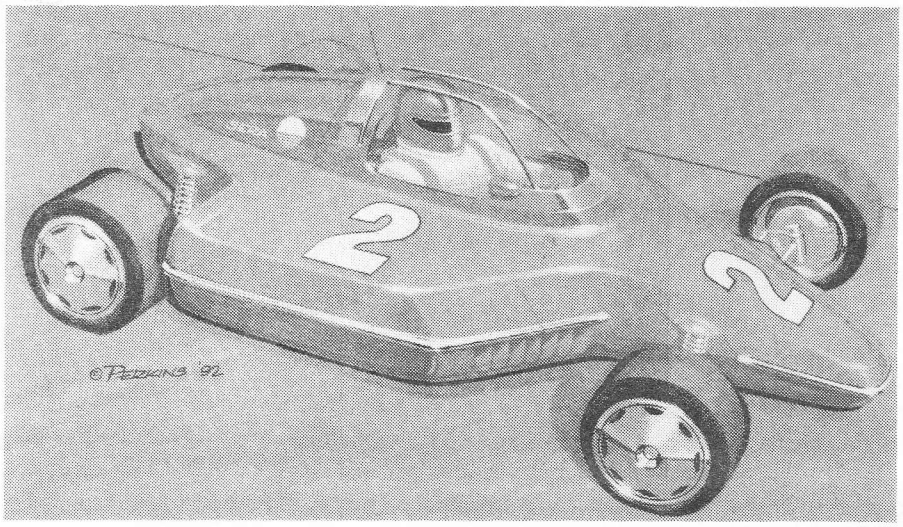
ELECTRIC AUTO ASSOCIATION

CURRENT EVENTS

August/September 1992 | Promoting the Use of Electric Vehicles Since 1967 | Vol. XXIV No. 5

EV Racing Chassis Debuts



The Solar & Electric Racing Association (SERA) founder of the APS Solar & Electric 500 in Phoenix, Arizona, has designed a new class of electric racing vehicle designated the "Formula Lighting".

These racers will be built and certified, in rolling chassis form, under the auspices of SERA, each indentical in every detail, less motor, controllers and batteries. Thus, these cars provide a "level playing field" via the identical platforms, for motor, controller and battery companies to demonstrate the capabilities of their products, in the various races that SERA promotes and organizes in major cities and market areas.

In addition, the Formula Lightning program will provide electric vehicle product manufacturers and suppliers an unparralleled opportunity to showcase their products and technology to high level government, industry and business leaders, plus major media in the electric vehicle arena.

The Formula Lightning racers are scheduled to be available for lease or purchase August 1, 1992 and will tentatively appear at the Charlotte Motor Speedway September 10-13th. One "Lightning" may appear at "SEMA," Las Vegas, November, 1992, and there will certainly be many at next years "APS Solar & Electric 500," March 4-7, 1993.

Interested parties, please call for additional details and a complete package of information. (602) 953-6672 FAX:(602) 953-7733 ❖

Lola Goes EV Racing

ZERO is the acronym for Zero Emissions Racing Organization, a British company who expects to have its first prototype electric racing car ready for testing by September, 1993. Headed by individuals well-known in UK racing and auto circles, participants include Lola Cars and its founder Eric Broadley, who will be responsible for building the chassis, and Zytek Systems who will develop the car's electronics, motors and batteries.

As a spokesman for Lola Cars said: "Environmental issues are not going to go away, so the sooner we seriously investigate the technology of zero-emissions racing cars, the stronger our position will be when 'green' pressures really start to bite."

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Editor's Corner

Electrifying Performances

In past editorials I documented a market size of a minimum of 28 million for a present technology EV, (even with less performance than gasoline cars) as long as they were equal or less in cost. Of course we know that a used car conversion can cost less than a new car does.

In the last editorial I stated that the public, for the most part, did not want a wimp-mobile. That if EV's could give equal performance to a gas car, then they would be willing to consider if its range would meet their needs. It was pointed out that our conversions would accelerate better if we used a higher voltage system of lighter weight (smaller capacity) batteries. This is what GM did in the Impact as a totally new design and what Alan Cocconi has done with a Honda CRX conversion.

The July Popular Science *and July* Motor Trend *documents Alan's 0-60 MPH time as 7.5 to 8 seconds and the South Coast Air Quality Management District certified a distance of 130 miles at freeway speeds in the LA basin. Both Alan's and GM's cars use 300+ volt systems and thus use only about 20 amps at 55-60 MPH. So both GM. and AC Propulsion (Alan's company) have proven that EV's can perform and give a good range (though maybe not at the same time. [this is the case with gas cars also as their mileage drops if hot rodded]).*

These use AC motors and controllers that are not stock items for sale,-yet. But using off the shelf parts, REAL racing at speeds in the 80's and 90's took place at Phoenix in April. And after the race another feat was accomplished. MaryAnn Walpert who had just completed her VoltsRabbit conversion a week before the race decided to save the towing cost from the Santa Cruz area (where it had been delivered after the race) to her home in Belmont. She conquered a 15 mile, 1800 foot mountain freeway hill climb with a total of about 35 miles with a warm controller, an almost cool motor, speeds equal to a VW bus and energy to spare. She recharged in San Jose and continued on to Belmont, realizing that she could have driven faster.

This too demonstrates that performance is achievable, even in our conversions. And all this using good old lead-acid batteries. These, of course, are being improved. GNB's "Pulsar", BAT Technologies catalyst and the soon to be Electrosource new battery will obviously improve all aspects of EV use.

Good performing EVs show that there can be a **carrot** *as well as a* **stick** *to help get the public to accept EVs. They are NOT just spinach that is to be tolerated because they are good for us, as a scurrilous and ignorant writer in Car and Driver said recently. They can be fun and clean and good for the world at the same time.*

As I write this, the newspapers are reporting that the fraction of gas cars contribution to air pollution has been woefully underestimated. Instead of 1/2, several studies that actually measured emissions of cars driving by (a reality check—not just computer projections) show it to be upwards of 2/3 or more. This is the ***stick and performance is the carrot.*** *Now on to convincing the public of these facts.*

Nothing will have the effect that full Indy 500 racing will. It is too bad that Larry Burton has not made it to Indy—yet. But word from Ernie Holden of Solar and Electric Racing Association is that there were two engineers at the April Phoenix race from the best known name in chassis builders who are planning to enter cars in the '94 Indy 500. They are starting now on the work. *(See Page 1.)*

I wonder how the Car and Driver writer will like his spinach (or crow) when an electric is entered in the Indy 500 line up by Lola, the World's biggest name in race car builders. Pb-editor

Submissions

If you would like to submit an article for Current EVents—the *preferred* form is on a floppy disk, formatted for DOS (Ascii Format) along with a printed copy of the article. *Any form is acceptable.* Also include camera-ready photos or graphics or include TIF formatted files with your copy. Please send to Paul Brasch, Editor (see address below.)

