



ELECTRIC VEHICLE RACE GATHERS MOMENTUM

by Wesley R. Iversen, *DESIGN NEWS*, 10-21-91

Battery technology holds the key to better design.

Following 30 years of false starts, it now appears that mass-market electric vehicle production could be around the next curve.

Thanks to tougher pollution laws, the push for more fuel economy, and the need to rely less on foreign oil supplies, electric vehicles are beginning to hit North American highways.

"If you look at the progress we've made in the last 10 years, we're getting pretty darn close to production cars right now," says Kenneth F. Barber, director of the U.S. Department of Energy's Electric and Hybrid Vehicle Propulsion Div. in Washington. "Prospects of getting an electric vehicle that will be publicly acceptable and fairly competitive are pretty good."

Forexample, production began last December on the electric G-Van, a modified GM Vandura van equipped with lead-acid batteries. Maker Vehma International, Toronto, Canada, bills the van as the industry's first fully engineered, commercially available EV. "We expect to see 150 of them on the road this year," says Lawrence G. O'Connell, senior transportation program manager at the Electric Power Research Institute (EPRI), Palo Alto, CA. EPRI sponsored the four-year G-Van development program, with support from Vehma, Chloride EV Systems of Great Britain, GM, and Southern California Edison.

What's more, all three Detroit automakers have stepped up their EV development programs, as have their overseas competitors. Many small com-

panies also are moving forward with new EV technologies.

Fuel for EV Growth

Several developments nourish the new EV activity—technological advances, plus growing concerns over pollution, fuel economy, and the U.S. dependence on foreign oil. But the prime catalyst, most agree, stems from tough, new air-quality regulations enacted by the California Air Resources Board (CARB).

By 1998, 2% of all vehicles sold in the Golden State must be "zero emission" vehicles, CARB says. The figure rises to 10% by 2003. That amounts to some 150,000 cars annually. Other big states are expected to adopt CARB rules, perhaps doubling industry requirements in the same time frame.

"There's been a tremendous increase in EV development effort by many manufacturers, and certainly at Ford, over the last 18 months," notes John R. Wallace, electric vehicle program manager at Ford.

"We're in a race here," adds Kenneth R. Baker, program manager at GM Electric Vehicles. "It's a chance to bring international leadership in automotive technology back to North America." Baker is the first chairman of the U.S. Advanced Battery Consortium (USABC), formed last January by Chrysler, Ford, and GM.

Battery Pact

The USABC projects a budget of \$100 million annually. Funding comes from the automakers, the utility industry, and battery makers, matched on a

costsharing basis by the DOE. "This represents the second largest consortium in U.S. history, behind the semiconductor industry's Sematech," says GM's Baker.

Battery developers are up against tough competition. Gasoline packs in an energy density equivalent of about 400 W-h/kg, but even the best lead-acid batteries have a specific energy of less than 35 W-h/kg. That severely restricts range for small electric vehicles to 60-100 miles between five- to eight-hour rechargings.

The problem only worsens for heavier EV designs. Indeed, the G-Van's lead-acid battery pack adds 2,600 lbs to the 7,050-lb curb weight of the cargo version. Maximum payload is 1,550 lbs or five passengers. But the G-Van is limited to 60 miles of city-type driving between eight-hour recharges,

(Continued on Page 3)

INSIDE

- 2 Editor's Corner
- 7 Mounting an Advance
Motor/Karman Giha
- 9 1st Meeting - Sacramento
Chapter
- 9 Review - Sourcebook 1991
- 10 California Tax Incentives
- 11 '92 Solar & Electric 500
- 12 Letters to the Editor
- 14 GE on Ford's EV Team
- 15 PBS to Run EV Story
- * EVIA Safety Survey
(Enclosed)

EDITOR'S CORNER

How big is the electric vehicle market? More than a decade ago Ford did a study that said that there was only a 1% market for EVs. The big three have persisted in this belief until the California Air Resources Board (CARB) mandated 2-10% of all vehicles sold in the state be zero emission vehicles (ZEVs) starting in 1998 to 2003. This single fact was the hit in the head that got their attention that people, or at least their government, wanted clean and efficient vehicles.

