg (198.5 lb.). This space frame forms a sturdy cage for occupant protection. Doors have impact beams.
Airbag	driver's side.
Body	Material for demo vehicle, - Fiberglass, Larit T30

Power System

Front-mounted Unique Mobility (UQM) PowerPhase system- state of the art in torque-based traction control. One of the most compact energy efficient EV systems available. Motor: UQM SR218H 53 KW (72 hp) very high efficiency brushless dc permanent magnet motor which provides continuous torque of 150 N-m.

Max. Power output: Continuous - 32KW (43 hp)

Intermittent - 53 kw

Max. torque 240 N-M (177 ft-lb.)

Max. rpm 8000

Efficiency 92% % 53 KW and 5000 rpm

Motor weight 47 kg (105 lb.)

Motor + gearbox + differential 92 kg (203 lb.)

Transmission

Drive Front-wheel

Gears 6.8/1 fixed ratio single stage

Selections: Forward and reverse speed plus neutral with electronic speed control. pawl-type mechanical.

Parking brake Mechanical

Differential UQM CR40-300. 400 V 300 amp inverter using 3 half-bridge IGBT power switching modules with digital microprocessor control. Software provides smooth quick acceleration with



Cute scoot. It is and it does.

Energy Storage System

phase advance control for extended power and full regenerative braking for extended range.

26 Ovonic NiMH 12 V batteries, providing twice the capacity and distance as lead-acids of the same weight. These batteries are characterized by high power, long cycle life, no memory effect and no maintenance and are totally recyclable.

Single unit weight 16.5 kg (36.4 lb.)

Pack weight 430 kg (945 lb.)

Pack configuration: 312 V DC, 85 a-hr.

Specific energy 70 Whrs/kg

Specific power 220 Whr/kg

Suspension Front - McPherson type with telescoping arms and coil springs.

Rear- Interconnected trailing arms.

Steering rack and pinion, no power assist.

Braking incorporates full regenerative capability supplemented by front disks and rear drums.

Battery Location Batteries are housed in 3 compartments, two under the front seats, one under the rear cargo area.

Performance

Max. speed 125.9 km/h (78.3 mph)

Acceleration 0-96 km/h (0-60 mph) 11.2 sec

Acceleration 0-48 km/h (0-30 mph) 3.2 sec

Max. range 241 km at 72.4 km/h (150 miles at 45 mph) 206 km at 80.5 km/h (128 miles at 50 mph)

Max. gradability Continuous - 21.4%

Intermittent 35.5% at 40 km/h (25 mph)

In USA, contact: Unique Mobility, Inc. tel. 303-278-2002, fax 303-278-7007 Internet lgilman@uqm.com (Golden, CO) Pininfarina of North America, tel. 810-619-1790, fax 810-619-1791. Internet wlpr@prodigy.com (Troy, MI)

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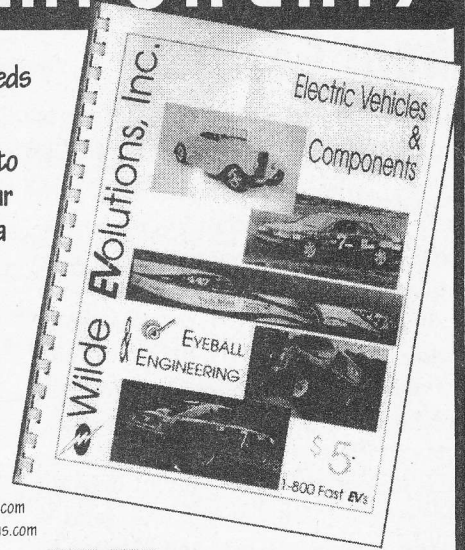
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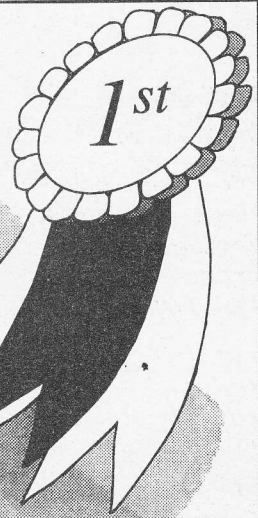
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You Can Help Let People Learn About EAA

BY DON GILLIS, SAN JOSE CHAPTER

In the letter below I made contact with our local Automotive Editor to let him know that the EAA should be used as an EV resource. Use my letter as a template and write one of your own. If you do, send me a copy (at the address below) so we can keep a listing of who we have contacted. Maybe the National EAA can establish regular communication with these writers. Another alternative is to send the name and address for your editor to me and I will send a generic version of this same letter to your editor. Tony Cygan suggested putting the same information into a "letter to the editor" for direct printing on the Opinion page. Help spread the word!

FOLLOWUP LETTER

Dear Auto Editor;

I see you listed the EAA in your Car Club issue today. Thanks. I look forward to more contact between us (you and the EAA) as more of the big auto producers bring their cars to market. One day it would be nice refer to this group as PIONEERS and not a bunch of fanatics.

Sincerely,
Don Gillis

5820 Herma St San Jose
95123-3410
(408) 225-5446
fax (408) 578-7664
don.gillis@sjpc.org

Date

Your Local News

Attention: Name of Editor

Street Address

City, State, Zip

Dear Auto Editor:

I really enjoyed your article on the GM EV1 and improving battery technology. We have actually come a long way since we met long ago at a San Jose chapter meeting. In future articles it would be nice if you could let your readers know there is a nonprofit educational organization out there to help inform the public. A sidebar might read something like:

Find Electric Vehicle Support with the EAA

Even though the EV is new technology to most of us, there is a very dedicated group of EV enthusiasts already out there with real-world experience; the Electric Auto Association. To those of us just learning about Evs, EAA members are a major resource. In 1997 they are celebrating 30 years as a nonprofit educational organization. The group was founded here in San Jose. Those who are interested in this new vehicle technology could learn from this group. They publish a monthly national newsletter. There are 9 local EAA chapters in California, five are in the Bay Area alone. Contact them at the National 1-800-537-2882 number. EAA is also accessible through the Internet.

Check them out at <http://www.calweb.com/~tonyc/ea.html>.

Please put the information below into your December, Drive Section on Car Clubs.

EAA - San Jose Chapter

Address: 1592 Jacob Ave. San Jose 95118

Contacts: Roy Paulson 408 269-7937

Mike Thompson m.t.thompson@ieee.org

Meetings: 10am to 12 noon, Second Saturday of the month
(call to confirm)

Reid Hillview Airport, Terminal Building

Events: EV information, EV Displays and local promotion

Let me know if I can help.

Sincerely,

Don Gillis, 5820 Herma St., San Jose, CA, 95123-3410
(408) 225-5446 (tel) fax (408) 578-7664

From gillis@VNET.IBM.COM

Wed Dec 4 16:14:50 1996

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Phoenix Chapter Tech Report, Part 3

BY JIM PIPER AND PHOENIX EAA

This paper is designed to help you decide on the proper commercial charger. If you are technically capable of designing your own charger, it will provide a list of desirable features to include in your design.

Once we know our pack voltage and battery type, we can consider the charger. A good charger can increase battery life and provide charging at the lowest utility electrical rate. It will also provide the fastest charge for the current and voltage rating of the ac supply line.

What to Look For

An excellent charger will have the following characteristics:

- ☛ Unity power factor
- ☛ Start of charge timer
- ☛ Connection to utility-controlled demand regulation systems
- ☛ Charging individual battery blocks
- ☛ Sensing individual battery block temperatures.
- ☛ Sufficient dc voltage times current (VA) rating to theoretically charge the pack in four hours or less
- ☛ Programmable charging characteristics
- ☛ Protection against both battery and ac electrical faults.