Advertisements

If you would like to submit an ad, please contact Susan Hollis/PCTEK at (408) 374-8605 or Paul Brasch at (408) 371-5969 between 10-5pm PT for additional information and rate sheet.

New Members

If you know someone interested in becoming a new EAA member, they may call EAA @ 800-537-2882 for a brochure and membership application. As a non-profit organization, the membership fee of $35 is tax deductible.

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Thank you to all contributing authors and members who submitted letters.

Notes about Three-Phase Controllers

By Daniel Pliskin

If you were to take a permanent magnet DC motor, pull out the brushes and turn it inside out, so that the magnets were on the rotor (rotating part) and the coils were on the stator (stationary part), you would have something very similar to a DC-brushless motor. The efficiency would go from about 80%, for the split-commutator motor, to roughly 96%, for the DC-brushless motor.

In some respects, this is cheating. The inefficiency of commutation, done by brushes in the split-commutation motor, has not been included in the efficiency figure for the DC-brushless motor. But at least we learn that commutation contributes to the majority of the inefficiency in a split-commutator, permanent magnet DC motor. On the other hand, the efficiency of a 3-phase motor speed controller, which does the commutation for the DC-brushless motor, can easily reach 99%. You just have to throw money, in the form of FETs (or one of the bipolar technologies), at lowering the voltage drop across the drivers. This brings the efficiency of the 3-phase controller/DC-brushless motor system, to a respectable, 95%. There are few other areas in electric vehicles, where you can expect a 15% increase in efficiency.

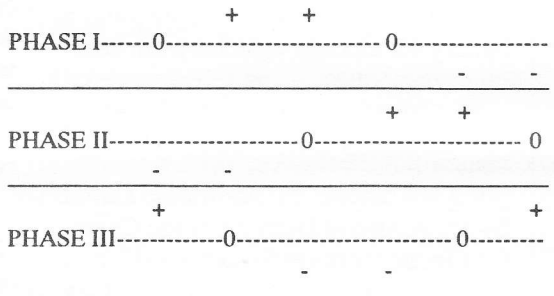
Clearly, there are additional costs in building both the DC-brushless motor and the 3-phase controller. Rare earth magnets, used in DC-brushless motors, are expensive. Three-phase motor speed controllers are significantly more sophisticated than controllers used for split-commutator motors and use six times as much silicon (FETs, or bipolars) in their three half-bridges.

With so few commercially manufactured 3-phase systems being sold, the majority of the cost of 3-phase motors and controllers is, still, due to amortizing research and development efforts. As an R&D engineer, I can't fault them for wanting to get paid for their work.

While there is much controversy over which 3-phase motor is best suited for a particular application, the controllers that drive these motors are essentially the same.

Three-phase controllers generate three pseudo-sinusoidal outputs that are 120 degrees out of phase with each other. By sequentially driving the terminals (I, II and III) either up to battery +, letting them float or driving them down to battery -, the 3-phases are generated (see the diagram below).

One Cycle of 3-Phase Outputs



There are as many pairs of magnetic poles on the rotor as sets of 3-phase windings on the stator (6 windings per set). The controller sequentially energizes the stator windings, creating an electrically "rotating" magnetic field which mechanically pushes and pulls the rotor poles around. As such, 3-phase motors are synchronous motors and the controller needs to "know" where the poles on the rotor are, in order to keep the stator poles "rotating" in sync with the rotor.

Each cycle of the three-phases is generated in six stages, as seen above. Three shaft position sensors (usually hall effect), "tell" the controller when it is time to electrically advance the stator to it's next stage.

Unlike stepper motor controllers, which control the RPM of the motor by directly controlling the frequency of the controller's outputs, 3-phase controllers control the power that goes to the motor by pulse-width-modulating the 3-phase outputs.

The circuitry that advances the stator poles, runs independently of the pulse-width-modulation section of the controller. It decodes the shaft position sensor outputs, directly, and encodes it into one of the six stages of 3-phase. The "rotation" of the stator poles is advanced when the shaft position sensors indicate that the rotor is in position for the stator poles to advance.

In open loop operation, the motor speed is, simply, controlled by how much power is to be used to drive the motor. In a vehicle, the accelerator acts much like that of a gas car. Alternatively, however, in closed loop operation, the RPM of the motor is compared with the output of a tachometer circuit. The controller uses that error signal to supply whatever power is needed (short of current limit) to maintain that motor RPM. This makes the vehicle's accelerator act something like a cruise control, where the accelerator position corresponds to a specific speed. **A major advantage of closed loop operation, is that it allows for controller configurations that regeneratively charge the batteries when the driver eases off of the accelerator.**

It may well be that the revolution in motor technology, is being lead by an ongoing revolution in the components that make up motor speed controllers. The power density of FETs is getting better every year and IGBTs have come of age. Several 3-phase controller chips are already on the market. Motors and controllers that, now, we can only ogle, will soon be common place. ❖

Daniel Pliskin is an electronics consultant and motor speed control designer who lives and works in Palo Alto, CA.

End of Innocence

By Shari Prange

Electric Racing was forever changed one hot April Sunday at Phoenix International Raceway. It happened just past the grandstands.

It was the final event of the Solar & Electric 500. The lead car, number 99 from Solectria, began to tail a smear of yellow-red fluid and vapors. It spun and came to rest not quite off the track. Driver James Worden struggled out of the car and collapsed on the ground.

It was a "snapshot moment", like the assassination of JFK. All evening, conversations would begin with, "Where were you when. . .?"

The other cars stopped and sat motionless, a still life painting of a race. Soon they retreated to the garages, yielding the track to ambulances and fire engines. The stands and infield were evacuated. Worden was flown by medevac chopper to the hospital.

Rumors ran wild: exploding batteries, deadly gas, Worden severely burned, pavement melted, and so on. It was almost a week before calmer, more factual reports filtered through. Worden was released from the hospital in a few days with no burns and no lasting damage. The track surface was undamaged. There was no explosion, just a leak.

Now that the drama and bromine have dissipated, it's time to dispel the cloud of potentially toxic questions which linger in the air.