We in the EAA have always felt that the market was very large as we have experienced the real practicality of our EVs. Now from the Institute of Transportation Studies, U.C. Davis comes a September 1991 study that shows that even with very severe restrictions on who might be a possible purchaser, their conclusion is that there are at least 28 million households that are candidates to buy a current technology EV.

Indeed they "maintain that the marketability of electric vehicles is not solely dependent on how close their performance characteristics are to conventional vehicles, but on the willingness of households to adapt their travel behavior to EVs." They go on to state that the cost of EVs will have a "profound" effect on their success, and that the market size decreases rapidly as needed household income increases.

What they have not considered in this study or in past studies is the possibility, or the reality of a large conversion market for EVs. A typical gas to electric conversion costs \$5-7,000 or even up to \$9,000, as opposed to a \$20,000-30,000 price tag for a new big three production car. This then greatly expands the market size because the needed household income level to purchase is therefore much less.

This is what the EAA has been all about throughout its history. As EVs start to roll off production lines and get the public's attention as real, acceptable cars, we will have quite a story to tell them about low-cost conversions. Also, if Larry Burton or Team Tucson accomplish their goals, they will greatly add to the public perception that the electric vehicle really has arrived.

In other news, we got some national publicity on Tom Brokaw's NBC Nightly News on Jan. 20th. They did a 3 3/4 minute piece on EVs with a short cameo of East Bay's Scott and Anna Cornell's two electrics.

Also, on Jan. 21-24 G.M. invited representatives from several national laboratories to their technical center at Warren, Michigan to motivate its technical staff to apply the national labs' ideas and technology. Dr. Richard Post of Lawrence Livermore National Laboratories, who spoke at our '91 Symposium on flywheel energy storage, gave a presentation. I asked him if he saw evidence of the old NIH attitude (not invented here). Much to my surprise and pleasure, he said that he saw none of that. They seemed to be genuinely interested, he said. Let's hope so.

The March '92 issue of "Discover", the lay science magazine contains a great over 5 page article on Paul MacCready and the Impact, "Batteries Included".

And lastly, I found out that Gary Jackson travelled more than 140 miles at last October's EVAOSC Rally in L.A. I do not know what their route was like, but Gary had a '76 VW Rabbit with a 120V system, weighing 3050 lbs. This is the best run since Saied Motaei did 168 miles in 1983 at our rally and 230 miles again in the '85 one. Congratulations Gary, lets see more of the same!

-Pb editor

Articles

If you would like to submit an article for the Current EVents newsletter, please send your article on a floppy disk formatted for DOS (Ascii Format) along with a printed copy of the article. Also send 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 Paul Brasch at (408) 371-5969 or Susan Hollis/PCTEK at (408) 374-8605 between 10-5pm PST 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. The membership fee of \$25 is tax deductible.

Editor:

Paul Brasch
1968 Elden Drive
San Jose, CA 95124-1313
(408) 371-5969 (10-5pm PST)

Design/Production:

Susan A. Hollis (PCTEK)
(408) 374-8605

Advertising/Promotion:

Susan A. Hollis
(408) 374-8605

Contributors:

Thanks for your contributions.
Bruce Brooks
Wesley Iversen
Dick Veik
Joan Zorr

All members who contributed to "Letters to the Editors".

COPYRIGHT 1992© All rights reserved.
Permission to copy for other than commercial use is given, provided that full credit is given to originator of copied material except for reprinted material.

EVs Gather Momentum

(Continued from Page 1)

EPRI says. Acceleration from 0 to 30 mph requires 13 seconds.