Compact and Light Weight

Very few of the chargers available today meet the above ideal. The possible exception is the GM charger for the EV1. The anticipated price is \$5,000. The inclusion of all of the items on the above list may be why.

Unity Power Factor:

New regulations give the electrical utilities the ability to demand unity power factor from large loads such as EV chargers. Another benefit of unity power factor is that the charger uses the full capacity of the power line. Power factor is the ratio of useful power out to

Charging with a 50% power factor charger takes double the power (and powerline capacity) as using a unity power factor charger.

volts times amps in. Unity is the theoretical maximum. (For a detailed discussion of power factor, see Lee Hart, "What is Power Factor?", *Current EVents*, August 1996, vol. 28, #8.)

Some old transformer/rectifier type chargers have power factors of less than 50%. That low power factor means that it is only using half of the ac power line's capability. In other words, charging with a 50% power factor charger takes double the power (and powerline capacity) as using a unity power factor charger. Less-than-unity power factor can cause other appliances on the same line (such as air-conditioners) to be less efficient.

Start of Charge Timer

A start-of-charge timer allows an EV owner to get the lowest off-peak charging rates. The car can be plugged in but the charger automatically delays start-up until the off-peak rate period begins.

Connection to Demand Control System

Some utilities may bill at a higher level for peak energy use over a given period. In these instances, the utility installs demand controllers. These devices reduce grid power demand by commanding or rotating large loads off when there are other critical demands and bringing them back on when demand is sufficiently reduced. In the future, such systems may prevent large loads such as EV charging from overloading the capacity of the power lines into the house. Power companies may require that they be able to remotely control EV chargers in exchange for the lowest electricity rate. This may be done to keep electrical demand from exceeding the utility supply at the start of the low rate period.

Charging each battery block individually

The term "battery block" refers to an assembly of cells that are internally connected inside a single case. In most cases (but not all) this is the same unit as an individual battery. The most popular voltages for EVs are 6V and 12V [Some are using 8V batteries. —CB]

Future batteries will be sealed or valve-regulated. You cannot add electrolyte or water if any is lost due to overheating or overcharging.

Most batteries fail gradually by developing internal high-resistance short circuits. Material shed from the plates gradually fills the bottom cavity of the battery. Because of its composition and its loose packing, this shed material is only slightly conductive. Eventually, it forms a high-resistance short across the plates. High-resistance shorts are also due to long thin crystals (dendrites) that grow through the separators.

These weakened cells slowly discharge internally. They also are slower to charge. Charging all cells with the same current will overcharge healthy cells, boiling and gassing them while attempting to bring up the lowest ones.

Monitoring and separately charging every cell would be ideal, but you'd end up with a huge cable bundle. An effective compromise is to only monitor the blocks. In addition, individually charging each block uses charging energy more efficiently, without wasting it in evaporating water out of healthy battery blocks.

Sensing the temperature of each battery block

Temperature sensing prevents battery blocks from being damaged by overheating. Some battery designs have rather low maximum temperature char-

acteristics. One manufacturer limits the battery block temperature to 50(C (122(F). This is not too far above ambient temperatures in Phoenix, Arizona. Temperatures in excess of this limit, even once, can reduce the life of the battery block. I believe that the failure mode in this instance is a permanent distortion of the battery block case.

VA Rating

The charger's VA rating is the maximum continuous output power determined by multiplying Volts times Amps. This is not the same as the input power VA rating. The difference is usually related to power factor and charger efficiency.

The charger may require remote regulation to prevent overloading the power grid or household wiring. Most batteries have to be topped off slowly, therefore they need a high charge rate needed early in the charging cycle. The charger should theoretically be able to recharge the car in three to four hours. Remote utility regulation of the charger may limit charge time to less than eight hours.

Programmable Charging Characteristics

To build a charger with the previously described characteristics will be expensive. Future battery technologies, however, may require different charging modes.

With so much invested, we should protect the charger hardware against obsolescence by making it "smart" or programmable.

One potential future technology is lithium-ion. These cells have the high-voltage characteristic of the lithium primary cells used in point-and-shoot Polaroid cameras. They also have a voltage that drops with state of charge in the same manner as lead acid. Presently, lithium-ion cells are constant-current charged until they reach a specific voltage, then constant-voltage charged at a slow rate. When the cell reaches the constant voltage portion of the charge cycle, it only contains 60 to 70 percent of a full charge. Completing the charge cycle

requires two to three hours. Battery researchers are attempting to reduce this time. When they determine an optimum charging profile, the battery's user can enter the details into a programmable charger. A really clever programmable unit will read the battery type and charge the vehicle accordingly.

Protection against Battery and AC Electrical Faults

This requirement seems obvious, however it has led to much debate at the APS Phoenix Electrics Race. Faulted batteries can supply tremendous currents that can overheat and rupture a battery or melt terminals and plates.. AC powerline input voltages and charger or battery DC output voltage can be fatal.

Remember, electrics came before gasoline. Gasoline was once considered too dangerous to have near the house. That is why the garage was behind most pre-1950's houses. During the 50's builders began attaching the garage to the house via a breezeway. By the 1960s, garages were directly attached.

In Phoenix, the carport was deemed sufficient to dissipate dangerous vapors while protecting the car. Again, attached garages didn't appear generally in Phoenix until the 70's. Now critics are demanding additional regulations for electric cars.

When the electric was dominant, gasoline was considered too dangerous to have near the house.

Isn't it ironic that some critics now consider the electrics to be too dangerous to charge in an existing garage?

Compact and Light

A heavy onboard charger loads and slows an EV. There is no excuse for building massive chargers now that today's advanced charging circuits can incorporate high frequency transformers and switching semiconductors.

Even an off-board unit needn't be a "boat-anchor. High frequency transformers can be much smaller than similarly-rated 60 Hz transformers. Using them results in a compact lightweight charger with little weight penalty when installed in car. These units are ideal

onboard "opportunity" chargers. Overnight trips to Grandma's house may become even more practical in electric vehicles, even if Grandma lives over 50 miles away.

A charger's design affects its cost. It also affects the day-to-day cost of charging the vehicle, the installation cost of supplying ac power, and the charger hardware cost. If a charger can accommodate future battery technologies, it won't need to be replaced or upgraded when these technologies arrive.—JP

Clarification to "High School Racers"

Tom Convey, who now works for EVTC, asked me to print the following clarification to the "EVs for Phoenix High-School Racers" article in the Dec. 96 CE.

The article might have inadvertently suggested that the APS Phoenix High School rules had been changed. They haven't. The rules still limit the High School class to 96V. All rules that applied last year are also still in force.

Bill Piper and the Phoenix chapter did a wonderful job of the technical report and I'm glad to have been able to print it. This glitch was minor and is the editor's responsibility.

By the way, Tom was very enthusiastic about the article and the fact that CE managed to run it sufficiently early to help teams building cars. National also sent 100 copies of the issue to Jesse James, who is mailing them out to schools. Thanks JJ!
—CBch

Also posted to EV Discussion list
(EV@sjsuvm1.sjsu.edu)

AC Propulsion Launches 4.9 sec EV

What could beat the tire-smoking AC Propulsion Honda off the line? Nothing, except another creation from the high-horse-power wizards in San Dimas. Having turned from the pursuit of efficiency to the generation of g-forces, they have designed a new sportscar that aims AC Propulsion's technology at the go-fast gang.

Having badgered ACP for years about putting the CRX into SCCA autocross competition, I was delighted to hear about plans for a purpose-built electric roadster. They call it T-Zero, a title that immediately suggests the esthetics of applied physics and the excitement of a Saturn-5 liftoff.