First, what really happened, and how dangerous was it? The Solectria car was using zinc/bromine batteries. In simple terms, electricity is stored by plating zinc onto a surface, then discharged by unplating it. The electrolyte, which is almost 80% water, is stored in a tank and must be continuously circulated by a pump for the battery to operate. During the race, one of the hoses became disconnected and leaked the bromine fluid, some of which vaporized on the 130 degree pavement.

Pure liquid bromine is extremely toxic. However, the battery uses a "complexed" bromine solution which significantly reduces the emissions of vapors. Phillip Eidler of Johnson Controls, manufacturer of the battery, said the fumes are comparable to ammonia fumes: irritiating to the lungs and extremely unpleasant, but not dangerous unless inhaled in concentrated amounts. Eidler himself was on the track within minutes after the incident, puring baking soda on the spill to neutralize it just as you would for a lead/acid battery spill.

The zinc/bromine battery has been under development and testing by Johnson Controls for several years. It is intended as a load leveler for utilities and home solar power systems, and a battery for electric vehicles from commuter cars to busses and delivery trucks.

The Texas A. & M entry also used zinc/bromine batteries, which were supplied by S.E.A. of Australia. David Swan, Assistant Director of the Center for Electrochemical Systems, said their car experienced no problems, and they still regard zinc/bromine as a promising technology.

The questions raised by this incident quickly extend beyond his specific battery, car, or race. What is the role of electric car racing? One role is to provide an exciting positive showcase for electric vehicles. Should racing then limit itself to proven "safe" technologies? Is there a "safe" technology in any car—electric or combustion— or are there only shades and flavors of danger? Where should racing draw the line?

Another role of electric racing is to spur the development of new technologies and be their proving ground. This is a heritage of racing in general. As Swan pointed out, the firewalls we now have in all our cars were developed in response to early racing accidents.

Perhaps separate racing classes would be appropriate: a "showroom stock" class, and a class for experimental or racing technology. Race organizer Ernie Holden said different classes are being considered for future events.

Racing is by nature dangerous, and drivers accept. that risk knowingly. As electric racing matures and speeds increase, there will be accidents and injuries. Safety precautions will have to grow along with the technology and performance of the cars, but there will always be some risk. Accepting risks is the way humanity explores the edges of its potential.

Not all risks are acceptable. It is not acceptable to endanger spectators. According to Johnson Controls, the incident in Phoenix did not pose any threat to spectators. However, it did raise the issue of the potential threat, which needs to be addressed in the future racing rules.

Many procedures can minimize risks. Ambulance and fire crews were on site and properly briefed for the race. "The emergency crews did exactly what they were supposed to do," said Holden.

Mike Brown of Electro Automotive was in the pits and one of his team's cars was right behind Worden when the spill occurred. said Brown: "I knew there were zinc/bromine batteries in the race, but I knew nothing about how they worked or what to do in an accident. Better safety briefings are definitely needed, especially on exotic technologies." Holden agreed that more detailed information on possible hazards should—and will—be disseminated to all track personnel and driving teams.

What rules should apply to the batteries themselves? Both Worden and driver Tim Considine agree the batter-

(Continued on Page 6)

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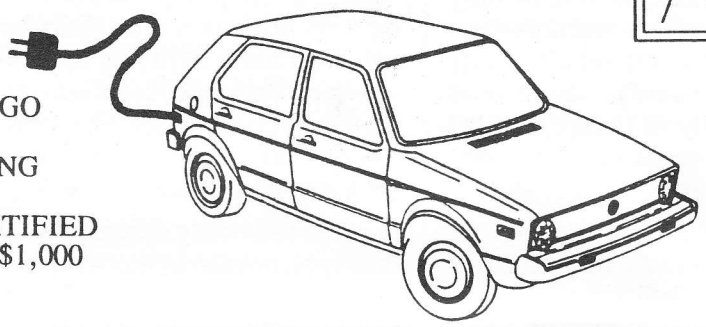

A bolt-in conversion kit for VW Rabbits--no design, welding, or fabrication necessary. This kit was designed by conversion authority Michael Brown. He has 13 years of professional electric car experience and 27 years of professional automotive experience–a background no one else in the electric car industry can match–and it shows. You don't need to have the expertise, because it's included in the kit. Detailed instructions are photo-illustrated. The complete conversion can be done in four days.

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End of Innocence

(Continued from Page 4)

ies—any batteries—should be contained and isolated from the driver.

What should tech inspections include? What are the qualifications of the inspectors? Holden plans to bring in qualified independent parties to assess the safety issures specific to exotic technologies. Teams will be required to submit detailed plans of their cars, especially the battery systems, well in advance of the race.

Professionalism is another factor. In both years the Solar & Electric 500 has run, some of the cars were literally bult at the track, in haste and under less than ideal conditions, making thier maiden runs to qualify. This erodes safety, and doubly so if experimental technologies are used.

Drivers and teams are responsible for monitoring the condition of their cars, and must voluntarily pull out if they detect potentiaol safety hazards such as leaks, bad tires, unsecured batteries, etc.

Considine, a professional race driver, objected strongly to the poor skills of some of the amateurs, which were evidenced by nunmerous reported "bumps" between cars. Althoudh"bumping" probably did not contribute to the bromine spill, it did unnecessarily lower the overall safety level of the race. "I saw some very foolish driving out there," he said "There has to be better policing of the drivers."

He does not rule out amateurs. "Amateurs can be good or bad. The fellow in the Porsche never made a wrong move, and he had never raced before."

One suggestion is that drivers be required to take several checkout laps under judges' observation to qualify for the race, or show some minimal driving experience. Perhaps the race sponsor could provide a short practical introduction to race techniques and etiquette by a professional driver prior to the race. Holden agrees that there will be tighter scrutiny and controls on driver ability in the future.

And what about the releases of toxic hysteria into the atmosphere? When the bromine hit the fan, there was a cry of "Run for your lives!" and a minor stampede through the infield. If the grandstands had been full, the panic could have been much more dangerous than the bromine.

Ignorance begets fear. In a world where we are daily warned of invisible dangers in the innocent-seeming sunshine and rain, of mysterious energy fields swirling around us, the unknown red cloud had a terrifying appearance. The race announcer especially should have information at his fingertips. His voice of calm sanity could do much to preserve order in such a situation.