Goals for the USABC effort include a mid-term technology with specific energy of 80 to 100 W-h/kg and a specific power of 150-200 W/kg. Long-term goals boost those figures to 200 W-h/kg and 400 W/kg. Other USABC criteria cover battery efficiency, maintenance, reliability, safety, and recyclability.

Several battery types look promising for advanced EV use—sodium-sulfur, lithium-aluminum/iron-sulfide, zinc-air, and lithium-polymer, among others. Rather than pour all of its resources into one, the consortium hopes to award contracts for development work on three or four technologies late this year. Selections will come from more than 50 proposals submitted this spring.

Individual Efforts

Of the Big Three, GM has made the most explicit commitment to EV technology. The company formed a separate marketing unit for electric vehicles. It plans to offer a mass-produced electric vehicle, similar to the Impact introduced early last year, some time during the next few years. The car will be built at the company's former Reatta Craft Centre in Lansing, MI.

With the Impact, the GM team took the conservative approach, relying on improved lead-acid batteries for the vehicle's power pack. But by designing the rakish, lightweight, two-seater from the ground up as an electric vehicle, GM managed to push the technology to some surprising performance levels.

Including an 870-lb battery pack consisting of 32 recombinant lead-acid 10V batteries, the Impact weighs in at 2,550 lbs and can zip from 0 to 60 mph in a flat 8 seconds. Its impressive specific power tops out at 230 W/kg at

83% of open circuit output voltage. The batteries—developed by GM's Delco Remy unit—have a specific energy rating of 34 W-h/kg. GM says this can provide 120 miles of driving range between recharges.

The car also features an aerodynamic design with a drag coefficient of 0.19—about half that of most production cars. It also runs on special 65-psi Goodyear tires that weigh only 12.5 lbs each and generate less than half the rolling resistance of conventional tires.

Advanced use of electronics and materials also contribute. At 61 lbs, the Impact's motor drive electronics package can handle more than 100 kW. That's a several-fold improvement in power-to-weight of previous EV controllers.

The ac induction motors, each driving one of the front wheels, power the Impact. Together, they develop 114 hp @ 6,600 rpm and 94 lbs/ft of torque from 0-6,000 rpm.

Each motor has single-stage reduction gears built into the housing. They drive the front wheels through a 10.5:1 planetary gear reduction. In the Impact design, "the whole focus is on vehicle energy efficiency," Baker explains.

Chrysler's Contribution

Last January, Chrysler announced a 28-month agreement with EPRI to further develop Chrysler's TE Van electric vehicle. Based on the T-115 Dodge Caravan and Plymouth Voyager minivans, Chrysler's EVs will rely on nickel-iron battery technology.

Given its relative maturity, many consider nickel-iron as the next viable step beyond lead-acid batteries. Nickel-iron offers several advantages, including higher specific energy at about 50 W-h/kg. "When you size it up, you can take today's lead-acid pack and cut it in half for the same output," observes Robert L. Davis, an executive engineer

for the TE Van program in Highland Park, MI. "It's also a very rugged battery. And from all the data we've seen, it certainly looks like it will last the life of the car."

Nickel-iron's prime disadvantage is high initial cost. "By the time you get it into volume production, it would probably cost easily three times as much as lead-acid," says Davis. In the long run, Davis believes the initial price disadvantage may wash out, due to lead-acid's replacement costs.

For the EPRI-backed TE Van effort, Chrysler will rely on 6V NIF 200 series nickel-iron modules from Eagle-Picher Industries. Last year EPRI announced an agreement with Eagle-Picher to build a pilot production plant with initial capacity for 500 nickel-iron EV batteries per year. If all goes smoothly, the operation could go on line by the first half of 1993.

The TE Van effort is the second phase of an earlier four-year effort between EPRI and Chrysler's Pentastar Electronics subsidiary. Under the current phase, Chrysler expects to build about 10 vehicles.

"We'll use these to do all of the crash certification work and some additional endurance running," Davis says. "Then we'll be at the point where we'll have a certifiable car, with the DOT label on it, that we could offer for sale."

