Electric Auto Association

CURRENT EVENTS

May '99 Promoting the use of electric vehicles since 1967 Vol. 31 No. 5

Electrics Crash Highlights Regen Safety Issue

by Clare Bell

The Salt River Project Ford Probe, car #90, has long been king of the EVTC Arizona Electrics Stock race. Number 90, with Tom Sneva and then Mike Heath at the wheel repeatedly crushed such challenges from the rest of the field. In recent years, Car # 25 from University of Idaho gave the Probe a good workout, but the brilliant sapphire blue and sun yellow SRP entry continued to own the stock race. The usual third placer, Car #13, also mounted determined though sporadic attacks on the king, but the Porsche team couldn't quite complete its attempted coup. Number 90 remained on top.

Cat Passes Downed King

On the last lap of the 40 km stock feature event, all that changed. Rounding the tower turn with #25 Camaro hard on its tail, the Probe skidded into the outside wall. As the wounded SRP car bounced over to the inside track, the big black cat Camaro from U Idaho bounded past it and ate the finish line.

"It was neck and neck going into the last curve," said UI team member Don Sturtevant, who added that UI's strategy was to closely tail the leader and take the lead late into the 23-lap race.

Dave Erb, a professional race driver from Columbus, Ohio took the lead on the 21st lap, but lost it on the next, said Sturtevant in a U Idaho press release. "But he stayed with the lead car and went right by it when it skidded on the last turn."

New Honcho of the EV Stockers

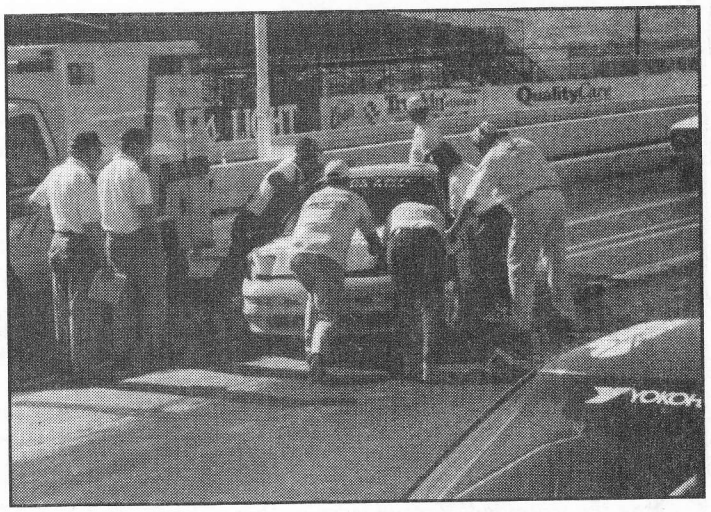
Probe driver Mike Heath was not seriously injured, though a little shaken. The stock event was a little more rattled. The king was dead, was the thought that went through the minds of onlookers; long live the new king.

Though Idaho's driver, Dave Erb and the Advanced Vehicle Concept Team rejoiced as they accepted the trophy, they were also somber and later expressed sympathy over SRP's loss.

The new ruler of the EV stock class is now a 1985 Chevrolet Camaro Z-28, converted by U Idaho students into an electric vehicle with a 150-kilowatt, 204-horsepower, 3-phase AC induction motor. The black beast draws its power from 31 12-volt Optima Red Top lead acid batteries.

The race entries clocked average lap speeds of 56 mph on the flat but twisty road course at Firebird Raceway. Top speeds on the straight-away hit 90 miles per hour.

University of Idaho earned a first-place trophy and the $500 race purse. This year's winning effort follows a second place finish in last year's race. "The Salt River Project vehicle, sponsored by an Arizona utility company, has been a dominant vehicle in the race," said Sturtevant, "and people were pretty excited to see us de-throne them."



Continued on page 10

In This Issue

DID THE DOG EAT YOUR EV PREVIEW 2000?

Or did your gasoline car leave oily tire tracks on the cover?

Well, never fear! EAA in its wisdom bought EXTRA copies (for those unfortunates who harbor magazine-eating puppies or vengeful petro-mobiles). So just order up another for your friendly EAA store and it'll be right in your mailbox. Just be sure that the above-mentioned malevolent entities don't get to it first.

For those unfortunates who aren't members and did not receive this excellent survey of EVs and HEVs available by the year 2000, JOIN EAA NOW! and order a copy via the EAA store order form, conveniently located on p. 23.

PHOTO CREDIT - COVER

Tending the wounded. Rescue team pushes #90 off-track to avoid oncoming cars. The Probe hit on the outside wall and rebounded over to the inside. Driver Mike Heath, thankfully, was not hurt.

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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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High Gas and EVs

The furor over the rise in gasoline prices is beginning to sound like a replay of the 1970s, with SUV drivers playing the same role that American land-yacht owners played back then. The howls are the same too, as fuel and cash gush into those bottomless tanks. There is also the echo of the 70's when EV drivers buzzed the lines of frustrated gas guzzlers stuck at the pumps. Twenty or so years later , EVs are giving more smiles as well as low-cost miles per kilowatt-hour. Those who have made their EV an integral part of their daily life were a little startled to find out about the gasoline situation.

This has been reflected on the Internet EV Discussion List with postings from folks such as Doug Pratt, whose daily driver is an EV truck. Doug wrote that he wasn't aware of the price jump until "...the driver sitting next to me at a traffic light rolled down his window and hollered, "Bet you're feelin' happy now. "To which I went, "Huh?" And he pointed out the gas prices at the station across the street."

The price rise also seems to be kicking off a flurry of effort to get sidelined EVs back on the road or complete projects. EV Discussion List member Rich Rudman responded, (March 31, 1999),

"Hey Doug.. it's jumped 30 cents in Seattle in the last 2 weeks." He added that he needed to get a new commutator in Goldie and "...get the Fiero put together."

So is this the start of another resurgence in EV interest like that of the late seventies?

A few years ago , people in the EV community predicted that when gasoline hit $2 gal then EVs would take off. Well in some cities, premium is over $2/gallon. Is this the time things are going to take off and are we ready for it.

How Much Has Gas Risen?

Impressions are that California gasoline has jumped by 40 to 50 cents per gallon. The following is an average of gas prices taken from 38 California stations each week since the start of 1999. One can see that things stayed fairly steady, even dropping slightly until the beginning of March. At that point, there was a small rise that might have been just the start of a small oscillation - the same as what the market had been seeing during the previous year or so. In the initial two weeks of March the rise suddenly steepened, going from about $1.12 for regular and $1.34 for premium on 3/1/99 to $1.46 for regular and $1.66 for premium on 3/29/99.

California Average Weekly Retail Gasoline Prices as of March 29, 1999

Date	Regular	Midgrade	Premium
1/4/99	1.129	1.237	1.347
1/11/99	1.126	1.233	1.344
1/18/99	1.122	1.229	1.338
1/25/99	1.115	1.222	1.331
2/1/99	1.106	1.216	1.326
2/8/99	1.101	1.212	1.323
2/15/99	1.099	1.209	1.321
2/22/99	1.113	1.221	1.332
3/1/99	1.118	1.227	1.338
3/8/99	1.162	1.264	1.371
3/15/99	1.191	1.292	1.399
3/22/99	1.229	1.332	1.438
3/29/99	1.456	1.552	1.656

These statewide averages compiled by the U.S. Department of Energy's Energy Information Administration (EIA) from a telephone survey of 38 California gasoline stations. These stations are sampled with a likelihood equal to the company's proportional size to the total annual volume of gasoline, by grade, sold in California.

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.

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How To Make Battery Cables Cheap But Good

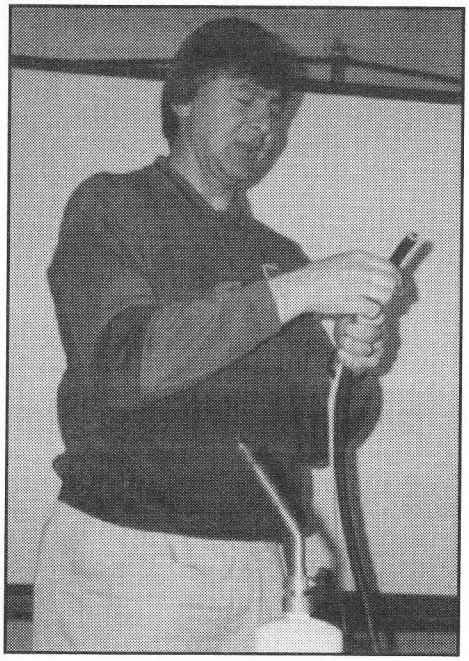
by
Scott Cornell
and Sparkz

Part Two: Step-by-Step

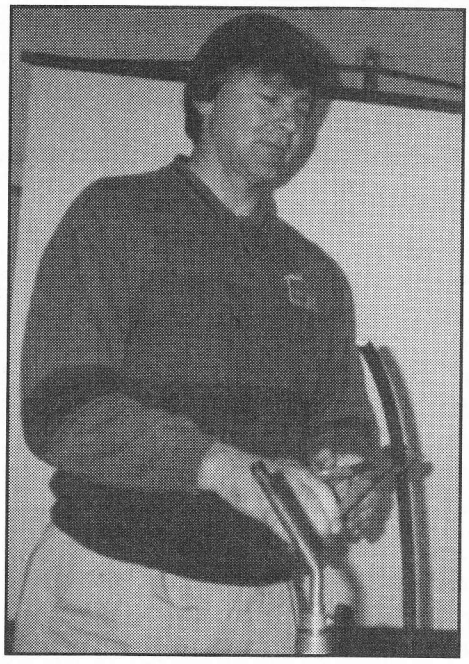
So last month we covered the basics of making your own battery cables. Now you have had a good overview of what you might be getting into and are now ready to go into more of a step-by-step description of the process

Even if Your IQ IS 180...