One final hotly debated race question applies only indirectly to safety. Should the car responsible for ending the race prematurely be awarded first place? Worden, leading by several laps when the race was red-flagged was awarded the trophy. So far, no one has found a precedent for the situation in racing history. Or is it possible, as Worden contends, that the spill could have been cleared and the race safely completed under calmer, better informed circumstances? "If I had to do it again, I'd do the same thing, " said Holden. "I prefer to err on the side of caution."

Race sponsors are still supportive, and plans continue for the Phoenix 500 next year, as well as new races at other tracks.

All right, so once we leave the race track, do these technologies really belong in our future personal cars and homes?

There is irony in this question. The accusations being tossed at exotic batteries are the same ones the public throws at EVs in general: "Aren't they dangerous? What would happen in an accident? They're too strange—we should stick to improving conventional technology.

We must evaluate the actual risks and benefits, and techniques to minimize or eliminate risks. Many common items in our homes and cars are very dangerous if used carelessly or improperly, but we scarcely notice because they are familiar and well controlled. Methods exist for handling dangerous technologies—like sulfuric acid, or propane—in a safe manner.

"It's time for electric vehicles to grow up," said Swan. "up until now, they've been idealized as wholly benign. We need to acknowledge that, like any car, they have hazards that must be adequately addressed in their design."

Brown, from his years as an auto mechanic, feels this incident is a strong argument for automotive-quality components in automotive applications. "Gauges and fittings that work just fine on a lab bench were never intended to withstand the temperatures, vibration, and jostling of a car. We already have the technology to handle hazardous fluids in vehicles. We need to apply it."

The questions raised by the Phoenix incident are too complex and important to be tossed off with quick and simplistic answers. They involve people as much as they do technology. One extreme attitude is to blindly embrace all new technologies as good, pretending that potential risks will never become realities. The other extreme is equally blind paranoia and condemnation of all new technologies and all risks as bad and unacceptable.

The wise answers will lie somewhere in the middle, and will be found only through a calm, objective, and thoughtful search. Black and white are easier to handle, but maturity requires us to take the harder path and distinguish shades of gray.

As Tim Considine said, "Today, electric cars came of age." ❖

Electric Service Station

Hughes Aircraft Co. and Pacific Gas and Electric Co. have signed a joint agreement to install and test a public service station for electric vehicles at PG&E's research and development center in Northern California.

The Hughes station is designed to provide refueling for electric vehicles in much the same way gasoline stations provide fuel. The station will use 220-volt, 30-amp service and will include a Hughes-patented inductive coupler designed to allow the public to safely and easily recharge their electric vehicles. The station will include a display, similar to those on newer gas pumps, which shows how much charge was delivered to the vehicle and allows the consumer to pay with a credit-card through a built-in credit card reader.

Hughes is a subsidiary of GM Hughes Electronics, a unit of General Motors. GM plans to commercially market its prototype electric car, the Impact, which will be built at the former Reatta Craft Center in Lansing, Mich. ❖

(PR NEWSWIRE: 4/24)

Ovonic Gets 1st USABC Contract

The United States Advanced Battery Consortium (USABC) has awarded the first contract for the development of a new generation of batteries for electric vehicles to Ovonic Battery Company, a subsidiary of Energy Conversion Devices, Inc.

Under the contract, Ovonic, which is located in Troy, Mich., will develop and demonstrate the technical feasibility of a Nickel Metal Hydride battery that would meet the "mid-term" goals of USABC to broaden the capability and availability of electric vehicles by the mid-1990s. USABC's "long-term" goals are to develop batteries that will be cost and performance competitive with gasoline-powered vehicles by the late 1990s.

"This agreement is an important step forward in fulfilling the promise of USABC to help give the U.S. a competitive edge in the intense international contest to produce a practical battery for electric vehicles," said the Department of Energy's Assistant Secretary for Conservation and Renewable Energy J. Michael Davis when announcing the selection. ❖

(DOE NEWS: 5/19)

EAA Member and the Utility

EAA Member Running For Board Of Directors Of Sacramento Municipal Utility District (SMUD)

Dan L. Field, MD decides to get even more involved and has this to say: "My personal commitment is evidenced by the fact that I commute daily in an EV conversion and have done so for two years. This is the only vehicle I drive.

My Motto: Plug into the Future.

My Platform: If it is clean, renewable and creates jobs...I am for it.

My day job is that of an Emergency Physician at Kaiser Hospital in Sacramento. I will be cutting back my hours (and income) to serve the public in this capacity." ❖

Good for you Dan. If you wish to talk to him about his car or plans for SMUD, you may call him at home at 916-638-8655. Ed.

Electric Motor Software

"MotorMaster", a computer software program developed by the Washington State Energy Office offers **energy efficiency comparisons of over 7,000 electric motor models sold in the U.S.**

The program, which will be distributed free of charge through WSEO, the Department of Energy and the Bonneville Power Administration, covers most three-phase motors sold in the U.S. ranging from 1 to 500 horsepower. The program's database includes information that allows engineers and technicians to easily identify motors that meet specific design requirements, such as full, 3/4, 1/2 and 1/4 load efficiency, full-load RPM, voltage ratings, power factor, service factor, and frame size. Marketing information for each model will also be included.

An analysis feature of the "MotorMaster" program quickly calculates the cost of running a particular motor in a specific application, and determines the simple payback of using a more efficient model. ❖

(DOE NEWS: 5/28)

Lola

(Continued from Page 1)

Zytek Systems' business lies in development and supply of electronic equipment for competition vehicles. Since the electric vehicle is viewed by many as the transport of the future, said a company spokesman, it is "logical that Zytek should combine these technologies in development of the ZERO electric racing car." ❖

(UK MOTORING NEWS: 5/28)

For those of you who don't follow racing, Lola is the world's biggest anme in race car chassis builders. Ed.

Clean Air Act Belongs to the Public

The following excerpts are from an editorial entitled, "Clean air is the public's business," which appeared in the May 19 Chicago Tribune:

A centerpiece of President Bush's domestic program - and of his repeated claim to be an environmental president - is the Clean Air Act of 1990. The president proposed strengthening the act, and though he quarreled with Congress over some provisions, he accepted them, signed the new law and eagerly shared the limelight for its approval.

But supporting the law and putting it into effect have become two very different things for Bush, who is attempting to change by rulemaking what he could not get written into law.

At issue is a provision of the law requiring companies to obtain pollution permits that limit them to specific levels of emissions. Under the law, any increase in emissions requires public notice and an opportunity for citizen groups to comment and object.

This ignited a bitter battle within the administration, pitting Vice President Dan Quayle, head of the president's Council on Competitiveness against Environmental Protection Administrator William Reilly.