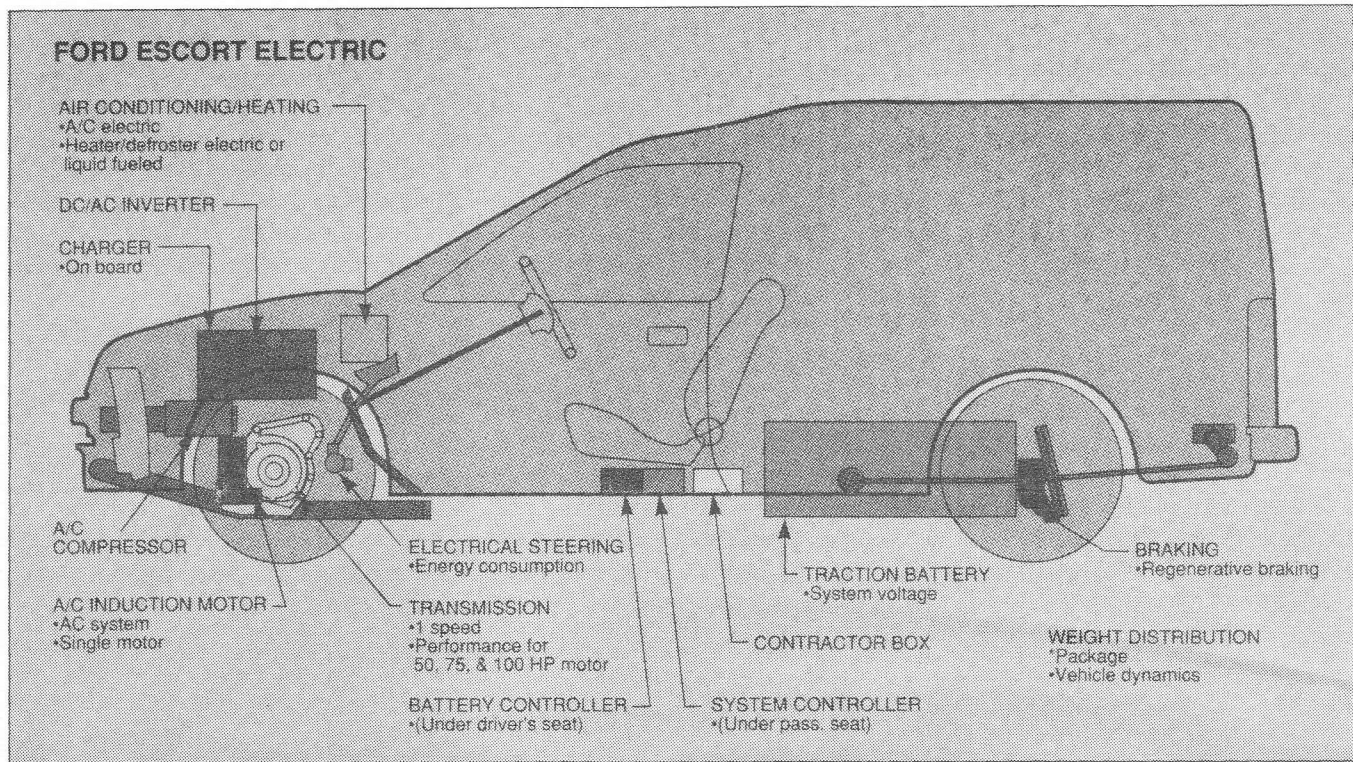
If all goes well, Chrysler could put a demonstration fleet of TE Vans on the road in Southern California by 1993 or 1994.

Unlike GM and Ford, which are using ac motors for EV development, Chrysler's TE Van will rely on an oil-cooled, 54-kW dc brushless motor. It delivers 65 peak hp to the van's front wheels through a manually or electronically shifted two-speed transmission.

(Continued on next page)

EVs Gather Momentum

(Continued from Page 3)



Electric Escort van features single-speed transaxle with integrated ac motor. A subframe helps protect the vehicle's 800-lb battery pack.