There are, however, some important details to this process, so the first-time cable builder is advised to read through the step-by-step instructions and look at the pictures before launching off.



Measure ...three times

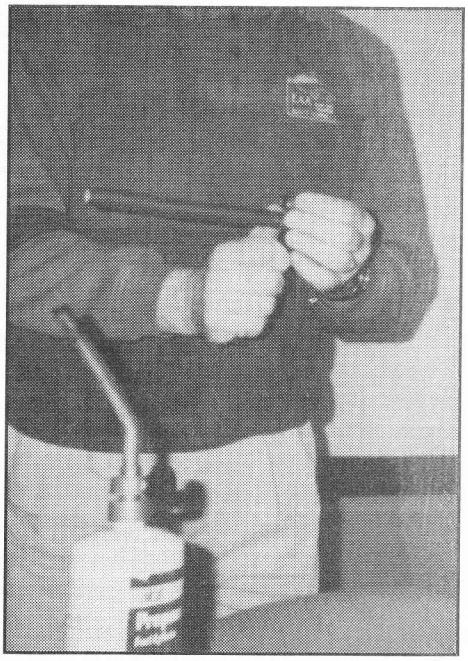


Cut once

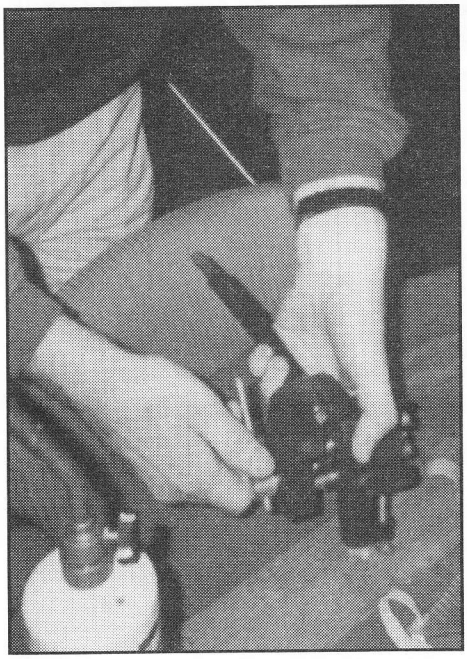
First, before cutting, soldering or drilling anything, figure out your cable lengths. A too-short or impossibly long cable is a waste of parts, even cheap ones.. Take the advice given on the TV Program "This Old House", namely, measure twice and cut once. (In my case, measure three times, cut once and still cross your fingers -Sparkz)

Using the hacksaw, cut two inch-long sections of copper tube per cable. You also need two inch-long sections of shrink tube to cover the exposed wire at the junction of copper tube and cable jacket..

For these cables, the cut raw welding cable length will be the same as the finished cable length, since the stripped-back portions of the wire run all the way inside the



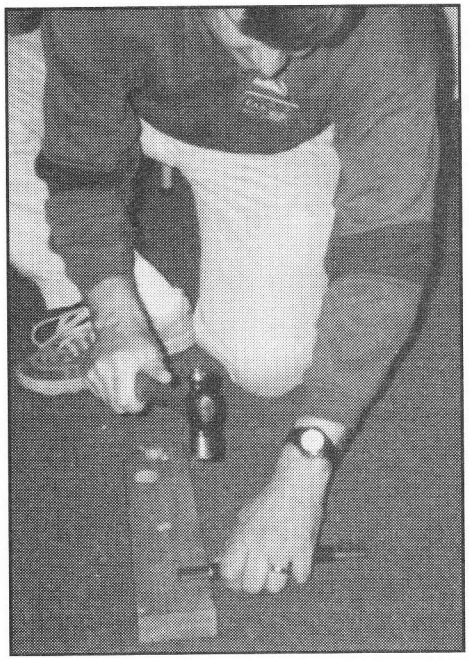
Don't cut all the way through the jacket - you'll nick the strands. The end will twist off even if you don't cut all the way.



Put the squeeze on the end to hold the copper in place.

copper tube. That is not the case with the crimp-on types, since the lugs extend an inch or so beyond the end of the wire.

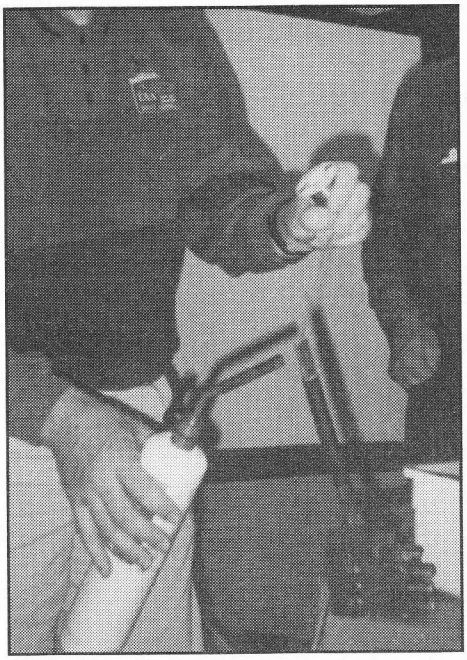
If you haven't got an exact measurement, cut slightly long. It's better to have a little slack than a cable that won't reach the terminal. A little flex also eases the strain on battery terminals. For most battery-battery interconnects, 9-10 inches is pretty good.



Then whack it!

No Nicks, Nick

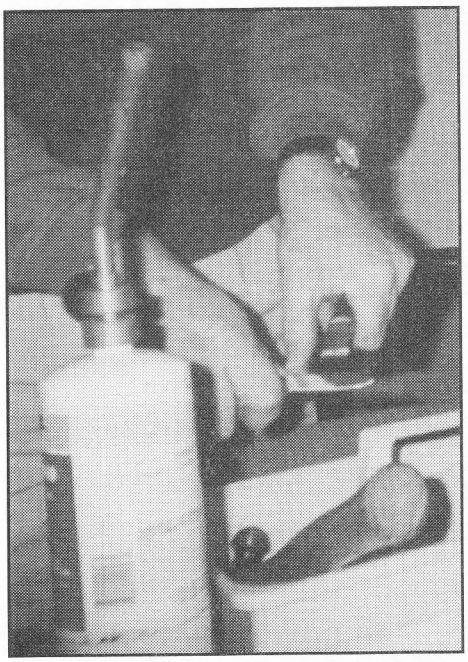
OK, you've got your raw cable length of 9 inches or so. Strip each end back about one inch, using the razor knife. When stripping the jacket off a cable, you don't want to nick the strands, or wires will break off and it won't be a 2/0 cable anymore. Nasty things will happen when too many electrons want to get through too few strands and things get hot. You paid enough for the 2/0, so don't compromise it. Refrain from slicing all the way through the jacketing; stop BEFORE you feel the blade grate on wire. A strong twist will remove a partially sliced-through jacket.



Sautee' nicely in electrical solder.

Whammo

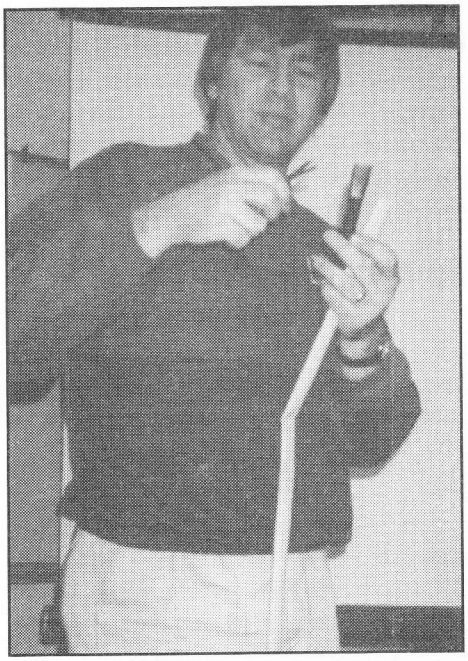
Take a section of copper tubing (with a bright shiny bare copper inside, remember?) and stick the wire end inside it. If you think that your shrink tube won't fit over the finished lug, slip it on now. Lay the copper-sheathed wire end on the wooden block, remove all breakable objects or vulnerable life-forms from the vicinity, take a deep breath and whack the sucker flat.



Scrape the oxide off - use a knife or heavy-bristled wire-brush.

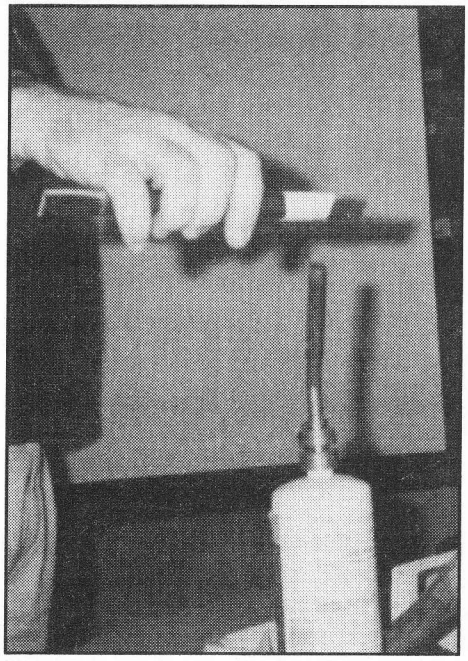
You don't have to mash it into oblivion, just enough for a nice firm crimp at each end.