Gogglin' Motor Heads

T-zero and counting, but the thing's already off the line and at the other end of the drag track before the announcer's voicebox has finished vibrating. 4.9 seconds, folks, is (pardon my French) friggin' flamin' fast. GM's EV1 awed motor-heads with its 7-8 second 0-60; ACP's little fireball is going to leave 'em gogglin'.

Alan, you'd better have manufacturing facilities in place, because if you put this little bundle of trouble on an SCCA Solo 2 track (and it performs as advertised), you are not only going to be mobbed, you are going to be submerged. Witness the major attitude adjustment that Bob Schneeveis performs each time his SnoWhite rips up the autocross track. The only reason there aren't more SnoWhites around is that Bob's a prototyper, not a build shop. Tee-Zero sounds like it's actually manufacturable. If you beat 'em, they'll buy it or what wins on Sunday sells on Monday. Vision of the future, a massive proliferation of really radical red road rockets.

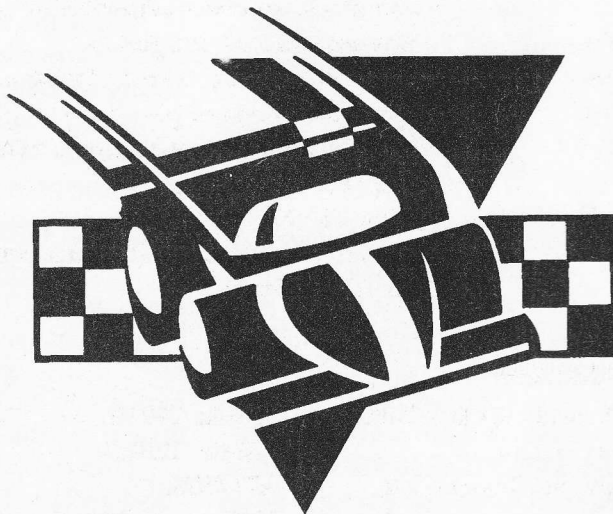
OK, Earth to Clare, time for splashdown. What's really in this package? Well, for one thing, ACP's established reputation in high performance. Another is their appreciation that weight makes a difference, especially chassis weight. 1210 lb. of Tee-Z's 2400 LB weight is batteries, more than the optimal 50%. Car weight is only 1190, and a major portion of that is 165 kW or 220 hp light-em-up drivetrain. It all goes to the wheels; no clutch, or energy-eating torque converter. This scat-cat is low, too, the 41 inches in height is to the top of the rollbar. She looks slippery too and ACP knows their aerodynamics, so she probably is.

OK, totting it all up, we have lightness, axle-twisting torque, stomach-wrenching power, low frontal area, low Cd, a good split of weight distribution front and rear, a suspension done right and...oh my, oh my, oh my...

At the risk of offending a certain E-Porsche, drool, drool, drool.

Okay, okay. keep the saliva off the copy and make sure the Thirteen'er isn't sulking (all I want for Christmas next year is an ACP drivetrain she says).

1210 lb. of Tee-Z's 2400 LB weight is batteries, more than the optimal 50%. Car weight is only 1190, and a major portion of that is 165 kW or 220 hp light-em-up drivetrain.



Vehicle

High-performance mid-engine, rear-wheel drive, 2-seat battery-powered electric roadster

Drive system:	
Motor type	Air-cooled AC induction design, 12,000 RPM
Torque	244 N-m / 180 ft-lb. (0-5000 rpm)
Power	165 KW/220 hp (6000-12000 rpm)
Motor controller	Air-cooled, voltage-fed IGBT
Charger	Integrated with controller, 20 KW max. output, GFI compatible, unity power factor
Battery	28 OPTIMA spiral-wound, lead-acid, 45-amp/hr modules, 336 V nominal voltage
Transmission	Direct drive, fixed ratio, no clutch or torque converter.

Performance

0-60 mph	4.9 sec
Top speed (governed)	140 km/hr 87 mph
Range	100-160 km 60-100 mi
Charge	1 hr @ 240V 80 A
(from 100% discharge)	3 hrs @ 240V, 30A

Chassis

Frame	Tubular steel space frame with integrated battery mounting at side and rear
Body	Glass-reinforced plastic, design based on Sportech by Piontek Engineering
Suspension	Front and rear, short and long A-arms with adjustable coil-over shock absorbers, adjustable sway-bars
Steering	Non-assisted rack and pinion
Brakes	Front: 280 mm dia., vented aluminum MMC rotor with 4-piston aluminum caliper. Rear: 280 mm dia. cast iron rotor with 1-piston iron caliper, integrated handbrake
Wheels	Alloy, 15 X 6.5"
Tires	Toyo Proxes FZ4, special EV compound, P195/50 R15 front, P205/55 R15 rear.

Dimensions

Curb weight (include battery)	1090 kg 2400 lb.
Battery weight	550 kg 1210 lb.
Weight distribution, F/R	47%/53%
Wheelbase	2235 mm 88 inches
Length	3810 mm 150 inches
Width	1625 mm 64 inches
Height (to rollbar)	1040 mm 41 inches

Book Review

Continued from page 3

Michael has learned from his 20 plus years of experience.

The chapter on conversions includes a walk-through of a Honda CRX conversion. The scratchbuilt chapter has photos of many innovative vehicles, some quite practical, others purely experimental.

Chapters 7 and 8, "Inside the Electric Vehicle" and "Find, Fit, Use and Maintain", need to be read as a pair. This will give the reader a good background on the various parts within an electric vehicle.

The reader will also learn why they would choose one part over another, such as a DC motor vs. an AC motor, or the type of battery pack wiring to use. One item lacking attention is the topic of low rolling resistance tires. There's a short section on rolling resistance early on in the book, but no mention of manufacturers that make these tires, just that they exist.

An interesting topic discussed is the "High State of Charge Bypass Charging" module, which looks like a forerunner of the "battery regulators" that have been getting lots of attention on the Internet's EV mailing list lately (see below).

One thing the reader will immediately notice is the use of boxes for Editorials, Techtalks and Application notes. As a relative newcomer to the world of electric vehicles, I found myself getting distracted by having to flip to the referenced box when, in many cases, the main text could have easily included the boxed information. In other places, it seemed appropriate to break the information out for reference from several places.

The recent date of the book's publication gives the reader an idea of how fast the field is starting to change. There's no mention of sealed batteries like the Optima YellowTop,

Continued on page 15



NAEVI Ride and Drive

The first car I wanted to try was the GM EV1, though I also had my eye on a little white Honda with a leafy vine painted on the back - the AC Propulsion CRX. As before, I got on the waiting list, but the wait was less than an hour. The Queen was as I remembered her from EVS-12, serene, sleek, perhaps a little re-styled in the front. Seating was space-age and very comfy. The car was ridiculously easy to drive — 1111 entered into the center console bought her alive and we glided out of the parking slot and though the Sheraton's parking area. Even at ambling speed, I felt the resources of power there — this car wanted to go.

On the shore road running past the conference hotel I tested the regen braking, then...

It was ground-level flight complete with G-force. Acceleration was instant and powerful, providing a definite shove-back in the seat. Handling was quick but sure, although this wasn't an autocross track, not a skidpad, even though a recent rain had wet the pavement. I also decided that the appropri-

With the power surge came an instant rush of desire to put an EV1 into SCCA Solo 2. Feeling the techno-performance of this PC-on-wheels makes me want to take her out a twisty track and gently, quietly, blow the doors off everything in sight.

ately-named Goodyear Momentum low-rolling resistance tires probably would not appreciate being treated like Yokohama 008s (Rumor has it that that 205 radials of the right size will fit, should you desire more fun that standard equipment allows.)