Their deadlock was so severe that Bush, after months of delay, had to intervene. He decide in favor of Quayle and industry, and *against his EPA chief, the public and the intent of the law."*

The symbolism of Bush's action is very dramatic. **Under pressure from industry, he is using rulemaking power to frustrate the intent of the law**. He is speeding the process for companies to increase pollution beyond the limits set by law. And he is saying they can do this without notifying the public.

If nothing else, this is a situation that invites litigation each time a company seeks to increase its emissions - an outcome that a public review period seeks to avoid. Indeed, environmental groups already are warning that they will sue to stop the new regulation.

"It might be more tolerable if Bush had the courage of his convictions on this issue. He didn't even announce his decision, letting it leak out in Washington instead. But then, who would want to take credit for undermining a law that made him look good?" ❖

(CHICAGO TRIBUNE: 5/19)

Hydrogen NOT Zero-Emissions Clean

Although hydrogen combustion uses no carbon, and thereby creates no carbon dioxide, carbon monoxide, or hydrocarbon emissions, it does emit oxides of nitrogen (NOx). Only with the use of pure oxygen can nitrogen emissions be prevented, but this creates a fuel storage problem.

Researchers have been exploring pressurized tanks and storage in a hydride form but, so far, the increased weight they add has made this solution unattractive. Research is continuing to try to make hydrogen combustion truly zero-emissions free. ❖

(ROAD AND TRACK: JULY 1992)

Lead-Acid Powers Super Honda

The California Air Resources Board (CARB) has just tested the Cocconi EV prototype Honda CRX powered by a lead-acid battery and reports that it averaged 51.1 mph on California highways for a distance of 131 miles and it went from zero to 60 in 7.8 seconds.

The significance of CARB's praise is that test figures for the Cocconi EV exceed those claimed by GM for its electric Impact auto. ❖

(AUTOWEEK: 6/29)

New Technology Cuts Emissions

If preliminary test results pan out, there may be a cost-effective way to cut sulfur emissions from older, coal-burning plants in time to meet Clean Air Act requirements. Technology known as Confined Zone Dispersion (CZD) is currently being tested at a 73-year-old Pennysylvania Electric Company plant.

CZD is a sorbent injection process that can be retrofitted into existing plant flue works, at relatively low cost. Test data shows the retrofit installation would cost roughly $25 dollars per kilowatt.

More importantly, the technology has shown it can help reduce emissions of sulfur dioxide (SO2). Testing of the CZD process actually exceeded the original goal to reduce SO2 emissions by 50 percent. CZD is being touted as one way to meet coming Clean Air Act SO2 emissions standards, either alone or with other technology.

The CZD process was developed by the Bechtel Corporation in the early 1980s. The current $9.2 million development and testing program receives half of its funding from the Department of Energy (DOE). ❖

(DOE RELEASE 3/20)

Another reason why electricity generation for electric cars will become cleaner with time. Ed.

Absolutely Cuckoo!

The following excerpts are from an editorial by Michael Silverstein, president of Environmental Economics, a Philadelphia consulting and research firm. The editorial, entitled "Bush's Polluter Protectionism Isn't Pro-Business," appeared in the May 28 Wall Street Journal:

"In recent months the Bush administration has declared a moratorium on new environmental regulations and taken steps to ease enforcement of existing ones. Such an approach, from the business perspective, strikes me as absolutely cuckoo."

"Laws and regulations that force polluters to spend money on cleaning up the environment do not diminish the wealth of a nation. They transfer this wealth from polluters to polluter-cleaner-uppers and lay a foundation for greater future wealth."

"The overall effects of this process over more than two decades have been extraordinarily positive. Not only have countless formerly high-polluting enterprises been forced to become less wasteful (i.e. less polluting) and thereby more competitive, not only has 'the environment' become a force generating technological innovation on a scale as great as the defense or space program's, but a vital new component of the U.S. economy has emerged in the bargain - the environmental industry sector."

"In 1991, this country's 65,000 to 70,000 environmental companies garnered an estimated $130 billion in sales. The 70 largest publicly traded firms in this group, with collective revenues of almost $30 billion, saw their revenues jump more than 18% last year. All told, some two million Americans now make their living doing some kind of environmental cleanup work."

"The rationale for the Bush administration's current anti-environmental policies is that they help keep us competitive, boost corporate profits and protect jobs. This is nonsense. What these policies really do is temporarily insulate inefficient producers from the need to innovate and invest in new equipment, while penalizing an industry that is arguably the most dynamic element of the entire U.S. economy." ❖

(WALL STREET JOURNAL: 5/28)

Alternative Fuels "HOTLINE"

What are the performance characteristics of a methanol-fueled car? If I convert my vehicle to natural gas, where can I refuel? How do I go about converting a fleet to an alternative fuel?

The Department of Energy (DOE) is ready and waiting to answer these and other questions for industry and the general public through its newly established Alternative Fuels Hotline. By calling a toll-free number, 1-800-423-1DOE, callers will be provided with the answer to questions, or referred to the proper source. A variety of publications will also be available.

Callers will also have access to information from the Alternative Fuels Data Center (AFDC), located at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. The AFDC has collected data on government fleet vehicles and fleet vehicles used in demonstration projects across the country as well as information on almost 400 alternative fuel refueling stations across the U.S.

Callers in the Washington, D.C. area may use (202) 554-5057. The "Hotline" will be available between 10 a.m. and 6 p.m. ET. ❖

(DOE NEWS: 6/12)

Pikes PeakChallenge

This year, for the first time, solar and electric vehicles will test their engineering in a timed event up Pikes Peak. The Pikes Peak Solar/Electric Challenge will be held October 6-8, 1992. If you want to be part of the first Annual Pikes Peak Solar/Electric Challenge - contact us! Entry forms and telephone calls should be directed to our event office at 219 W. Colorado Ave.,Suite 202, Colorado Springs, CO 80903 ph. (719)635-8871. Registrations must be returned by Sept. 8. ❖

"Red" Sparks - Part II
Cautionary Follow-Up for First-Time Electric Car Converters

John Burke ,Guest Author

Some pretty savvy EV guys have objected that my article in the last issue made electric drive with the TRANSMITTATRON sound too easy. And maybe I was a mite hazy about how the TRANSMITTATRON works. So you had better hold off building for a bit, while we take a closer look at some of the problems.

I think the story on batteries and a direct-connected shunt motor will hold up. You just switch the system on and forget it, so long as you don't crowd it too hard or too long. Self-regulations should hold the motor speed close enough to constant for this purpose, say + or - 5 to 7 %.