In contrast to sealed, maintenance-free, lead-acid batteries, nickel-iron batteries cannot be sealed and require regular watering. They also need a gas removal system to dissipate hydrogen generated during the recharge process.

An earlier TE Van carried a water tank on board. But for the phase II vehicles, Chrysler is developing an automatic watering system. It consists of quick disconnects for recharging and watering and electrical and water hose attachments.

The TE Van's gas management design relies on large blower fans to circulate air across the batteries. The air is vented in the rear of the vehicle to prevent build-up of explosive-level hydrogen concentrations.

Despite its weight/power advantages over lead-acid, the nickel-iron battery pack contributes about 1,800

lbs to the TE Van's 5,000-to-5,300-lb curb weight. It can travel about 100 to 120 miles between recharges, the company says, equaling the range of the lighter GM Impact. But performance is more pedestrian. The TE Van accelerates from 0 to 60 mph in 25 seconds—glacial by internal combustion engine standards.

While nickel-iron may be a promising step beyond lead-acid, its performance still falls short of the USABC's mid-term battery goals. Davis is quick to note that despite Chrysler's current focus, the company is not wed to nickel-iron. "If somebody came through with something better, we'd probably be the first to jump," he says.

Ford's EV Future

After nickel-iron, many put advanced sodium-sulfur as the next most

promising EV battery. Though farther from commercial production, that's where Ford is placing its bets, at least for now.

Ford announced plans in April to build a demonstration fleet of 70 to 100 vehicles beginning in late 1992 to be based on the European Escort Van. For this effort, the vans will use a 336V, 40 kW-h sodium-sulfur battery pack supplied by Chloride Silent Power of the United Kingdom.

"This is really a major milestone for us," says Ford's Wallace. "These vehicles are not just concept vehicles, they're being fully engineered."

Ford plans to lease the vehicles for use by public and private fleet operators in the U.S. and Europe. Following

(Continued on next page)

EVs Gather Momentum

(continued from Page 4)

a 30-month demonstration phase, company plans call for EV production some time during the latter half of the decade.

With its choice of sodium-sulfur batteries, developed in-house in the 1970s, Ford appears to be going farther out on a limb than its Detroit competitors. But, like Chrysler, it intends to remain flexible. "We had to pick a battery to go into these demonstration vehicles. At that point, sodium-sulfur was the choice," Wallace explains. "But that does not imply that we're locked into sodium-sulfur for now and ever more."

Sodium-sulfur offers about three times the energy content of lead-acid at 100 W-h/kg, as well as reasonable power at about 140 W/kg. It also has several drawbacks.

Because the technology relies on molten sodium and sulfur electrodes, it requires operating temperatures of 662 to 715F. This raises potential corrosion problems. What's more, the materials could cause fire or explosion if allowed to contact outside elements, such as water. As a result, the batteries must be heavily encased for safety and ruggedness. The sealed, no-maintenance design can double the weight of the battery pack. And an internal heater must be included to maintain battery temperature when the vehicle is not in use.

On the other hand, the low-cost materials promise inexpensive long-term costs. Right now, however, the batteries cost about four times that of nickel-iron, Wallace says. Sodium-sulfur battery life—currently around 18 months—is also not acceptable to Ford.

The electrically equipped Escort will weigh around 3,000lbs, including its 800-lb sodium-sulfur pack. Target range: about 100 miles between six-hour recharges, with 0 to 50 mph acceleration in 14 seconds.

The battery pack, housed under the vehicle floor between the driver's seat and the rear axle, adds about 30% to the vehicle's curb weight, making crash worthiness a formidable packaging challenge. Ford designers designed a new energy-absorbing subframe for the vehicle that acts as a secondary load path in line with the battery's center of mass.