Now solder the flattened end. The idea is to fill up the inside, making a matrix of wire and solder that bonds to the copper tube.



Shrink tube is cheaper in long lengths.

This part can be done with a very hefty soldering iron, but Scott prefers the propane torch. Ignite the torch (keeping any latent pyromania under control) and heat the copper tubing while feeding the solder inside. Stop before it wicks any distance down the



Slip on a section and barbeque gently. Julia Child, eat your heart out.

wire beyond the lug - too much solder in the body of the cable will make the wire inflexible and brittle. You are going to have a tough enough time snake-wrassling your cables between batteries or around corners without making things harder on yourself. Make snakes that are easy to wrassle!

Bends at the Ends

If you need a tight bend to clear or reach a battery terminal, make it after you have hammered the end flat, but before you've soldered it

Don't Get Wound Up....

In both of the pretty blank copper lug ends that you have created, drill 5/16" centered holes for battery bolts (or whatever bolts you need). Use a small pilot bit first, then the final size. The holes will look better and be easier to drill. Safety note - drill bits can catch and stick in copper. Either use a small low-torque battery-powered drill that won't sprain your wrist or find a drill press. If you have to use a high-torque power drill, put the part in a vise, and brace the drill handle against your body so that your wrist doesn't take the full strain if the bit does catch. (I damn near wrapped myself up on a big power drill once - the Ace bandage around my hand advertised my mistake for everyone to see.)

Now you have a functional cable. Finish it off by shrink-tubing the junction between cable jacket and copper lug. This prevents battery acid from getting into any exposed wire and corroding the cable internally. It looks better too. You get better protection from the shrink tube that has hot-melt glue

Voila! Ze finished interconnect (as proudly displayed by Scott Cornell's son, Dean Cornell).

already spread on the inside. However, you have to heat the stuff longer so that the glue melts and seals. Heat it until the goo starts seeping out around the edges. It's easy to char or melt the shrink tube when using a torch, so take it easy. Or use a heat gun. No, you can't use your Con-Air — hair driers aren't hot enough and won't work.

As a final flourish, you might want to just check it with a volt-ohmmeter (VOM) to make sure that all the connections are low-resistance (no cold-solder joints). You shouldn't have to do this, however.

Voila! You are now qualified to participate in Aunty Sparkzy and Uncle Scott's next Cabling Bee.

Throwing Your Own

If you want to organize your own Cabling Bee, here's a few hints:

♦ Pre-cut all the copper tube sections and shrink tube lengths and lay them out.

♦ Have some cables pre-made to act as models for those who are new to this business

♦ Make cutting guides using markers on cardboard or paper, or tape a yardstick or ruler down to a table.

♦ Do batch processing, i.e. have everybody cut cables first, then strip them, then put the ends on, etc.

♦ Or do it Henry Ford-style, with an assembly line.

♦ Break out the beer AFTER you do the soldering.

Happy cabling! —**SC** and **S**

EAA Membership Drive

The goal is to **double** our membership by year's end '99

The Board of Directors approved the first recommendation of the membership committee, consisting of Roy Kaylor and Scott Cornell

For each new member sponsored by an existing member, the existing member will receive a free three-month extension of his or her membership!

This **trial benefit** is good for a test period of six months, ending August 31, 1999.

Sign up four new members before August 31, 1999 and get a **free** extension of your membership for a whole year! (A $39.00 reward)

Just think;
Sign up a hundred new members and get a 25 year **free** extension of your membership (A $975.00 reward)

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With a hundred thousand members, we could be a real **political force.**

If this membership drive is **successful**, then the other recomendations may also be implemented, which would be of benefit to all

For more Info. call:
Roy Kaylor
650 325-6900 -or-
831-338-2200
(kaylor@access1.net)

Feel-Good EV Scooter

When Brian Hill commutes from Midtown to his job downtown, it's a sight you'll remember. Weather permitting, Hill rides a $700 motorized scooter that looks very much like the foot-powered models many of us used to glide around on as kids.

"You get up feeling in the dumps and you feel good with this thing by the time you get to work," said Hill, who has a trace of many years of living in London in his voice. "Kids love it. They'll just stop in the street and stare as you come by." For Hill, riding the scooter or an electric-powered bicycle to work instead of making a five-minute drive is a matter of practicing what he preaches.

As assistant general manager of Centennial Olympic Park, Hill has orchestrated an electric revolution of sorts. All of the 17 vehicles used by employees of the 21-acre showplace are electric-powered. "With the problems that face Atlanta, it's good for us to be out there and show alternatives," said Hill, an avid white-water kayaker and dead ringer for Max Weinberg, Conan O'Brien's "Late Night" band director. "The ability to have a zero-emissions fleet in the park was too good to resist."

The program is funded by $272,000 in grants from the state and federal governments and Georgia Power. The fleet ranges from Ford Ranger EV pickups and golf cart-like "short-bed workhorses," used to carry equipment, to a stylish little Bombardier NV, a street-legal electric car. The first big inner-city park built in the United States in 25 years, Centennial is also the first park to employ an all-electric fleet, Hill said.

The park will almost certainly be the greatest legacy of the 1996 games, and no one can deny that it has triggered an encouraging renaissance of the western part of downtown.

"To be actually changing a city is an exciting thing," Hill said. The park is patrolled by the Georgia World Congress Center police, whose electric-powered fleet includes bikes and police cruisers. "They've done what people said couldn't be done in downtown and that's keep the park clean and safe," Hill said. "It's essential people feel safe coming into a place. They (the police) are personable and friendly. They're good public relations for us."

"In and around the park, there are 17,000 available parking spaces," he said. That motorized scooter frees up one of them. Hill folds it down and leans it against a wall in the corner of his office. To mark Valentine's Day, we've discovered another wacky Web site, this one dedicated to those who fall in love in traffic.

EV - The Atlanta Journal - The Atlanta... (ATJC) Local News The Lane
Ranger Park official gets charge out of scooter commute Joey Ledford
STAFF 02/14/99 (Copyright, The Atlanta Journal and Constitution - 1999)

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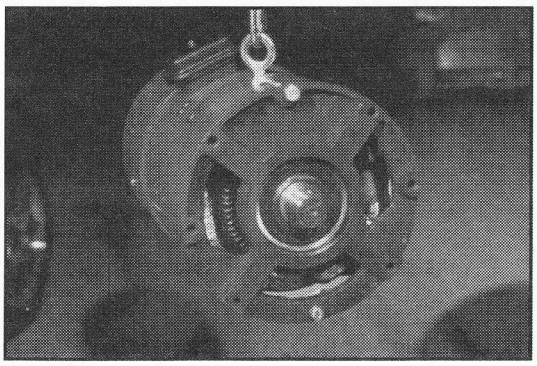

New from Kaylor Energy Products

Educational Electric Bicycle Kit	$199.95
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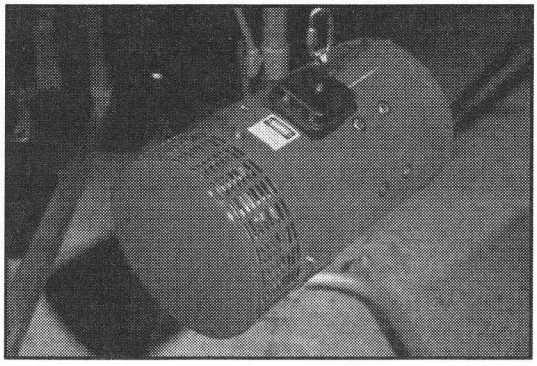

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For folks interested in baking from scratch, here is a list of circuits of my '95 home-built Electro-Metro with associated experiments, published previously in the DEVC. The schematics are **$2** per page, and the software (3.5" floppy) for projects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

Order from:

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For Sale - Circuits Published in DEVC

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- Individual Battery Charger, used on Electro-Metro to keep batts at + or -0.1**(5 pgs + micropr)**
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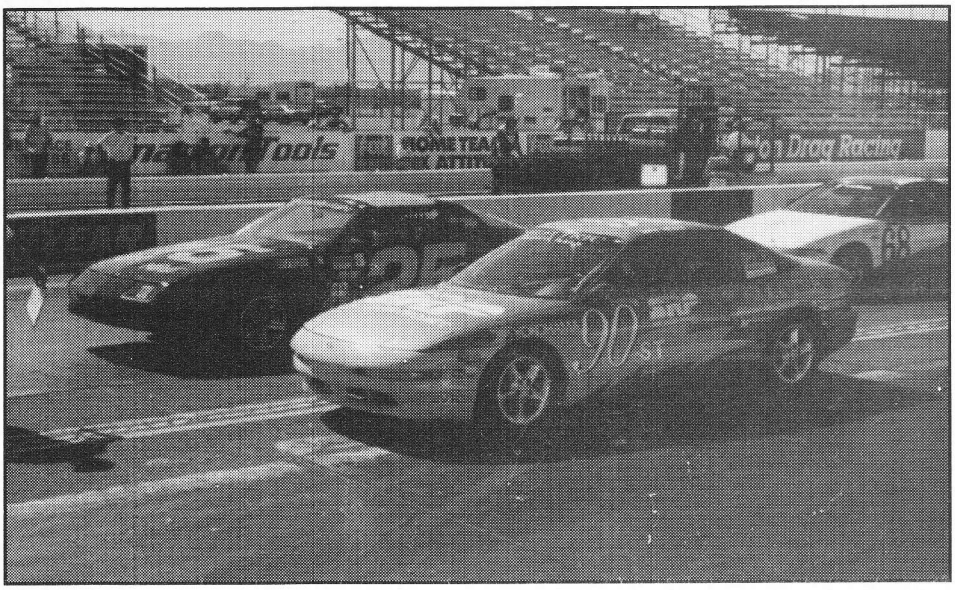
- LiteBar, LED lightbar for brake lights, etc, using HP ultra-brights.....**(1 pg)**
- Solar Heating System_Controller, controls Grundfos circulating panel.....**(3pgs. + micropr)**
- Metro Charger and dashboard display, batt gauge, tach, temp, amps etc....**(6pgs + micropr)**
  (uses PFC Ferro-Resonant 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.....**(l pg)**
- 200 W Class-D amp 95% efficient audio amp for batt applications.....**(2pgs)**

Electrics Crash *Continued from page 1*

Fifteen of the 28 Advanced Vehicle Concept team members attended the race.