The Mechanical Part

Now for the mechanical part: conceptually the TRANSMITTATRON described will perform like I said, but there remains the somewhat complicated matter of efficiencies, and questions about whether the speeds and load-carrying capabilities of the components you are likely to find can be made compatible. the best belt-type CVT's are about 85 percent efficient at a maximum, but 65 percent is more typical at the speeds and loads at which a car would run most of the time. A parallel-shaft automotive power take-off should consistently deliver 95 percent, the differential maybe 85, and the pillow blocks, universal joints and whatnot needed for installation, say 95. Now you can't just multiply these; there is a joker. The flow of power within the TRANSMITTATRON has to be considered. The motor, the CVT, the transfer gears and their differential input always run in the same direction at approximately constant speed, and when both the transfer gear ratio and the CVT ratio are the same (here, 1 to 1) the differential input from the CVT matches the other input, but in the opposite direction, causing the differential output to remain stationary. Any change of the CVT ratio will now make one of the differential gears turn faster than the other and the output shaft will be forced to turn in one direction or the other to satisfy this condition. Resistance to output rotation causes torque on the differential ring gear and half of the torque acts on each input gear, but in the same direction. This will either aid or oppose motion of the CVT output, depending upon the sense of its speed adjustment.

Forward and Reverse

So in one direction, say "Forward" power goes through the CVT to the differential, a portion of it appears at the output shaft and the remainder "circulates" back through the transfer gears and adds to that being supplied by the motor. In the "Reverse" direction power circulates through the transfer gears to the deferential, yielding some to the output shaft and delivering the rest backward through the CVT to join that flowing from the motor.

The CVT

Obviously, if the lower-efficiency component, the CVT, can be partially relieved by throwing most of the load onto the more efficient gear set there will be a substantial benefit to overall efficiency. So direction of rotation makes a big difference.

The Problem of Speed

Then there is the problem of speed. Assuming the differential is the same as the one in the axle of the car, and assuming the CVT ratio range of 4.0 (1:2,2:1) and that the max. car speed is 40 mph and that the effective wheel radius is 11 inches and that both differential ratios are the same the wheels and the differential ring gears must turn at 611 rpm, the CVT output 1222 rpm, and the other differential input 611 rpm. So the motor speed is also 611 maximum. Now a practical motor will have to turn, say 3000 rpm and must therefore be belted down accordingly. If your CVT is not rated to run at that input speed you will need a belt drive from the motor, and whether or not it will have a suitable power rating at 1222 rpm dictates whether it can drive the differential directly. Physical size and weight are important, so the CVT must be run at its highest allowable speeds. Therefor, probably a second belt set will be needed.

Now Something Else

Now something else: we have been talking about a CVT where the input and output run at the same speed at the halfway point of range adjustment and the transfer gear was chosen 1:1 which put the zero output of the differential at the middle of the CVT range. But in a car you don't want to go as fast in reverse as you do forward, so almost one-half of the CVT never gets used at all. Now supposing you made the gear ratio different than 1:1. The zero output point would be moved closer to one end of CVT adjustment, e.g., 90% foreword, 10% reverse. In this way the full range of the CVT would be used, with benefit to the life of the tractive surfaces.

Well fellas, I do apologize for skipping over these points before and I hope none of you have gone too far with your project yet. It's possible that other points of interest will come in connection with the TRANSMITTATRON system. I'll clue you right away if I hear anything.

— John W. Burke. ❖

Source for Citicar Parts

Hollywood, Fla — Pro Electric Vehicles, a leading supplier of golf car parts and repair services in Southeast Florida, has acquired the entire inventory of spare parts for the most popular electric vehicle ever made, the Citicar.

Pro Electric purchased the parts from Sebring Auto-Cycle (SAC) of Sebring, Fla., the company that had been distributing spare parts for the past four years. SAC had acquired the spare parts business from two previous manufacturers, Comuter Vehicles, which declared bankruptcy in 1982, and Sebring-Vanguard, which manufactured over 2,200 two-passenger Citicars between May 1974 and December 1975.

PRO ELECTRIC is Now "THE SOURCE"

Founded in 1985, Pro Electric maintains electric golf carts for country clubs throughout Dade, Broward and Palm Beach Counties. The principal owner, Albert Navarro, experienced first-hand the need to obtain parts to refurbish the decade-old vehicles. Navarro says he got the idea to form a "one-stop shopping" service for EV parts. "Imagine making one phone call to get all the parts you need to make your CitiCar or Comuta-Van ready to get back on the road," he continued. "It works in every other industry, but we haven't really developed that kind of service yet for on-road electric vehicles. So I started *The Source*, which is a subsidiary of Pro Electric."

Owners of CitiCars, Comuta-vans, Comuta-Cars and old Postal vans made in Sebring can obtain spare parts from *The Source* at (305) 983-6003. To obtain a catalog of parts available, send $2 to *The Source*, 2322 S.W. 58th Terrace Hollywood, FL 33023. ❖

Nomination for the Award of EAA Fellow

The EAA intends to recognize our members who have made special contributions to the purposes and goals of the Electric Auto Association. We ask each chapter to nominate one person for the award of Fellow at this time. EAA members who are not in a chapter may enter a name directly to the Board of Directors who will evaluate the nominations.

Each nomination should be accompanied by a B&W photograph, if possible, and up to a 300 word description of the EV activities and accomplishments of the nominee. The EAA Board of Directors will make the final cut, if necessary.

We hope to be able to have at least 15 Fellow awards to report in these pages this year. For this first year , people who have already received honorary EAA awards, such as the Keith Crock award at any EAA national Symposium are not eligible for the Fellow award at this time.

Please postmark your entry by Sept. 30th to EAA Fellow Nomination, 1249 Lane Street, Belmont CA 94002-3756. ❖

2nd Annual SunDay Challenge

Cape Canaveral, Fla. - The cars of the future rallied in central Florida for the 2nd Annual SunDay Challenge, a 75-mile rally along public roadways on June 14, 1992. Thousands of people came on a beautiful sunny Florida day to see the start of the race at Universal Studios and the finish and exhibits at Howard Johnson Plaza Hotel in Cocoa Beach. This non-gas guzzing road event was sponsored by the Florida Solar Energy Center (FSEC) and the Florida Energy Office, Florida Department of Community Affairs.