With the power surge came an instant rush of desire to put an EV1 into SCCA Solo 2. Feeling the techno-performance of this PC-on-wheels makes me want to take her out a twisty track and gently, quietly, blow the doors off everything in sight.

What wins on Sunday sells on Monday — GM please take note.

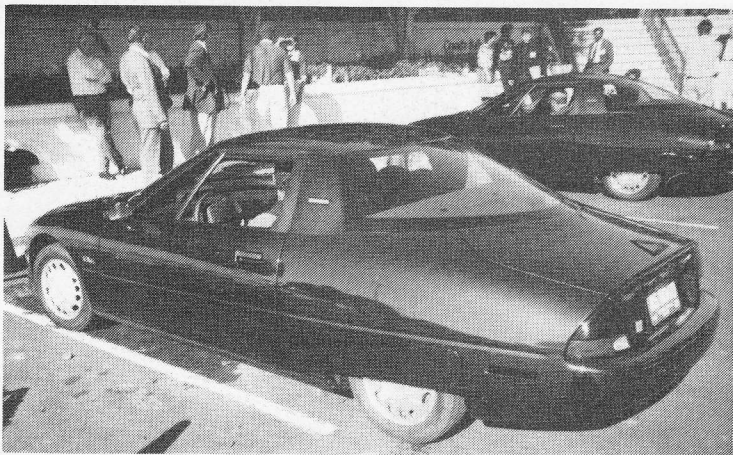
There are sufficient displays and gadgets to please the most techno of

nerds, yet all are well-integrated and none are overbearing or overwhelming.

It was also neat to see the EV1 in quantity — 5 or 6 in the ride and drive plus 2-3 in the inside display booth. The cars came in silver, forest green and there were two very gorgeous red twin sisters. One might ask if the red paint adds another +5 mph to the speed (as it is said to do for many sportscars). The performance of these EV1s renders the question supremely superfluous.

Like the legendary VW bug and the Chrysler Neon, the EV1 is very "pettable", yet the car's styling goes far beyond cuteness. She is sweet, yet awesome and all we hoped she would be.

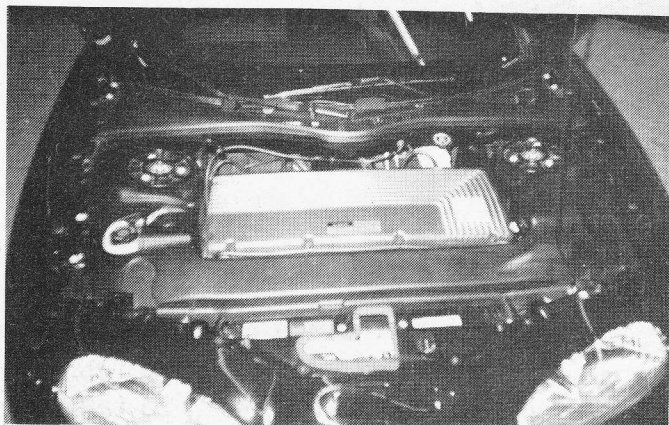
Since 1990, the EV world has been waiting. Welcome, EV1. —CB



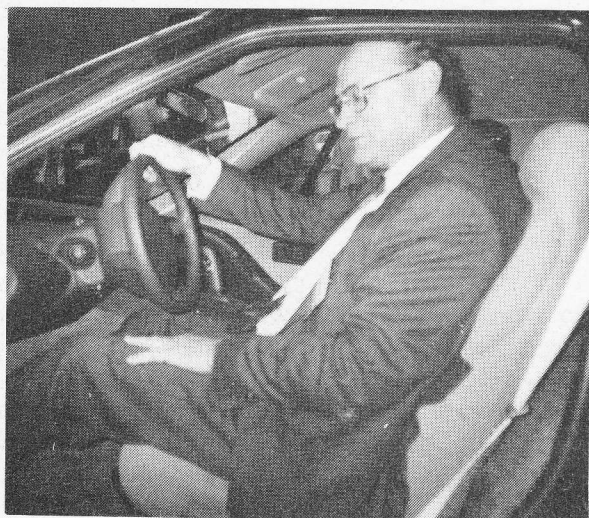
The tails of two pretties. Though that rear quarter-panel could use something to break up the expanse. Suggest a black stripe to make them look a little less... matronly?



Hustlin' to get a ride in the EV1.



The controller takes up most of the space under the hood.



Some folks had to squeeze a bit. (Stan Skokan is 6 ft 2") No joke about 10 ft Poles - he's Czech.



GM had this shower set up to demo their "chargin' in the rain while lickin' the paddle" capability. They didn't need it, since San Diego weather supplied the real thing. I thought at first that it was a portable car-wash rig (well, they were keeping the critters sparkly-clean).

Solectria - The On-Road Experience

NAEVI CONFERENCE SPEECH BY MARK DOCKSER, SOLECTRIA CO.

With vehicles in production since 1991 and the most EVs on the road in the US, Solectria is the corporate EV pioneer of the 1990s. 250 Solectria cars and trucks run on roads in 36 states and 9 countries, and have racked up 2 million EV miles. The composite-bodied Sunrise has already exceeded the Partnership for a New Generation of Vehicles goals for weight and distance with its 375 miles on one charge of its Ovonics NiMH batteries.

With its cars now available through a Chevrolet dealer in MA, Solectria continues to grow. As Dockser said (pun I am sure intended), a lot of Forces are converging.

Solectria has built its success on simple, reliable drive systems with technology available now. Their philosophy is reflected in their use of:

- Air cooling
- Modular design
- High reliability
- Moderate size pack
- Lower costs sooner
- Having cars available today

They design the cars to serve the 35-50 mile trip commute niche, making the most efficient use of the existing 110V infrastructure with power-factor corrected chargers. This 35-50 miles is reliable under almost every condition. In EVermont testing at -20 degrees, Solectria cars and trucks still delivered an average of 43 miles.

Solectria's Tri-position switch, with Economy, Medium and Hi performance lets the driver put a bit of spice in the commute if they wish, or, for those who get their kicks out of efficiency, provides the wherewithal to get the most out of every amp.

With the European-designed Sonnenshine 12V battery, Solectria finds that the pack has a life of 2-3 years with a replacement cost of \$1400. That may not be the ideal, but it is honest and workable.

For the future, they look to nickel-metal hydride. Already proven in the APS Electrics race-winning Solectria RS, NiMH Forces are getting 85 miles on the Federal Urban Driving Cycle.

E-10 Pickup

With all the hurrahs about Ford's 1998 Ranger and GM's S-10, let's not forget Solectria's E-10. This truck is in production now, using the expertise that Solectria has gained from its 2 million customer (not test) EV miles. At 4600 GVW, the E-10 carries a modest but useful 500 lb. payload. It has 220V offboard charging with emergency 110.

It's appeal as a sweet-running reliable little beast is substantiated by the rate of consumer satisfaction in a 20 vehicle test program. The E-10 rated an 8 out of possible 10 each month for two years. A friend of mine who had one for a week had a hard time giving it back. It gets 20,000 miles out of it's Sonnenshine batteries and needs only a annual gear-oil change and battery terminal inspection/tightening.

Solectria uses battery thermal management in both the E-10 and the Force. They don't neglect to warm the passengers either. With cabin pre-heat and a fuel-fired heater (this is one way to use fuel very efficiently), folks stay toasty and the efficient air conditioning system causes only a 20-30% drop in range.— MD and CB

NAEVI Ride and Drive ACP Honda CRX

I have been trying to wangle a drive in this little legend ever since I first saw its tire smoke waft across the Phoenix Raceway parking lot in 1993. Circumstances, however, have never cooperated. At NAEVI, thanks to ACP Rep Thomas Gage, they did, it did and I got to.