The Arizona Electrics race promotes the development of electric vehicles and features vehicles developed by colleges, high schools and private businesses. Major support for the Advanced Vehicle Concept team came from the UI National Institute for Advanced Transportation Technology, Avista Corporation and Schweitzer Engineering Laboratories



Both Salt River Project's #90 Probe and University of Idaho's #25 Camaro have AC drivelines. The Probe is front-wheel drive, the Camaro is rear-wheeled.

More Than Bench Racing?

Even while celebrating the winner, attention turned back to the disabled #90. Onlookers and participants alike asked what happened. This wasn't just a casual question - the Probe's competitors felt that it might have happened to them.

The Culprit – Regen

Why did the SRP Probe drift so wide on the tower turn that it smacked the wall? Did driver Mike Heath totally lose control or did something else happen?

CE's theory is that heavy regen kicked in at the wrong time. Regenerative braking is a nice feature in AC drive systems, and the AC Propulsion unit in the Probe makes good use of it. However, when batteries are depleted, as at the end of a race, the slowing force of regen can be much stronger than the usual internal combustion engine (ICE) compression braking (which regen is supposed to simulate). The AC Propulsion driveline also provides regen when the driver releases the accelerator pedal as well as when he depresses the brake. This is very common in all sorts of AC drive technologies.

Analysis

Here's the scenario. Heath was going slightly too fast through the turn and he lifted his foot on the accelerator. Regen kicked in, slowed the drive wheels drastically, they started to skid and the car lost traction. Some members of my team noticed that both Mike Heath in #90 and Dave Erb in Idaho's #25 came close to skidding when they rounded the tower corner during previous laps. Both of those cars have AC Propulsion drive systems with regen.

Steered and Driven Wheels

Why Mike skidded and Dave didn't. The Camaro is rear-wheel drive while the Probe is front-wheel. When the Camaro's rear wheels went into regen, the back end might have started to come around, but Dave could compensate by steering the non-regen wheels. The Probe's regen caused it to lose traction, not only in the drive wheels but the steered wheels as well, so Mike Heath couldn't compensate, and ... wham!

No Quarrel with ACP

This incident points up a problem with heavy regen in front-wheel drive EVs. Since most EVs these days are front-wheel (since the gas cars they are made from are front-drive), this needs to be addressed. I have no quarrel with AC systems or with the AC Propulsion units. Alan Cocconi and his company have done an enormous amount to bring EVs out of the "small, weird and slow" pigeonhole. The EV1, for which Cocconi designed the original prototype driveline is an attitude adjuster par excellence.

Nor are the problems confined to conversion cars using AC drivetrains. Honda has just issued a safety recall for a condition that could cause their EV Plus vehicle to slow drastically because of heavy regen.

Fix It, Don't Can It

AC systems have so much going for them that we should not back away from that technology because of the regen safety issue that was exposed by the Arizona Electrics stock race. These systems can undoubtedly be fine-tuned so that regen is limited in severity. Since most of those who drive EVs also drive gasoline vehicles, perhaps regen on accelerator pedal lift should be limited so that it simulates the compression braking in the ICE vehicles. I imagine that the AC Propulsion and other systems are sophisticated enough to provide a hardware or software adjustment for regen current on lift. It is probably a matter of advising users to set their systems safely for their front-wheel drive EVs rather than re-engineering the controller. Or configuring the system so that regen only cuts in on braking.

Constructive Destructive Testing

This points up one of the purposes of the Arizona Electrics - namely to stress-test new EV technology. Though I regret the damage done to the Probe (luckily driver

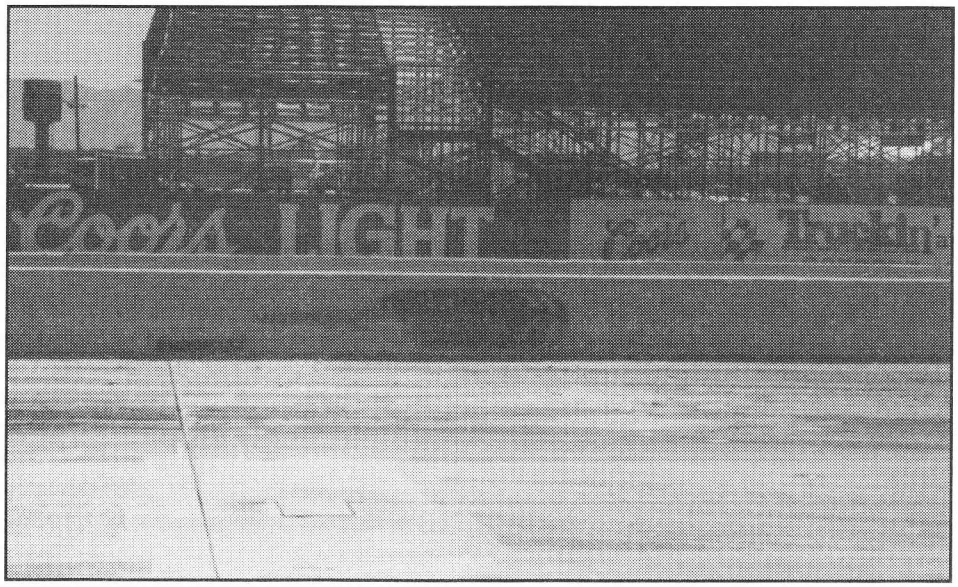
Mike Heath wasn't hurt), I am glad that this incident happened on the race track rather than the highway. In this case the demands of racing served to focus attention on a condition that might otherwise have remained vague and questionable. What happened to the SRP Probe may one day save lives on the highway, not to mention prevent unfavorable publicity from being generated that could damage the nascent EV movement.

I hope SRP does repair the Probe — it has been a valiant contender and deserves to be retired honorably even it doesn't race again.

Up Front About Regen

One thing that the EV community should NOT do is try to squelch discussion about safety aspects of front-wheel drive regen for fear that anti-EV forces will use them as ammunition. We need to openly address the issue, admit that there is a problem, not point fingers, and work together to solve it.

Similar issues about combining steering and drive wheels confronted the gas car industry when front-wheel drive was introduced. They resolved the problem and we can too.



Tire mark on outside track wall opposite Coors Tower showed where #90 hit. The strike on the outside suggests severe under-steer caused by loss of front-wheel traction.

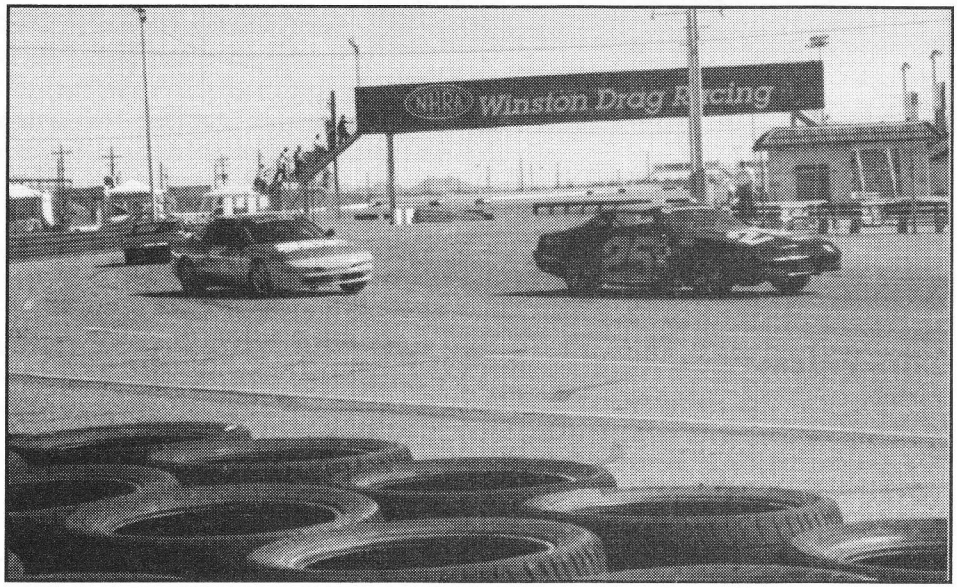
As always, CE welcomes other opinions and analyses. — **CB**

Sources:

UI Electric Vehicle Takes First Place at Arizona Electronics Race, March 22, 1999, University of Idaho

News Release

U.I MEDIA CONTACT: Jeff Olson, University Communications and Marketing,
(208) 885-8934 or e-mail to:
jolson@uidaho.edu
U.I STORY CONTACT: Don Sturtevant, Advanced Vehicle Concepts Team,
(208) 799-8744 or e-mail to:
stur2560@uidaho.edu



CE Photographer Roy Kaylor caught the Probe and the Camaro as they entered the tower turn during the stock event final. The Probe may have been undergoing heavy under-steer (plowing) due to front-wheel regen on accelerator pedal lift.