Alternative fueled vehicles from across the country participated in the event, including two university-sponsored SunRayce contestants, eight commuter cars and seven open category vehicles. The race was a "high-tech" showcase with representation from universities, corporations and far-sighted individuals.

For more information about the SunDay Challenge '92 Alternative Energy Vehicle Rally, contact Bill Young at the Florida Solar Energy Center at 300 State Road 401, Cape Canaveral, Florida 32920, (407) 783-0300. ❖

ECO Car Challenge

As a media publicity event to spotlight the Solar Energy Expo and Rally (SEER), which takes place on August 8 and 9 1992 at Willits, California, there will be a gathering of alternately powered cars at the Exploratorium in San Francisco on August 6. Vehicles will be on display for the media from noon to 2 PM for a press conference and send off. They will then cross the Golden Gate Bridge under view of the media and continue as far towards Willits as they choose.

For information on participating call Phil Jergenson at 707-459-1256. ❖

Letters to Current EVents

Dear Paul

I have been a member of EAA for only a short time, but have enjoyed the newsletter very much. I have been interested in electric cars since I was in high school in the late 70's and early 80's. Only recently have I been able to afford to build my own electric, but new developments daily make me glad I have waited. I hope to send you more information on my project of late. I plan to use two counter rotating flywheels for added acceleration. The car is based loosely on a Bradley GTII, but has the added safety of an aluminum frame and roll cage, and a centrally located battery array.

Keep up the good work, and I hope to write to you again soon.

Bryan Owings - Tuscaloosa, AL

Dear Editor,

Twelve years ago I purchased a new electric Commuter Car (city Car) and drove it regularly to my work (twenty mile round trip) for just over four years. The vehicle operated on a 48 volt system with a separate twelve volt battery to operate auxiliary equipment.

Just prior to the car being taken off the road for good due to reduced speed and range the car had some brake work performed. I thought at first that the brakes shoes were too tight or bearings were tightened too much but the problem still existed. Somehow the motor seemed to heat up.

My purpose in writing is my interest in putting the car back on the road again. I would like to hear from members who may still own these vehicles in order to help solve my old problem and also to learn how to update the controller system as well.

Steve Hanrahan - 4921 Chestnut
Bellaire, TX 77401 / (713) 667-4983

Dear Steve,
See the announcement about "The Source" on page 11. Ed

EAA Reprints

EAA reprints available:

1) **$1.00** **Editorials** - *100th Monkey , Market Size, Twilight or Dawn, Public Acceptance*
2) **$1.00** *Discovered: The Perfect EV Battery*
   Facts about the battery that will change the world.
3) **$5.00** **Dr Richard Post** - *Flywheel Energy Storage*
   Dr. Post updates 1970's thinking and finds a viable solution.
4) **$5.00** **Chuck Lemme** - *Team Tucson Land Speed Record Plans*
   Includes many power and aerodynamic formulas. A wealth of technical considerations.
5) **$5.00** **Ambrose Manikowski** - *Dr. Billing's Hydrogen Fuel Cell*
6) **$5.00** *EAA XA-100 Hybrid (Includes Table 2&3)*
   Report on the EAA's Hybrid Vehicle Project (all 3 chapters).

Please send donation (check payable to EAA) for your choice of reprints to: **EAA/Reprints, 1968 Elden Drive,San Jose, CA 95124-1313.**

Please include SASE/w 2 stamps for $5.00 items and 1 stamp for $1.00 items to cover postage cost.

1992 Electric Grand Prix

All Electric Car owners who may be interested are invited to participate in the 1992 International Electric Grand Prix, October 15-18, 1992. Planned as one of the largest competitive road rallies of electric cars ever held, this non-profit effort will take the message of alternative energy transportation right through the neighborhoods of 26 Southern California cities. The competition will go for three days from Veterans Stadium in Long Beach to Santa Monica College, then to the Rose Bowl in Pasadena and finally to the Orange Show Stadium in San Bernadino. The Grand Prix will also feature a day-long festival of exhibits and demonstrations at the end of each leg along the way.

A Formula electric race car will be on the course in San Diego on Sunday Oct. 11 as promotion for the Electric Grand Prix a few days later.

For more information contact Peter Hackes at 301 1/2 Central Avenue, Seal Beach, CA 90740. Tel:310-430-9779, FAX 310-431-2052. ❖

Electric Mobility Consortium

Santa Rosa, California-Solar Electric Engineering announced the formation of the California Electric Mobility Consortium, a coalition of businesses and non-profit organizations to advance the use of non-polluting electric transportation.

"With the current state of the environment and the economy, we simply cannot wait for conventional auto manufactures to provide alternatives," said Solar electric spokesman Alex Campbell. "the basis for the Consortium is to form an organization with real power for change."

"Now that we have **sold over 100 non-polluting vehicles** and have begun to open electric car dealerships," said Campbell, "we want to ensure that our dealers and customers will always have access to the latest technology."

Solar Electric, a publicly owned corporation (SOEE-OTC), is the nation's largest manufacturer of electric vehicles. For information contact Solar Electric at 1-800-832-1986. ❖

EAA On the Fidonet Network BBS

Don Kulha, System Operator of Sonoma Online, now has EAA information. The BBS number is (707) 545-0746 in Santa Rosa, CA.

Set your modem for 1200 or 2400 baud, 8 bits, Parity NONE, Stop Bits 1, and Full Duplex.

We have files of some articles from Current EVents and a ten year subject index prepared by Don Gillis, Pres of San Jose Chapter, EAA. See Home Power pp 60-62 of issue #27 Feb/Mar 1992 for an article by Don on FidoNet and to find the nearest hub in your area. BBS telephone numbers are included within the United States.

Try out this conference and post your chapter meeting notice and enter EV news, reports or new developments that come to your attention.

FidoNet also has the first ten issues of Home Power magazine on the HOMEPWR echo conference. These issues are no longer available from the publisher.

We are sorry that the Greenpeace Environet BBS did not work out. ❖

—Bob Wing, Chair-Membership and Chapter Relations Committee

B.A.T. Technology, Inc. Aquired

Ultra Force Battery Catalyst to be widely marketed.

Application has been made to change the name of October Associates, Inc. to **B.A.T. International**. October Associates is publicly traded under the symbol 3OCTB. To obtain investment information, you may call Mike Jensen, Director of Stockholder Relations at 801-977-0119. ❖

Calendar

August 7-9 SEER, Solar Electric Expo & Rally, Willits CA (707) 459-1256

August 9-22 ENER-RUN Transcontinental Rally. Washington DC to Los Angeles in alternative powered vehicles. Call Les Adam (501) 856-3877 for details.