The Honda is even more falling-off-a-log easy to drive than the EV1 — There is not even a shift lever. Three lighted pushbuttons select forward, neutral and reverse.

Again came the glide through the parking lot, the exchange of tickets at the parking fee both and then we were out on the shore road in front of the hotel. With the car's incredible reputation I expected some nervous race-horse dancing at low speed, but there was not even a hint of a jerk; even on creep, it was silky.

Flooring it (as I had to) is the ultimate EVenture. ABS traction control prevented any wheelspin and the acceleration felt like it would go on forever. There is simply not enough road for this EV — you will run out of pavement (or guts) before you run out of power.

It zipped nicely around the end-of-route circle. I didn't try to break the rear wheels loose, since I didn't know how the car would handle, but there was enough adrenaline without (though a test track would have been most welcome). A measure of appeal for any car is how long you stay in it after the test drive. ACP probably would have to have resorted to a crowbar to lever me out had I sat any longer.

Good job, guys! — CB

Corbin

continued from page 1

Corbin is a man well qualified in this arena. In 1974, at the Bonneville Salt Flats, Mike set the land speed record for an electric powered vehicle at a round trip average of 165.367 mph with a top speed of 171.102 mph. In the same year, Corbin took First Place in the Mt. Washington Electric Vehicle Regatta by being the first person to climb the highest mountain on the East Coast with an EV...twice! Calling on all of his experience and the skills of some of the finest designers and engineers in the world, Corbin is ready to launch the "Sparrow". This car is an entirely new approach to providing a permanent solution. Designed specifically as a commuter vehicle, the Sparrow offers seating room for one (Personal Transit Module) and a range of 60 mph for 60 miles. Price is \$12,900. — Corbin Sparrow

TECH SPECS

Type	3 Wheeler, two in front, one at rear
Drive	Rear Wheel
Dimensions	Approx. 4' Wide x 8' Long
Seating	For single passenger
Cargo	Monocoque has room for briefcase and laptop computer. Rear hatch (production model) has room for 4 bags of groceries
Windows	Roll-down type
Gross vehicle wt.	990 lb.
Stability	Low center of gravity / Low roll center
Battery weight	540 lb.
Front suspension	Double "A" arm
Rear suspension	Single sided swing arm
Brakes	3 Wheel Disc/ Manual parking brake
Tires	P145/80R13 Radials
Batteries	8 at 1 Kwhr-hour each
Type	Lead-acid sealed valve-regulated
Chassis	Composite fiberglass monocoqu
Range	60 miles at 60 MPH
Charge time	6 hrs. @ 110V/15 amp, 2 hrs. @ 220V
Charger	Onboard 110V (220v optional)
Motor	DC Series 400 Amp / 15 Horsepower
Controller	Solid State Controller
Amenities	Fuel Gauge / Heater / Radio / CD Player Upgrade
Exterior colors	Red, Teal, Plum, Yellow, Silver
Interior colors	Black, Grey, Cream
Cost	Approx. \$12,900

To Order Contact Tom Corbin 408-633-2500 / 408-633-1512 Fax

e-mail: tomi.corbin.com / www.ev-sparrow.com

Book Review

continued from page 11

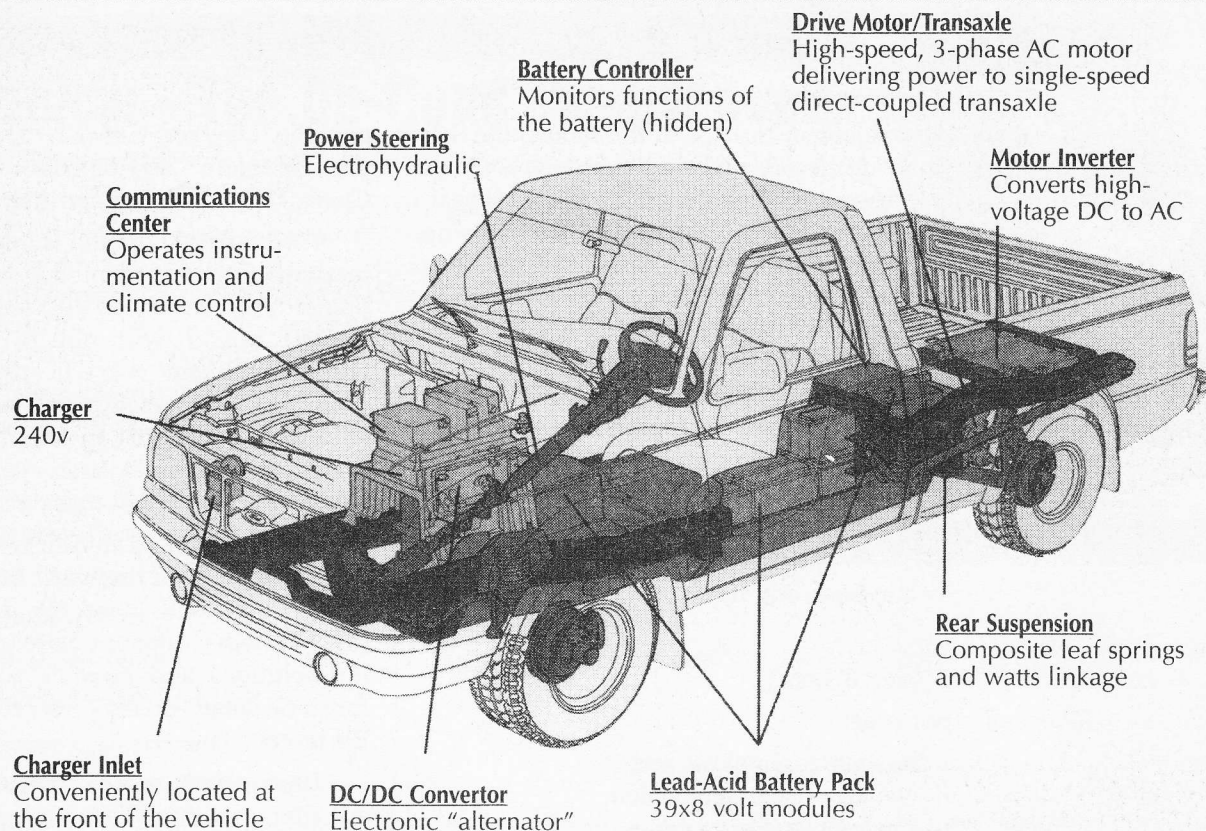
nor the Hawker Genesis. The only modern controller described is the Curtis 1221B - no Zapi, no Auburn.

I feel the final chapter is important reading for everyone. As Michael points out, converting all vehicles to electric power will not solve the world's problems. We will still be left with jammed freeways and acres of land devoted strictly to automobiles. We need to also look at alternative solutions like efficient mass transit.

Overall, I found myself rereading several sections of the book. My brain was racing with ideas for different drive systems, different battery charging solutions and possible solutions for some details on my own project, an EV motorcycle.

If you aren't inspired and motivated after reading "The New Electric Vehicles", you aren't paying attention.