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, Hanger 20, 2701 Monarch St., Suite 146 Alameda, CA 94501

1999 Arizona Electrics Race Notes

North High School Helps Optimal Performance

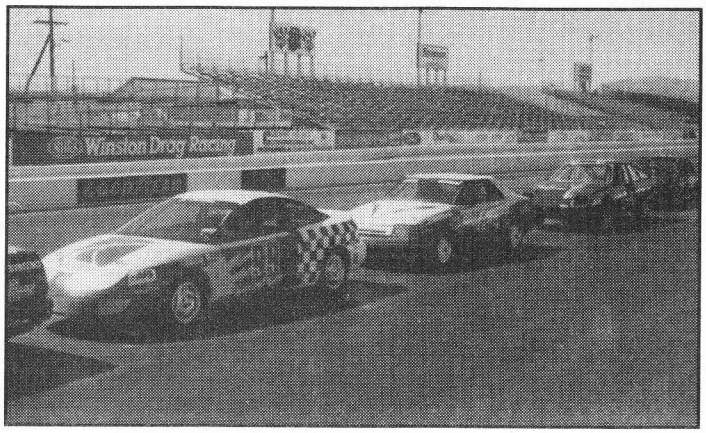
By Clare Bell

#13 was ready to join Saturday's stock practice, but as she was pulling out of the charging area, she lost power. The team initially thought that the problem was caused by an elderly circuit breaker which decided to undergo spontaneous self-disassembly when faced with nearly 300 volts of freshly charged Optimas. However, a check of the top rear battery box showed one battery with 200 + volts across it, showing that one was blown.

Paul Compton and Mike replaced the original circuit breaker with a large fuse, pulled the toasted Yellowtop out and replaced it with a fresh spare. Heading out for the final 3 laps of the second practice session, (which also served as unofficial qualifying round, the Porsche didn't even complete one lap before she died again. A quick tow into the garage revealed another yellow had blown its top. Both of these were originally from the front pack, which had seen some abuse from my infamous attempt to cross the San Mateo Bridge with only one pack (of a double string) fully charged.

This too was replaced with a spare - the spares were put on trickle-charge in the charging area, since both were weak in comparison with the healthy batteries (all the remaining ones, we hoped).

The fuse worked for practice, but the team really needed another breaker. Yours truly ran around badgering other teams to see if anyone might have a spare Heinemann 10K amp interrupt capacity in their back pocket. North High School, who had the superbly performing car #6, the Ford Escort EPX, couldn't take said item out of their back pocket, but did have one on the shelf at their home campus. I cadged a ride with North when they went to get some spare Trojans (they had melted down a terminal) and got the part as a loaner. The switch handle on theirs was broken, but between the spare breaker and the burned-out one, there were enough bits to make a good part. As a bonus and a thank-you, we'd be able to return the loaner to North with a working switch lever.



North High School of Phoenix Fielded the range EVent winner, #6 Escort (2nd car in lineup)

Incidentally, this was another example of the sharing and helping spirit shown in electric competition — this is one of the most wonderful and valuable things that has come out of EV racing and the Electrics.

Range Champ - North HS #6 Escort

The run from the track up to North HS also presented an opportunity to interview North and gather their recipe for winning the range event.

No secret, really. Their method consists of doing it and doing it and doing it. North ran in every event in the local EVTC electric series, including the Desert Valley Classic, the East Valley race and the others. By taking advantage of every opportunity to compete, they got the car and the team dialed to exceptionally high levels of performance.

There are some tech wrinkles that North has used to improve efficiency and range. The Escort doesn't have a clutch. Instead it has a direct dive to the transmission constructed by welding the splined end rod that would normally go into the clutch to a coupler which is bolted to the motor shaft. Shifting is done by rev matching, crashbox-style. With an experienced driver, this can actually work quite well. The car then behaves like a semi-automatic, with only two pedals to have to fuss with, the accelerator and brake.

The trans itself is a 5-speed gearbox running 30-weight oil rather than the usual 90-weight hypoid.

No duck feet or pigeon toes on this bird — the wheels point straight ahead with zero toe, which is the ideal for maximizing range on an electric. Tires are Yokos, filled to 35-45 psi, depending on ambient or expected air temperature (important in the asphalt-softening temps than can hit Firebird).

Though when sitting in the Optimal Performance shade tent in the breeze off the Gila River, one could almost image the climate as being livable - **CB**

EVents Calendar

April 18

EARTH.TECH.2000
"Finding Tomorrow's Solutions Today" A project of San Jose Beautiful. Sunday 10:00 a.m. thru 4:00 p.m. Civic Auditorium & Parkside Hall, San Jose, Califorina. For more information call the Expo Hotline: (408) 277-4664 or the Internet at: **www.earthtech2000.com**

April 23-24

Richmond Electric Vehicle Road Rally, organized by Richmond Technical Center. Web: www.rtp.net/~teaa/events.html

May 1

Carolina EV Challenge,
E-mail: ralphgoodwin@cplc.com
Web: www.rtpnet.org/~ev

May 22-29

NESEA American Tour de Sol, CT, MA, NY. Eleventh annual road rally and competition for 50 entries. Runs on secondary roads between Waterbury, CT and Albany, NY. Organized in part by NE Sustainable Energy Association. Contact NESEA at 413-774-6051 or nesea@nesea.org
www.nesea.org.

June 5

5th Annual San Francisco Bay Electric Auto Rally (SFBEAR). Tanforan Mall Parking lot in San Bruno just of El Camino Real 10 a.m. to 4 p.m.
SFPEAA, bj@bjharding.com

June 13-16

EnV '99, Ypsalanti, MI. Seventh Annual Environmental Vehicles and Alternate Fuels Conference & Expo Twelve sessions during a three day conference.

June 19-20 - 24

Hour Le Mans Endurance Race at Bugatti Road Circuit, Le Mans, France. Contact Auto Club De L'QUEST 33 2 43 40 24 00. Fax 33 2 43 40 24 88.

June 20-July 1

Sunrayce 99, Washington DC - Ocala, FL. Biennial road contest of solar cars making the rounds through Washington, Winchester, Linchburg, Research Triangle Park, Charlotte, Clemson, Atlanta, Macon, Tallahasse, and Ocala. 1-800-606-8881

July 24 - 25th

SOLWEST RENEWABLE ENERGY FAIR. Grant County Fairgrounds, John Day, OR. Check out the SOLWest site at: www.eoni.com/~solwest/
e-mail to: solwest@eoni.com

August 17-19

SAE Future Transportation Technology Conference and Exposition, Costa Mesa, CA. The FTT Conference will feature advanced transportation technologies that have the potential for making real, practical improvements in vehicle and highway systems. Contact: Karin Bolcshazy, SAE. (724) 776-4841, Fax (724) 776-6622, E-mail: karinb@sae.org

August 19-20

The Changing World of Industrial and Specialty Electric Vehicles, Orlando Florida. Conference sponsored by EPRI on electric off-road vehicle technologies . Discussions of applications of new technologies and exhibits of related products. Contact: Michele Samoulides, EPRI. (650) 855-2127, Fax (650) 855-2900.

September 18

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).
Website http://www.evcl.com/eaa-sv/
Contact: Will Beckett
BeckettW@corp.hp.com 650-857-3859

October 13-16

16th International Electric Vehicle Symposium and Exhibition (EVS 16), The 16th annual Electric Vehicle Symposium and trade show in Beijing, China will be hosted by EVAAP, CES and SEA-C.
86-10-6853-3347 Web: www.ces.org.cn
E-mail: evs16@ces.org.cn

November 18-19
North American Electric Vehicle and Infrastructure Conference (NAEVI), Atlanta, Georgia. Conference focuses on commercialization issues of electric and hybrid electric vehicles and EV infrastructure in North America. Contact: Pam Turner, EVAA. (650) 548-9464, Fax (650) 548-9764. E-mail: firstopt@aol.com

Year 2000

April 2-6

Future Car Congress, Arlington, Vergina. A government-industry conference focusing on a collaborative approach to the development of new automotive technologies. Discussion topics range from fuel cells to supercomputer applications and high-tech transportation workforce for the 21st century. Contact: Meeting Promotion, SAE. (724) 776-4841 ext. 7340. Fax (724) 776-1830. E-mail: rodman@sae.org

October 16-18, 2000

International Electric Vehicle Symposium, Montreal, Canada. EVS-17 will be hosted by the Electric Vehicle Association of the Americas.

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 EIN Publishing. If reprinted, please credit CE and Ruth Shipley.