September 5-6 Clean Air Gran Prix @ Road Atlanta (404) 875-4140

September 12 Utah Electric Car "World Challenge" 240 Mile Non-Stop $25,000 1st place (801) 977-0906

September 12 Princeton Plaza Car Show, San Jose, CA. EAA is invited (408) 378-1154

September 19-20 20th Electric Auto Association Expo, World's Oldest Electric Car Event, Electrathon and Symposium.

September 23-27 Al Tran Ex'92, International Alternative Transportation Exposition. Conference and Expo. Burbank Airport Hilton & Convention Center (310) 285-0093

September 27-30th EVS-11 The 11th International Electric Vehicle Symposium, Florence, Italy. Phone: 011 39 2 57731

October 3-4 New Energy Technology Expo at Laguna Seca. For more info, call Billy Hinds (408) 646-1490

October 6-8 The Inaugural Pikes Peak Solar/Electric Challenge, Colorado Springs, Colorado. For more info, call (719) 635-8803

October 9-10 S/EV 92 Solar and Electric Vehicle Symposium Car and Tradeshow, Word Trade Center, Boston, NESEA (413) 774-6051

October 10-12 Berlin Motor Show. EAA has been invited. Contact AMK Berlin Chicago (312) 245-5230

October 21-23 National Electric Vehicle Conference Mark Hopkins Hotel, San Francisco. Pam Turner Conf. Coord. POB 10412 Palo Alto CA 94343-9743

November 17-19 WESCON, The Western Electronics Show & Convention will highlight electric cars at the Nov. '92 show. Panels, talks and some 40 EVs to be exhibited.

December 2-3 Electric Vehicle Systems Conf., Hyatt Regency, Dearborn, MI (313) 995-4440

Membership Dues Increase

Beginning November 1st, the EAA Board of Directors has approved a dues increase to $35 for U.S. members. Canada will be $40 and all other countries will be increased to $45.

This increase is necessary as a result of increased production cost for the expanded and enhanced newsletter as well as to expand our services to members and increase our promotional activities.

Anyone who wishes to renew prior to November 1st, may renew their membership at the present rate up to 1 year. Mail your renewals to EAA Renewal, 2710 St. Giles Lane, Mountain View, CA, 94040.

Our present, very active Board, is looking into various dues structures and planning new services, activities and EV promotions for all EAA members. ❖

Electric Cross Country Challenge

Santa Monica, CA to Jacksonville, FL "Electric cars are not just for local commuting anymore."

Dan Parmley, president of Diversified Technical Services, Inc. (DTS) and his pioneering associates will be attempting to establish and set a Guinness Book of World Records by traveling over 2500 miles in six (6) days coast to coast across the United States in an electric vehicle.

The main objective of this event is to show that a standard Detroit vehicle, that has been converted to electric, is capable of traveling cross-country in the same time and with the same level of convenience as a regular gasoline car. Typical refueling stops, in this case battery pack change outs will actually take less time than filling up an ordinary car. Our rapid battery change out system will be shown to the public for the first time at this event. This unique device is the key ingredient for future battery replacement centers nation wide.

DTS will be demonstrating their new internationally standardized EVFS I Electric Vehicle Fueling Station that is now available for sale. This 15,000 lb. transportable charging station, which can charge 30 or more vehicles simultaneously, can be unloaded from a semi-truck and set in place in less than 10 minutes. It is designed for charging present electric vehicles and can be easily adapted in the future to meet new emerging technologies. These charging stations can be set up in almost any location in the world including existing neighborhood gas stations, shopping centers, places of work, apartment complexes and rest areas along interstate highways.

They will be leaving Santa Monica, CA on August 27 and arrive at Jacksonville, FL on September 1. They then will drive to Atlanta, GA for the "Clean Air Grand Prix" September 3-6.

For more information call Dan Parmley, 602-243-1642. ❖

Calstart Starts

A bid to make California a world center for electric-vehicle manufacturing formally began June 8 when Calstart, a broad-based coalition of public agencies and private businesses, set up headquarters in the Burbank complex where the Stealth fighter was built.

The group has already raised $14 million toward seven development projects in the next six years, including production of a prototype electric car to be shopped to potential buyers around the world.

"This has really come a long ways fast," Southern California Edison President Michael Peevey said. Peevey, who has long supported development of electric vehicles on regional and national policy organizations, is chairman of the Calstart board.

"There's going to be at least one of these centers" in the world Peevey said, "so why not here?"

"We are the center of the first major usage of electric vehicles," Peevey said, "so we can have an environmental win, an economic win and a technology win altogether...We're playing for world preeminence in this area."

Calstart is a 41 member consortium of five major utilities, large and small aerospace and high-tech companies plus educational and research institutions.

Lockheed which has donated two rent-free years at the 155,000 square-foot Burbank office building, is among the Southern California aerospace and defense companies hoping to replace some of the business lost to Defense Department cutbacks by meeting expected higher demands for electric transportation.

"What you have is a unique opportunity for a successful public-private partnership," Peevey said, "something this nation's foreign competitors have historically been much better at than we have." ❖

Want Ads

Jet Electric Courier Truck, 23 hp GE DC series motor, 120 volt, gas heater, low miles good body, needs new batteries & controller, $3,500. Le Car hatchback, prestolite 18 hp DC series motor, 48 volt, low miles, perfect body, needs new batteries & controller, $3,500. CALL (415) 388-0838

G.E. 2 CM65, 120 V.D.C. aircraft gen.-motor, with adapter plate with bearing, flywheel, clutch for VW. Also inductor and duplicate motor without shaft. All for $300. Dave Abell, PO Box 103, Finley, CA 95435

1981 Datsun 200SX Lectra Hatchback, 20 HP Prestolite, 108V system, gas heater, air conditioner, PMC controller. $6,500 CALL Dan (415) 388-0838

For SALE, 2 generators, 1 400 AMP, 1 200 amp, both 30 volts, D.C. Make offer. CALL Harvey (408) 238-4657

Bargain Electric Cars and Conversion parts, Prestolite motor $795, controllers $395, used batteries $30. CALL (800) 832-1986

Charger Electric Motorcycle, new PMC cont. 35 MPH. Street legal. Fun to ride! $500. (415) 856-3669.

Rates for Want Ads
$5 for the first 30 words.
For each additional word, 25 cents per word.
Please use abbreviations whenever possible.
The EAA is not responsible for the accuracy of ads.

EAA

August/September 1992

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