(The EV mailing list is for the discussion of all topics related to electric vehicles. To join the EV mailing list, send the command "subscribe ev" as the text of a mail message to the list server at "listserv@sjsuvm1.sjsu.edu".) —RM



1998 Ford Ranger EV

The Vehicle

Styleside, regular cab pickup, short wheel-base, all other dimensions similar to 1998 gas-powered Ranger

Powertrain

Motor	90-hp, high-efficiency 3-phase AC Induction
Transaxle	Single-speed rear-wheel drive

Battery

Type	Sealed Lead-acid, 8V version of the Delphi used in the GM EV1
Voltage	39 x 8 modules; 312 volt system
Battery energy	@ FUDS 23 KWHR (19 kwhr at capacity rating 85% discharge)
Charger	Onboard 240V/30 A

Performance

0-50 mph acceleration	12.5 sec)gas Ranger < 12 sec
Rated top speed (governed)	75 mph
Customer range	@32 F including heater 35 miles @ 72 F 50 miles
Range - FUDS cycle at 72 F	58 miles without A/C or heater operation

Standard Features

Dual Air bags Electronic	Occupant safety protection Ford designed, state of the art, microprocessor control units
◆ Battery controller	Monitors functions of battery
◆ Motor inverter	Converts high-voltage DC to 3 phase AC
◆ Communications	Operates instrumentation and climate center control
Economy drive	Driver-controlled with increased regenerative braking.
Heater	Electric resistance
Regenerative braking	Energy recovery to increase range.
DC/DC converter	Electronic "alternator" to charge aux. battery from pack
Power steering	Electro-hydraulic
Wheels and tires	Lightweight aluminum wheels, low rolling resistance tires
4-wheel ABS	Straighter stopping and greater steering control under most conditions

Warranty

Vehicle	Same as 1998 gas-powered Ranger
Batteries	2-year warranty; pro-rated in second year.

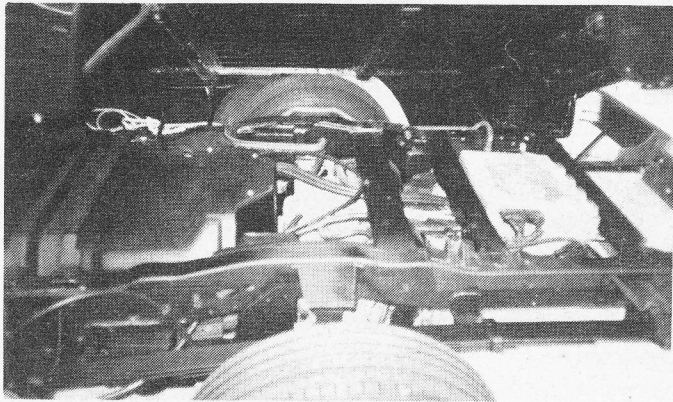
For more information about the 1998 Ranger EV, call 1-800-ALT-FUEL or visit Ford's website at www.ford.com/~electric vehicle



No, this is not the latest in tilt-beds. Ranger angles up to show drivetrain



Numbers up tells what's what on this Ranger



All Ranger components including batteries are located between the frame rails for crashworthiness. Did Ford learn some engineering from EcoElectric's Desert Lightning



Battery Basics

By SPARKZ

Have you ever wondered what's inside that black box called a battery? Many EVers just think of these energy storage devices as storage tanks for electricity, as if it were a fluid like water. That's fine, and you can work with a battery that way. For those who want to know more, read on.

Lives of A Cell

The functional unit of the battery is the electrochemical cell. This device is based on observation that metals or metal-like substances will dissociate, i.e. go into solution as ions, releasing electrons. Zinc dissolving in hydrochloric acid, iron dissolving in salt water or lead dissolving in sulfuric acid are examples. (The solvent involved is usually water, although a few reactions can take place in different media, such as alcohol or hydrocarbon-based liquids)

At the surface of the zinc metal that contacts the acid:

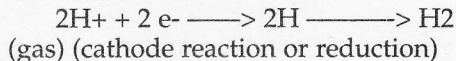


Released electrons flow through the metal until they find a place where they can be used up.

The electron-releasing process is called the anode reaction, or oxidation. The electron-uptake process is the cathode reaction, called reduction.

The Fizz Biz

With zinc in hydrochloric acid, the released electrons are taken up by hydrogen ions (H^+), which bubble off as hydrogen gas. This is why the reaction fizzes.



For the overall process (zinc dissolving in acid) to proceed, there has to be both an anode and a cathode reaction. If the electrons can't escape, they accumulate and charge build-up stops the process. In the Zn/acid dissolution, they latch onto hydrogen ions and are carried off in the escaping gas.

Counter-Intuitive

Note that in the anode, electrons are left in the metal as the ions depart into solution. The metal in this region has a net negative charge. In the cathode, electrons are absorbed by positively charged ions that accumulate in the metal there. Thus, although it may seem counterintuitive, the cathode has a net positive charge and the anode a net negative one

Electrochemical potentials

The energy that drives metal into solution is unique for each element and is called the electrochemical potential. Since electrochemical potentials are always measured between two systems and are not absolute, a reference point is established by using a standard hydrogen electrode (hydrogen gas bubbling around a platinum electrode in a 1 M solution of H^+ ions — the platinum acts only as a catalyst and does not participate in the electrochemical reaction.) Each metal is tested against that under standard conditions (the metal is immersed in a 1 M solution of its ions)

Half-cells

The test cell is set up so that the metal solution and the acid solution are separated by a semipermeable separator. Electrons from the metal anode, instead of jumping right onto the hydrogen ions and escaping, must flow through a wire to the hydrogen cathode. The force or voltage pushing electrons from one cell to the other is the electrochemical potential, measured with a voltmeter. When measured against the standard hydrogen electrode, this voltage is known as the half-cell potential and the reaction on the metal side is the half-cell reaction.

Electron Givers

Against the hydrogen electrode, Zn generates a voltage of -0.76, showing that it wants to donate electrons to hydrogen. Lead (Pb) generates a volt-

age of -0.12V, so it also donates electrons, but the driving force is weaker. Metals such as sodium (Na), potassium (K) and lithium generate 2.5 -4.0 V against the reference, which is one reason why they are being studied for use in batteries; their high potential provides high voltage and high capacity without needing as many cells.

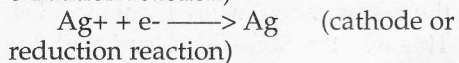
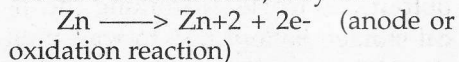
Electron Grabbers

Silver (Ag), on the other hand, generates a potential of +0.799, meaning that it likes to pull electrons off hydrogen. In this case, silver is acting as the cathode, silver ions coming out of solution to take up electrons and plate metallic silver on the electrode. This is the basis of electroplating silver. Silver will also hog electrons from the very willing zinc, providing the basis for the high capacity silver-zinc primary cells used on spacecraft.

Gold at +1.5V and platinum at +1.23V take up electrons so strongly against hydrogen that they will only plate out of an ionic solution and are thus extremely resistant to corrosion.

Put Two Together

An operating electrochemical cell consists of two half-cell reactions. In the case of silver-zinc, they are



Because oxidation and reduction are taking place simultaneously, these are called redox reactions

The standard electrochemical potential of this redox couple is the differential between the standard two half-cell reactions. Note that because zinc "likes" to give up electrons and silver "likes" to take them, the standard electrochemical potential of the two is larger than either alone, namely $0.8\text{V} + 0.76\text{V} = 1.56\text{V}$

In a redox couple such as nickel and cadmium, both like to give up electrons, but one does more than the

other, so that the standard cell voltage is less than either half-cell alone, namely $0.4V - 0.25V = .15V$

Note that the term "standard" precedes the description of half-cell or full cell reactions. This is a reminder that these measurements are taken at fixed ionic concentrations (1 M). If concentrations vary, as they do in actual working electrochemical systems, then the cell voltages will also vary.

In the lead-acid couple, the standard cell voltage is essentially the same as the standard half-cell voltage because the cathode is the hydrogen reaction.