Companies Demonstrate Milestone Fuel Cell

A Department of Energy (DOE)-sponsored program to develop automotive fuel cell technologies has achieved high efficiency and near zero emissions using a gasoline-powered fuel cell. By combining a Plug Power fuel cell stack and an Epyx Corporation multi-fuel processor, the program recently demonstrated an integrated fuel cell system that met the expected interim fuel utilization targets for achieving an overall 40% system efficiency. In addition, the system produced emissions levels well below the Ultra Low Emission Vehicle (ULEV) classification given to conventionally-fueled vehicles. Plug Power and Epyx plan to deliver a fully-integrated automotive fuel cell system at the end of the program that can power a full-sized car. The companies used low-sulfur gasoline for the most recent tests, and plan to also demonstrate operation on California Phase II reformulated gasoline, ethanol, methanol, natural gas and M-85, a blend of 85% methanol and 15% gasoline.
(PLUG POWER RELEASE: 5/20)

SwRI Engineers Develop Hybrid

Researchers at the Southwest Research Institute (SwRI) in San Antonio have developed a concept for a parallel hybrid vehicle configuration that they say is designed to be the most efficient hybrid powertrain design. The SwRI hybrid powertrain prototype uses a three-cylinder, one-liter internal gasoline-fueled combustion engine in conjunction with a 53-kilowatt (peak) AC induction electric motor and 24 lead acid batteries. Project engineers say the only comparable commercially-available hybrid powertrain is found on the Toyota Prius, which uses two electric motors. The SwRI hybrid operates in five modes: electric, in which the electric motor supplies power to the vehicle; charge, in which the gasoline engine operates at maximum power, with excess energy transferred to the electric motor by a planetary gear system; assist, in which the gasoline engine and electric motor both deliver power to the wheels; regeneration, which uses power from deceleration to charge the batteries; and, limp, which allows the vehicle to use the gasoline engine after the battery pack has lost the charge required by the electric motor.
(TECHNOLOGY TODAY: SPRING 1999)

INEEL Completes EV Performance Testing

The Department of Energy (DOE) recently announced its Field Operations Program at the Idaho National Engineering and Environmental Laboratory (INEEL) has completed baseline performance testing of the new General Motors EV1 and Chevrolet S-10 EV. Both of the vehicles feature nickel metal hydride batteries from Ovonic Energy Products. DOE said the EV1 is the first vehicle to have a range in excess of 200 miles. In addition, the S-10 EV with nickel metal hydride batteries traveled twice as far as the lead acid battery-powered S-10 model previously tested. The EV1 has a single charge range of 140 miles during the driving cycle test, 221 miles at 45 mph, and 161 miles at 60 mph. The EV has a charging efficiency of 2.7 m/kWh and a drive cycle efficiency of 5.6 m/kWh, and accelerates from zero to 50 mph in 6.3 seconds. The S-10 was able to achieve a single charge range of 95 miles during the driving cycle test, 131 miles at 45 mph, 88 miles at 60 mph, and accelerated from zero to 50 mph in 9.9 seconds. The pickup has a charging efficiency of 1.3 m/kWh and a drive cycle efficiency of 3.6 m/kWh.
(DOE RELEASE: 5/17)

India Tries Electric Auto-Rickshaws

City officials in Lucknow, India recently forced nearly 2,000 of the city's 5,000 highly-polluting, diesel-powered three-wheel taxis off the road in order to address the city's worsening air quality problems. While the pollution levels have dropped as much as 60%, the daily commute for city residents has gotten much worse. A bus service that was started to replace the convenient auto-rickshaws has yet to satisfy local riders. To help ease the situation, a state-run company has brought back 20 battery-powered taxis for a technological and commercial trial run. So far, commuters have been pleased to have their small taxis back. Scooters India, Ltd., which manufactures the taxis from parts imported from England, is currently seeking government subsidies and reduced taxes to help bring the price of the auto-rickshaws down to an affordable level. The battery-powered taxis cost $4,100, which is nearly double the price of the old, diesel-powered taxis.
(AP: 5/15)

Nissan to Develop Prototype FCV

Nissan Motor Company recently unveiled an early prototype fuel cell-powered vehicle that converts liquid methanol into electricity, and announced it has no plans to join either of the automotive industry's two big fuel cell vehicle (FCV) development alliances. While it won't rule out eventually joining a broader FCV research and development (R&D) project, the company said it plans to develop the fuel cell technology with its largest shareholder, Renault SA. Critics of Nissan's decision call into question the company's ability to assume the expense of commercializing and establishing the technology. A spokesman with Nissan's R&I center in Detroit said the company's fuel cell program has deeper roots than may be apparent. He noted that Nissan has worked on fuel cells with Ballard Power Systems since 1991. In addition, Nissan officials maintain that the company's current R&D needs can be financed out of cash flow, cash reserves and credit facilities. The company plans to develop a prototype with a more compact fuel cell system by early next year, and hopes to have a marketable FCV by 2003.
(WALL STREET JOURNAL: 5/14)

EVAA Hails Alternative Fuels Promotion Act

The Electric Vehicle Association of the Americas (EVAA) has voiced its support for

a recent piece of legislation that will provide incentives for the commercialization of EVs and other alternative fuel vehicles. The Alternative Fuels Promotion Act of 1999 was introduced by Senators John Rockefeller (D-WV), Orrin Hatch (R-UT), Richard Bryan (D-NV), and Michael Crapo (R-ID). The bill offers a 10% tax credit — up to $4000 a year until 2010 — to consumers who purchase EVs, including fuel cell-powered vehicles. Owners of vehicles with a 100-mile range between charges are eligible for an additional $5,000 tax credit. Currently, businesses are able to take advantage of a $100,000 tax incentive for the vehicle charging infrastructure. Under the act, a special tax deduction of up to $30,000 would be available for installing an EV charging system. To date, there are approximately 3000 EVs on U.S. roadways. (EVAA RELEASE: 5/11)

NECAR 4 Shows Progress

Car and Driver profiled the new Daimler-Chrysler NECAR 4 concept vehicle in its June issue. Writer Frank Markus noted that the company has made great strides since the introduction of NECAR 1 in 1994, a delivery van prototype that sacrificed the entire cargo area to the fuel cell drive system. The NECAR 4 is a compact based on the Mercedes-Benz A class vehicle that still has room for five passengers and some luggage, although Markus said DaimlerChrysler still hopes to trim about 650 pounds from the system before introducing a production model in 2004. The NECAR 4 also handles a little differently than a typical electric car, exhibiting a slight pause between pressing the acceleration pedal and movement. Markus noted the problem could have been addressed by using a battery or ultracapacitor, which DaimlerChrysler decided would be too heavy to include. The vehicle uses a methanol reformer to power the fuel cell. The NECAR 4 could use ethanol to directly power the fuel cell, but that technology still emits too many pollutants. The company faces hurdles in producing an affordable and clean direct-methanol fuel cell, including the formation of the necessary fueling infrastructure.
(CAR AND DRIVER: JUNE 1999)

K&W Introduces BC-250 EV Charger

Marion, IA-based K&W Engineering, Inc. has introduced its BC-250 model compact 4,000-watt EV battery charger. The BC-250 features a dual-mode, constant-current and constant-voltage charge profile, weighs 13 pounds and occupies about one-third of a cubic foot. In addition, the charger includes state-of-the-art high-frequency switching regulator circuits, is fully protected against short circuits, overload and reverse polarity, and is designed for in-vehicle mounting. The unit charges 72- to 160-volt direct current (dc) battery packs at a 20-ampere rate, with a charging voltage adjustable from between 90 and 200 volts dc. Constant current charging is adjustable to 20 amps with 200 to 240 volts of alternating current (ac) input, and to 10 amps with an input of 100 to 120 volts ac.
(K&W ENGINEERING RELEASE: MAY 1999)

Fuel Cells Will Be "Powerplant of Choice"

The AUTOFACTS Group, a division of the Global Automotive Practice of Price Waterhouse Coopers, recently released findings of its first-ever global powertrain study. The report, titled "Global Powertrain Strategies Study," includes ways the powertrain industry can successfully utilize global economies of scale in the face of regional market requirements, and the differences between the North American auto industry and that of the rest of the world. The study predicted hybrid and fuel cell-powered vehicles will not make major inroads before 2005, due in part to the low cost of gasoline. In addition, the group said fuel cells will be the "powerplant of choice" for future EVs. Internal combustion engines powered by traditional fuels will dominate the powertrain field in the near future, according to the study. However, advanced engine technologies show significant promise, including direct-injection engines, compressed natural gas engines, and EVs utilizing a parallel-hybrid design.
(PRICEWATERHOUSECOOPERS RELEASE: 5/12)

Toyota Touts Battery-Powered e-com

While some car manufacturers have moved away from battery-powered autos, others continue with promising results. Toyota has developed the e-com, a small two-seat, battery powered vehicle intended for use on college or business campuses and planned or retirement communities. The e-com is still in the research and development phase. However, Toyota is considering producing the vehicle and selling it for approximately $10,000, or less with federal and state incentives. The front-wheel drive e-com is equipped with a compact, permanent-magnet motor located directly between the front wheels producing 19 kilowatts of power (25 HP). It has a maximum torque of 80Nm (60 lb/ft.). Its top speed is electronically limited to 62 mph and the e-com has a regenerative breaking

system, which contributes to the 60-mile range. It uses a single, sealed battery pack made up with 24 dry-cell nickel metal hydride batteries that produces 288 volts of direct current electricity. The e-com can be charged with either a 110-volt conductive system or the newly designed MagneCharge system, a 220-volt inductive system designed by Toyota and General Motors.
(TOYOTA RELEASE: 4/26)