Stack 'Em Up

By themselves, single electrochemical cells can't generate very useful voltages (especially for powering things such as electric cars.) However when cells are connected in series (one after the other), the voltages add up. thus the first practical electrochemical storage devices consisted of many individual units in a series array or "battery" of cells, which is where we get the term we use today.

The Original

The first battery was Volta's "voltaic pile", made up of thin sheets of copper and zinc, separated by paper soaked in salt water (the first absorbed electrolyte battery!). Volta's pile could make sparks, but its current output was feeble. A working chemical storage battery had to wait until the Frenchman Gustav Plante in 1854. This was the fluid-filled lead acid, the basis for our automotive and traction batteries today.

Standard Stacks

In order to have voltages that were compatible with electric equipment, storage battery developers and manufacturers decided on standard configurations of cells inside a case. For the familiar lead-acid system, they settled on the three-cell 6 volt and the six-cell 12V for automotive and other applications. 8V was also used for truck starter batteries and is

also coming into use for electric vehicles.

And Packs

The voltage and current from a single 6 or 12 V battery is often insufficient for some applications (such as Evs). Individual batteries are made with output terminals or posts that are standardized so that batteries can be connected together into a block or "pack".

Battery Terminology

Commercial storage battery manufacturers speak of plates or grids rather than electrodes, since these metal parts have to be heavier to generate usable current. As in the laboratory version of the electrochemical cell, batteries have semi-permeable separators and ionic solution called electrolyte. Access is provided in fluid-filled batteries by caps in the top and they require periodic additions of water. They also require insulators between cells and conductive pathways called interconnects that bring current outside the case to connective fixtures called terminals or posts. These come in a variety of types, including automotive, L-terminal, universal terminal, marine, screw-type and others.

Electrolyte does not necessarily have to be liquid, although because of the common lead-acid battery we think of it as such. And electrodes or plate do not necessarily have to be solid. Ford's controversial sodium-sulfur battery has a molten "plate" and solid electrolyte.

Competing systems

Lead-acid wasn't the only system powering vehicles. The Edison or nickel-iron battery threatened for a while to displace it, especially in cabs and delivery vans. Nickel cadmium also developed into what it is today. Since almost any two half-cell reactions can be combined (in theory), batteries can and have been based on a bewildering variety of metals and even non-metals such as conductive organic polymers.

Roll Your Own

The accompanying chart shows electrochemical potentials of various elements. Just for fun, try picking a pair and see what sort of battery they'd make. What would be the best pair (from an electrochemical standpoint only)? What would be the worst?

Not All Rechargeable

One should note that some battery technologies do not depend on recharging for energy renewal. Several use materials that must be consumed and replaced. Some systems, such as one studied by Nissan, refuel by replacing spent electrolyte. Others (aluminum air, zinc-air) require the battery to be opened, the spent plates lifted out and replaced with fresh ones.

Present and near-term batteries are based on familiar materials such as lead, nickel, zinc, and silver and less familiar ones such as sodium, potassium, lithium, aluminum, magnesium and carbon in both inorganic (graphite) and organic (polymeric) forms.

Technology is moving so rapidly that batteries based on new materials such as nickel-metal hydride and lithium-ion are becoming commercially available, though in limited quantities and at high costs. —Sparkz

News in Brief is compiled by Ruth M. Shipley from information supplied by the Environmental Information Network. If reprinted, please credit CE and Ruth Shipley.

Edison EV Builds EV Infrastructure

To facilitate rapid, efficient and reliable installations of EV charging equipment for both residential and commercial customers, Edison EV, an EV infrastructure company, is forming alliances with San Diego Gas & Electric Company, Southern California Edison and the Sacramento Municipal Utility District. These unique alliances are expected to provide the basis for building and marketing charging networks throughout California. The agreements address sales and marketing of EV chargers in each utility's service territory, servicing of chargers, and utility practices that will allow easy and rapid installation of chargers at customer locations.

(PRNEWswire: 12/11)

Single Unit Fuel Cell Built by NASA

Prototypes of a new class of efficient, single unit regenerative fuel cells that feature solid ionomer alkaline membranes have been built and tested at NASA's Lewis Research Center in Cleveland, OH. These single unit, regenerative fuel cells can serve either as fuel cells or as electrolysis cells and may become key components of future electric power generating/energy storage systems. The use of single unit, regenerative fuel cells — as opposed to the use of separate fuel cells and electrolysis cells — could potentially increase the energy densities of energy storage systems. So far, three prototype cells have been built. The round trip efficiency of one of the cells, measured at a current density of 40 milliamps per square centimeter, was 54% at 40 degrees Celsius.

(BATTERY & EV TECHNOLOGY: NOVEMBER 1996)

Tucson Resort Offers EV Charging

A Tucson resort has decided to support the launch of GM's EV1 in Arizona by offering its guests an EV charging facility. The Westin La Paloma, a luxury resort in the foothills of Tucson, is one of just a handful of locations in the United States to offer this service. GM has selected Tucson as one of four cities nationwide to market the EV1, which is now available from participating Saturn dealerships. Car owners visiting the Westin La Paloma will pay only \$1.60 for a full charge, a bargain compared to gas prices. The time to charge will vary from about one to three hours depending on how much juice the battery needs.

(PRNEWswire: 12/12)

TCR Develops EV AC System

Thermodynamic Control Research (TCR) of Trenton, FL has developed a high-efficiency air conditioning system for use in EVs. The TCR unit is lightweight and has power requirements about one-half to one-third of those found in other systems currently available. The TCR system incorporates a secondary battery that does not draw power from the main vehicle battery. Depending on the type of fan used, the TCR system only requires 600 to 650 watts. This low power requirement enables the unit to be left on to cool a parked vehicle or programmed to cool at specific times. The unit's small size allows it to be placed anywhere in the vehicle, and the use of a Sierra environmentally-safe secondary coolant allows it to be adapted to existing vehicle evaporator and blower systems.

(TCR RELEASE: 12/12)

Enova Funds EV Charging Stations

Enova Corporation, the parent company of San Diego Gas & Electric (SDG&E), has announced it will fund the development of a network of public charging stations for EVs in the utility company's service area. Enova will provide \$50,000 to business and government agencies in San Diego and southern Orange counties to aid them in building charging stations. No specific locations for the stations have been established yet, but they may include major shopping centers, government offices, parking garages and employee parking areas at facilities of the region's largest employers. SDG&E will provide incentives to encourage overnight charging, since it makes more efficient use of the company's electrical system and benefits the customers.

(PRNEWswire: 12/5)

New 24-Hour EV Record

A team consisting of technicians from Monrovia, CA-based AeroVironment, Inc. and Delphi Energy and Engine Management Systems (Delphi-E) set a new EV 24-hour distance record recently. The team drove an EV on streets and highways in and around Los Angeles from noon on Saturday, December 7 until noon on the following day for a total distance of 1,020.5 miles. The previous record, set in 1994 in Atlanta, was 832 miles. The Arizona Public Service Company utility provided a converted Saturn coupe for the run. Delphi-E provided the valve-regulated lead-acid batteries, the same batteries that are currently used in the GM EV1. AeroVironment contributed its ProCharge fast charging system, which was able to completely recharge the vehicle's battery in 12 minutes.

(BUSINESS WIRE: 12/10)

Ethos 3 Gets Good Reviews

A Golden, CO-based engineering company is offering the world a peek at the future with the introduction of the Ethos 3 EV. Unique Mobility developed the vehicle in partnership with Pininfarina, a world-renowned design and manufacturing company in Turin, Italy. Pininfarina designed the body, suspension, interior and aluminum space frame design, while Unique Mobility created the electric propulsion system for the four-door, four-passenger car. It is powered by 945 pounds of NiMH batteries, reaches a top speed of 78.3 mph and accelerates from 0-60 mph in 11.2 seconds. The car can travel about 150 miles at 45 mph or 128 miles at 50 mph between charges. Test drivers from the Denver Post rated the car highly.