Australia Develops Hybrid

Australia's Commonwealth Science and Industry Research Organization (CSIRO) recently joined with 60 Australian-based companies to develop a multi-million dollar hybrid electric concept car that could cut motorists' fuel bills in half. The HEV will be built by aXcess australia, and will feature gasoline/electric powertrain technology from CSIRO. The HEV will have a small conventional internal combustion engine that will power a generator to produce electricity for an electric traction motor which will drive the rear wheels. The electricity will be stored in a surge power unit. The car will be aXcess australia's second concept vehicle. The company's first concept car cost $13 million to build and recently completed a 15-month tour of the world's car makers and major suppliers.
(ASIA PULSE: 5/5)

DE4 Develops Chassis Manufacturing Process

Design Evolution 4, Inc. (DE4) of Lebanon, OH said it has successfully developed a manufacturing process that uses high strength composite structures to produce a complete single piece chassis for the Solectria Sunrise. DE4 said the chassis is a one piece, bumper to bumper FRP composite unit—the largest single piece automotive composite structure to be made in the U.S. The chassis weighs 180 pounds and varies in thickness from 3/8-inch solid laminate to .100-inch thick lightweight sandwich core sections. To produce the chassis, DE4 developed an all-new multiple injection port system whereby one person operates the entire process from a master flow board. The process is called a sequential multi-port resin injection manifold system. The company claims it can make a complete 16-foot chassis in 7 to 9 minutes. The Sunrise is a four-passenger sedan powered by nickel-metal hydride batteries that can reach 204 miles on the higher fuel economy test and 151 miles on the urban driving schedule, with combined city/highway driving at 179 miles.
(DESIGN EVOLUTION RELEASE: MAY 1999)

Toyota Introduces Hybrid Minivan

Toyota Motor Corporation recently announced it will unveil the world's first hybrid electric minivan next year. The new Estima will be powered by a hybrid propulsion mechanism, and will come equipped with either a 2.2-liter or 2.4-liter engine. The company said the hybrid propulsion mechanism featured in the new Estima will provide greater power than Toyota's Prius hybrid electric passenger car, due to various innovations it has added to the motor and a special transmission mechanism. Toyota has been marketing the Prius hybrid car since December 1997. The company decided against making a second hybrid electric sedan because "releasing a second hybrid car at this stage would end up making it and the Prius compete with each other." The Prius has a fuel economy of 28 kilometers-per-liter of gasoline, which is more than twice that of conventional gasoline-powered cars with a 1.5-liter engine. Toyota also announced plans to unveil a hybrid sport-utility vehicle during the Tokyo Motor Show later this year.
(KYODO: 5/1)

Tests Show Efficiency of EVs

The Southern California Edison Electric Vehicle (EV) Technical Center recently conducted road tests of gasoline- and electric-powered versions of the Ford Ranger pickup and the Toyota RAV-4 sport utility vehicle. The tests showed the EVs had about 60% better fuel economy than their gasoline-fueled counterparts. Researchers at the Center conducted the source energy efficiency tests over five days, keeping conditions identical for all vehicles. The tests found the electric RAV-4 got 38.1 mpg equivalent, compared to 22.8 mpg for the gasoline RAV-4. Over 15,000 miles, fueling costs would be about $177 for the electric RAV-4, compared to $595 for the gasoline version. The electric Ford Ranger attained 27.69 mpg equivalent, compared to 16.95 for the gasoline Ranger. The electric Ranger would cost about $243 to fuel over 15,000 miles, while the gasoline version would cost $799. Testing indicated that the RAV-4 EV would save the equivalent of about 264 gallons of gasoline annually, while the electric Ranger would save 343.
(CURRENT: VOL. 4 ISSUE 2)

Edison EV to Cease Operations

Edison EV recently notified its customers that it soon will cease operations. The company, an arm of the Los Angeles-based utility Edison International, distributes the Magne Charge inductive charger for General Motors. "Edison International has decided to exit the charger and infrastructure supply business," said Edison EV president Diane Wittenberg. She added, however, that Edison International will continue to support the EV industry in part by continuing to expand its own EV fleet. Bob Purcell, GM's chief of advanced technology vehicles, said the company's operations will continue in the interim. "GM remains fully committed to its EV customers and the EV industry, and is currently working with [Edison EV] to smoothly transition to another infrastructure provider with the same capabilities and levels of service." Some are speculating that the Sacramento Municipal Utility District or CSW Southwest of Texas and Oklahoma will take over the Magne Charge business for Edison EV.
(FLEETS & FUELS: 4/26)

Honda Halts EV Plus Production

Honda recently announced that it has stopped production of its battery-powered electric vehicle (EV) the EV Plus. In stating its preference for developing other advanced vehicle technologies, such as fuel cells, the Honda announcement could signal a move away from battery-powered vehicles by the auto industry as a whole. The announce-

ment also triggered a response at the California Air Resources Board (CARB). "We're highly disappointed in Honda," said CARB chief deputy director Tom Cackette. "We are concerned that this violates their agreement with the board to continue to produce battery-electric vehicles if customer demand warrants it." Honda insists that the EV Plus has lost its value as a research tool, and that it had trouble generating consumer interest in the EV. "[We] don't believe we are in violation," said Honda spokesman Art Garner. "The program has met both the letter and the spirit of the agreement. Our commitment was to lease 300 vehicles over three years, and we've done that." Most of the EV Plus leases were with government agencies and business fleets, who are required to use low-emission vehicles.
(LOS ANGELES TIMES: 4/29)

Red Tape Delays Australian release of the Toyota Prius HEV

A DESIGN rule hitch threatens to delay the Australian release of the oyota Prius, the world's first mass-produced green vehicle. Toyota Motor Corporation Australia had hoped to launch the hybrid sedan as early as May next year. Those plans are now on hold as Toyota attempts to resolve Australian Design Rule requirements for the Prius. The problem, which came to light only a couple of weeks ago, relates to the vehicle's regenerative braking system.

TMCA senior manager for environmental products Peter Evans said that if the braking system had to be altered to comply with Australian requirements, the car's introduction would be delayed by at least six months. The car is due to go on sale in Europe and the US about the middle of next year. Mr Evans hopes that Federal Government proposals

to bring Australian compliance guidelines closer in line with Europe's could work in the Prius' favour.

The hiccup has forced TMCA to postpone plans to bring a Prius road show to WA later this month. Six of the cars were due in Perth for evaluation on April 19. Instead, TMCA will send one car to Perth for Auto Expo at the Burswood Dome from April 22-26. The road show will not come to the West until the design issue is resolved.

The Prius, a Corolla-sized sedan which uses a combination of petrol and electric power, went on sale in Japan in December 1997. More than 20,000 have been sold. Using a conventional 1.5-litre engine and a 30kW electric motor, the fuel miser can cover up to 25km on a litre of petrol.

The Prius produces only half the carbon dioxide and about a tenth of the toxic exhaust emissions of a similar-sized conventional car. The Prius is expected to cost about $35,000 when it does go on sale here but Mr Evans said that figure depended on what support TMCA received from the Federal Government. Canberra has indicated it is prepared to offer incentives for green vehicles but Toyota is concerned that, despite its technology, the vehicle would lose much of its appeal if it is not priced correctly.

Later this year, Honda will begin producing a hybrid car which could be available in Australia late next year. Hybrid vehicles are seen as the next step forward to reduce greenhouse gases and toxic emissions. They are likely to be superseded next decade by hydrogen power via fuel-cell technology.

http://www.margaret-river-online.com.au/twah/index.html
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E-mail: spcorn@pacbel.net -or- ebeaa@juno.com
60 Alan Dr., Pleasant Hill, CA 94523-1902
Meetings: 4th Saturday/month, 10:00am (call for Nov-Dec date)
2701 Monarch St., Hangar 20, Room 215
Alameda Point, Alameda, CA (old Alameda Naval Air Station)
From Hwy 880, take Broadway turnoff to Webster St.; from Webster, go through the tube to Atlantic, right on Atlantic to the old Alameda Naval Air Station

Los Angeles EAA

Saxe Dobrin, President (310) 453-1531
1630A Franklin, Santa Monica, CA 90404
Meetings: 1 st Saturday 10:00 am
Cal Tech, Winnet Lounge, Pasadena, CA

NORTH BAY EAA

Chuck Hursch, President (415) 927-1046
13 Skylark Dr. #13, Larkspur, CA 94939-1270
Email: gandhi!chuck@uunet.uu.net
Homepage: www.ecoalliance.com/nbeaa/
Meetings in Santa Rosa, CA: Call (415) 927-1046 for time and exact location.

SAN FRANCISCO/PENINSULA EAA

Jean Bardon, Acting President (650) 355-3060
540 Moana Way, Pacifica, CA 94044
Homepage: www.geocities.com/MotorCity/1759
Meetings: 1st Saturday/month, 10 a.m.
San Bruno Public Library.
701 West Angus St. (at El Camino)
San Bruno, CA

SAN JOSE EAA

Michael Thompson, Pres., Contact Person (408) 997-2404
E-mail: m.t.thompson@ieee.org
US Mail: Roy Paulson, 1592 Jacob Ave. San Jose, CA 95118 USA
HomePage: http://members.aol.com/sjeaa Tel. 408-269-7937
Meetings: 2nd Saturday/month, 10:00 am (call to confirm), Reid Hillview Airport, 2350 Cunningham Ave. San Jose. (Hwy 680, Capital Expressway (South), right onto Cunningham)

SACRAMENTO ELECTRIC VEHICLE ASSOCIATION

Tim Loree, President (916) 962-3044, (916) 568-3100 ex 2833
2428 Wisconsin Dr. Citrus Heights, CA 95610-7432
E-mail: Loreet@2extreme.net
Meetings: Call Tim for new meeting time, place and date
HomePage: www.calweb.com/~tonyc/sevahome.html

SAN DIEGO ELECTRIC VEHICLE ASSOCIATION

Scott C. Kennedy, President, (619) 658-4152
1621 San Elijo Ave., Cardiff, CA 92007
Meetings: 4th Tuesday/month, 7pm
San Diego Automotive Museum
2080 Pan American Plaza,
San Diego, CA.

SILICON VALLEY EAA (Founding Chapter)

Will Beckett, Pres., Contact (650) 494-6922, fax (650) 852-8384
4189 Baker Ave, Palo Alto, CA 94306
HomePage at http://www.geocities.com/MotorCity/1754/
Meetings: 3rd Saturday/month, 10:00-12:00 am
Hewlett-Packard, Santa Clara facility
5301 Steven Creek Blvd.
Santa Clara, CA
(Lawrence Expressway and Stevens Creek)

COLORADO

DENVER ELECTRIC VEHICLE COUNCIL (DEVC)

George Gless, President (303) 442-6566
2940 13th St., Boulder, Co, 80304
Meetnigs: 3rd Saturday/month. Contact George for time and location

MASSACHUSETTS

NEW ENGLAND EAA

Tony Ascrizzi, President (508) 799-5977
34 Paine Street, Woercester, MA 01605
E-mail: tonyascrizzi@juno.com
Meetings: Every 3rd Saturday 2:00 p.m. (call for directions)
HomePage:www.norfolk-county.com/users/ws3f/neeahome.htm

PIONEER VALLEY

Karen Jones, President (413) 549-4999, (413) 253-1633
P.O.Box 153 Amherst, MA 01004
Meetings: 3rd Saturday/month (Jan.-Nov.), 2pm
Jones Library (Amhurst Rm), Amherst, MA

MISSOURI/KANSAS

MID-AMERICA

Bruce Edgeworth, President (816) 524-4734
Mike Chancey, Treas., 1700 East 80th St. Kansas City, MO 64131
E-mail: Mike Chancey evtinker@hotmail.com (816) 822-8079
HomePage at http://www.geocities.com/MotorCity/Downs/4214/
Meetings: Contact Mike for meeting time and location.

NEVADA

LAS VEGAS EAA

William Kuehl, President (702) 645-2132
4504 W. Alexander Rd. North Las Vegas, NV 89030
E-mail: billk@anv.net
Meetings: call (702) 642-4000 for time and place.

NEW MEXICO

ALBUQUERQUE EAA

Neil Wicai, President (505) 899-8420
19 Santa Maria, Corrales, NM 87048
E-mail: neilwicai@upaznm.com
Meetings: 1st Tues/month, 7:00 PM
Shoney's Restaurant, 6810 Menaul NE,
Albuquerque, NM

NORTH CAROLINA

TRIANGLE EAA

Jerry Asher, Contact Person, (919)403-8137
4 Melstone Trun, Durham, NC 27707
Meetings: 2nd Tues 3:00 PM, odd months
Conference Room, IEL Lab, Centennial Campus, NC State University (call Jerry Asher for details)
Email teaa@rtpnet.org
HomePage: www.rtpnet.org/~teaa/

SOUTHEASTERN EVA

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

TEXAS

HOUSTON EAA

Ken Bancroft, Contact Person, (713) 729-8668
4301 Kingfisher St., Houston, TX
Meetings: 3rd Thursday each month 6:30PM
Citizens National Bank - Activity Center
5217 Cedar St., Bellaire TX (Take Bellaire exit off West 610 Loop go west on Bellaire about 1 mile to Ferris, turn right one block to Cedar, Activity Center on right)

NORTH TEXAS EAA

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

UTAH

WEST VALLEY CITY EAA

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

VIRGINIA

CENTRAL VIRGINIA EAA

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

WASHINGTON

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

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

SEATTLE EVA

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

WASHINGTON DC

ELECTRIC VEHICLE ASSOCIATION OF WASHINGTON DC (EVA/DC)

Dave Goldstein (President) (301) 869-4954
9140 Centerway Road, Gaithersburg, MD 20879-1882
E-mail: goldie.ev1@juno.com
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. 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)

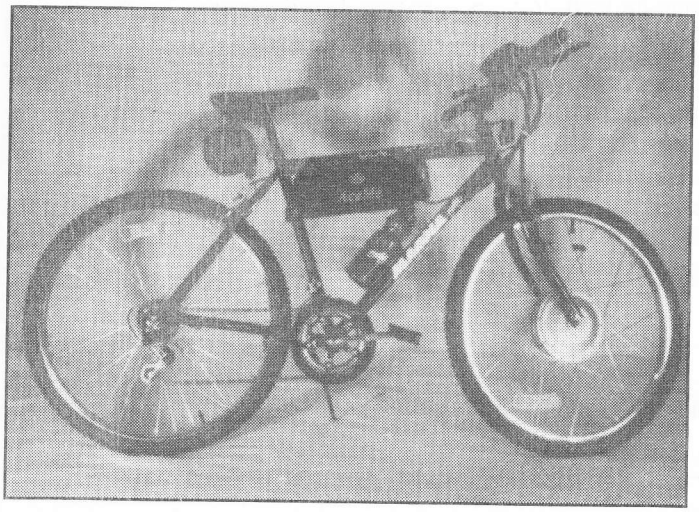
EAA Chapter List

Chapter contacts and meeting locations. Most verified as of 3/1/99. For information about the Electric Auto Association, call 1-800-537-2882

- FOR SALE -
MEMBER WANT ADS

73 Mazda PICKUP. Flared-fendered, low-slung, former rotary. Leather interior. NEW Trojan T125 batteries, and factory refurbished on-board 110 VAC charger. Electro Auto deluxe 108 V conversion kit. In-dash gauges. Functional space because batteries are under bed and hood. $7400 Call 831-688-0144 and come see it near Aptos.

WANTED! Used Doran fiberglass body, and building plans with parts list, for the 3 wheeler electric car. Contact: Ervin N. Larsen, 1920 - 19th Ave., SW. Willmar, MN 56201, 320-235-2461



Saturn Electric Bicycle System. Direct drive Includes: Pre-assembled disk motor with 24" or 26" rim and tire; Controller; Portable battery pack with bag; and Battery charger. Up to 15 mph and 15 miles per charge. Introductory $349 (MSRP $399). Educational and institutional programs available. 30 minutes to retrofit. www.choicemall.com/aceme. Fax 916-386-3518.

Snow Blower for E-15 GE ELEC-TRAK, included rear counterweight attachment, spare motor & controller. $500. + shipping. Mark Hanson 540-473-1248. 184 Vista Lane, Fincastle, VA 24090

For Sale: 1983 Bradly GT II. New General Electric Motor, New Michelin Low Resistance Tires, All New Interior Carpet! 18 US 2300 Batteries, Curtis 220/110V 25A Charger, onboard 110V Charger, Disc Brakes, Koni Shocks. Maximum Speed 86 MPH. Price $10,000. Call Bob Lombardi (408) 629-1263 / chiplom@aol.com

Wanted: Electric Bike and/or electric bike kit or components, used or new. Also folding bike, also want gasoline Toyota 4x4 pickup. Call Joel (510)881-5400

1984 Pontiac "Fiero" A "Cherry!-white" 9" Advanced Motor - Curtis PMC Controller, 16 "NEW" 12 Volt Trojan Deep Cycle Batterys - 96 Volt System, Volt and Amp meters - on board charger - New L.R. Tires. A show car - Includes near new tow dolly. $6,250. Albert Ryan 5369 Lilac Ave. Livermore, CA 94550-1219 925-447-5369

For Sale: Books "The EV's Are Coming" by Al Smith # 970, 1999 edition @ $7.95 ppd. POB 180192, Coronado, CA 92178, (enclose check).

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 each 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) 864-2093. 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 137
Alameda, California 94501

Electric Auto Association (EAA)
Membership Application

New Member: ._____ USA: ._____ Note: EAA membership dues are
Renewal: ._____ Canada: ._____ tax deductible in the USA
Other Country: ._____ as allowed by the IRS.

Date: .____/____/_____

Name: ._____ Company: ._____
Street: ._____ Phone: . Hm-_____ Wk-_____
City: ._____ Fax: ._____
State: ._____ Zip:_____ 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

Send order to:

EAA Store
5820 Herma St.
San Jose, CA 95123-3410

Name _____ Phone _____

Address _____

City _____ St, _____ Zip _____

Item #	Size/Color	Quantity	Item Description	Unit Cost	Amount

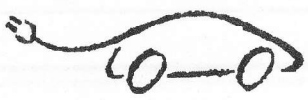
Subtotal	
Postage (10% of subtotal, for USA*)	
Handling	$2.00
Total	

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

ELECTRIC AUTO ASSOCIATION

P.O. Box6661, Concord, CA 94524

• Address Correction Requested •



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NON-PROFIT ORGANIZATION U.S. POSTAGE PAID SUNNYVALE CA PERMIT NO. 420

55 P3

• Time Dated Material - Please Do Not Hold •