(THE DENVER POST: 12/6)

USABC Funds Cost-Reduction Program

The U.S. Advanced Battery Consortium (USABC) has approved a 15-month, \$8 million program with GM Ovonic to reduce manufacturing costs for nickel-metal hydride (NiMH) batteries for EVs. Since NiMH batteries have proven reliable and able to yield longer ranges in EV tests than other battery technologies, this next step will be important in making NiMH battery technology more commercially viable. "Our goal is to take a battery proven in performance, maintain that performance, but reduce its costs to affordable levels," said USABC program manager Bruce Rauhe. Ovonic Battery is a subsidiary of Energy Conversion Devices, Inc. (ECD), and GM Ovonic is a joint manufacturing venture involving Ovonic Battery and General Motors.

(ECD RELEASE: 12/5)

Dealership To Sell Solectria Force

Mirak Chevrolet-Geo of Arlington, MA has become the first automobile dealer in the US to offer Solectria EVs directly to individuals and fleets. New car buyers can now purchase the new Solectria Force four-passenger, four-door electric sedan on display at Mirak's showroom. The car can reach a top speed of 70 miles per hour and has an average range of 40 to 45 miles per charge. Standard equipment includes a cold weather package and a user-friendly Range-Power Selector to maximize range. Wilmington, MA-based Solectria also offers the Force sedan equipped with advanced nickel-metal hydride batteries, which will power the car 80 to 100 miles on a charge, and the Solectria E-10 electric pickup truck.

(SOLECTRIA RELEASE: 12/4)

EV1 Ad Could be a Hit

A television commercial spot developed by San Francisco-based Hal Riney and Partners for the General Motors EV1 advertising campaign is beginning to attract attention. The spot, which shows scores of household appliances unplugging themselves to go outside and have a look at GM's EV1, was scheduled to debut in December on local TV stations and movie theaters in the Los Angeles, San Diego, Phoenix and Tucson markets. "The idea of an electric car is a huge, huge piece of news," said Riney copywriter and executive creative director David O'Hare. "In focus groups, when we'd describe the car, people would come back and say, 'There's an electric car? Wow.' They couldn't get past the fact that it was here, let alone what its name is or who makes it."

(NEW YORK TIMES: 12/4)

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SMUD Receives DOE Award

The Sacramento (CA) Municipal Utility District (SMUD) recently received the Department of Energy's "Special Recognition" in the National Energy Efficiency and Renewable Energy Awards for its innovative electric transportation program. SMUD has launched 200 EV charging outlets at 32 locations throughout the county in neighborhoods, downtown public parking garages, shopping centers, the State Capitol and Sacramento International Airport. The utility is also collaborating with GM to develop the charging infrastructure for the EV1. SMUD's electric transportation program, begun in 1990, was one of six transportation technology winners chosen out of 240 candidates.

(SMUD RELEASE: 11/21)

Welcome to the Electric Auto Association calendar of events. Listed are events of direct or related interest to Electric Vehicle Enthusiasts and Alternative Transportation Technology Businesses. If you know of an event that should be listed, please email event information to kawatson (evchdler@primenet.com)

1997

Jan. 24-28

Great Southern Sunrace, Australia. First annual solar car race from Adelaide to Melbourne via Elizabeth, Peterborough, Broken Hill, Mildura and Bendigo. Contact: Sustainable Energy Enterprise Developments, tel. (03)9820 9032, fax (03)9820 2027

Jan. 22-27

Convert It: The Workshop: Hands-on Training, Santa Cruz, CA. Electro Automotive (Mike Brown and Shari Prange) is doing their classic four-day hands-on electric vehicle conversion workshop. Location, Electro Automotive, Felton, CA (Santa Cruz area). Emphasis on safety and reliability. Geared for the amateur mechanic and EV hobbyist. The primary focus is actually putting together an electric Rabbit and getting it running. Cost \$400 per person, pre-registration required, space limited. Contact: 1-408-429-1989

Feb. 24-27

SAE International Congress and Exhibition, Detroit, MI. Annual conference and exhibition sponsored by the Society of Automotive Engineers, held at Cobo Center, Detroit. Contact: SAE, 400 Commonwealth Dr., Warrendale, PA. 15096-0001 tel. 412-772-7131, fax 412-776-0002, email meeting@sae.org, or visit SAE Web site at: <http://www.sae.org>.

Mar. 7-9

APS Electrics, Phoenix, Arizona. EVTC conducts electric vehicle competitions as a means to increase public awareness of electric vehicles, develop an electric vehicle educational infrastructure and advance EV technology, all in an effort to support commercialization of electric vehicles in accordance with Energy Policy Act mandates. EVTC competitions provide laboratories for High School and University students to work out real life solutions to textbook

problems. Location of EVTC: Firebird International Raceway. Classes (additional classes maybe added however): ABB University Spec Series, Formula E Class, Prototype Demonstrations, High School Challenge Series, Street Stock Class, Super Stock Class. Contact: EVTC, tel. (602) 256-2599, fax (602) 256-2606

Apr. 7-10

EnV'97, Detroit, MI. Fifth annual Environmental Vehicles Conference and Exposition is held concurrently with the 12th Annual Advanced Composites and 6th Annual Advanced Coatings Technology Conferences and Expositions at the Westin Hotel. Sponsored by The Engineering Society of Detroit and SAE. For more information on the 5th Annual Environmental Vehicles Conferences, Contact: Kristin Karschnia, ESD, 29355 Northwestern Hwy., Suite 200, Southfield, MI, 48034, tel. 810-355-2910, fax. 810-355-1492.

Apr. 21-22, 1997

First Annual National Storage Battery Conference, Boca-Raton, Florida Hosted by Albercorp, 990 South Roger Circle Suite 11, Boca Raton, Florida 33487. Tel. 407-997-2299

The intent of this Calendar is to provide a comprehensive list of events that will help to increase awareness and participation in the ever-growing interest and use of Electric Vehicles. Your support and input is greatly appreciated. Thank you.

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BumperSnickers

Steve McCrea (Florida) forwarded these to me by email. None of them have appeared on a vehicle (as far as the source knows), nor have any been copyrighted. Several would be suitable for EVs.

- ☛ Make it idiot proof and someone will make a better idiot.
- ☛ A flashlight is a case for holding dead batteries.

So are some EVs I've known—ed

- ☛ Forget about World Peace.... Visualize Using Your Turn Signal !
- ☛ EARTH FIRST! We'll stripmine the other planets later.
- ☛ Change is inevitable, except from a vending machine
- ☛ When you do a good deed, get a receipt, in case heaven is like the IRS
- ☛ Very funny, Scotty. Now beam down my clothes.

Commentaries on conflict

- ☛ Diplomacy is the art of saying 'Nice doggie!'... till you can find a rock
- ☛ If you can't lick'em, BITE 'EM [I added this one]

For the engineers in the crowd

- ☛ $2 + 2 = 3D5$ for sufficiently large values of 2.
- ☛ 3 kinds of people: those who can count & those who can't.
- ☛ Ever stop to think, and forget to start again?

EV PHOTOS



We've been saying it for years — now they finally believe. San Diego was absolutely saturated with these billboards — this was taken not two blocks from the Motel 6 where we stayed.



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- ◆ BYCAN Battery Chargers for 48, 120-144 V battery systems
- ◆ K & W ENG. AH-100 Amp-Hr. Meter & TD-100 Tachometer Drive/Rev Limiter
- ◆ The latest in EV publications with a growing lineup of videos
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