The electric Escort's powertrain engineering builds upon earlier work done by Ford under a DOE contract for the Ford ETX-I and ETX-II electric vehicle projects. Shown in 1989, the ETX-II was a modified Ford Aerostar minivan that converted an ac motor, two-speed transmission, and drive axle into a single-axle package. Ford engineers claim this as a first.

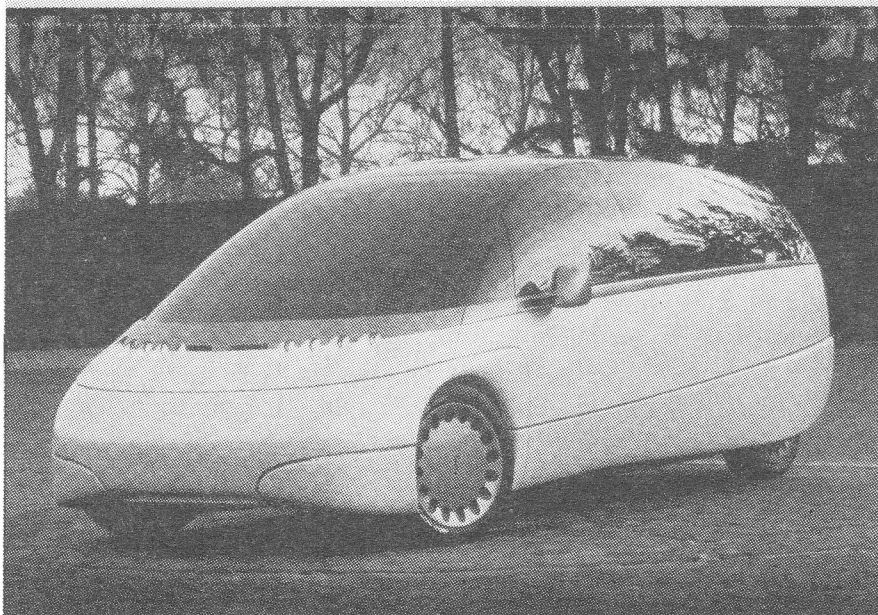
For the demonstration vehicle, the company has switched to a single-speed, front-wheel-drive transaxle with an integrated 75-hp, 140 lb/ft stall torque, 13,000-rpm induction ac motor. "This is a fully sealed unit. The only thing

that goes in are the wires," says Wallace.

Unlike earlier ETX models, the Escort transaxle is a fully engineered unit, with heavy attention paid to gear noise, wear, and design-for-assembly. "We'll probably use a magnesium case on the transmission to reduce weight," Wallace adds.

Ford believes that the added complexity and weight required by ac motor control technology—compared to dc—is already more than offset by the smaller ac motor size and better motor efficiency. Further improvements in power electronics and ac inverters will widen the gap, while bringing ac controller costs down. Power electronics in the Escort van will be based on advanced Insulated Gate Bipolar Transistor (IGBT) technology developed by General Electric, a major subcontractor for the DOE-funded ETX work.

(Continued on next page)



GM HX3 hybrid vehicle carries a battery pack and a small gasoline engine for power. The sleek design has a drag coefficient of 0.258.

EVS Gather Momentum

(continued from Page 5)

Ford has joined GE in another project geared to push EVs down the road to commercialization. Under a four-year, \$14.5 million DOE contract announced last fall, the Modular Electric Vehicle Program (MEVP) aims to develop "modularized" EV powertrain components that are easy to manufacture and mix and match for a variety of vehicles. Using such common components, Ford will develop three electric powertrains with 50-, 75-, and 100-hp ratings. They will be integrated into three vehicles—a two-seater passenger car, a subcompact wagon, and the Aerostar minivan.

Small-Firm Push

The Big Three aren't the only ones running the EV race. Electric vehicles from start-up firms and other small outfits are also beginning to appear. A 9-month-old Seaside, CA firm, California Electric Cars, for example, is launching its lead-acid powered Monterey—a lightweight, open-air EV designed for Southern California commuting. Likewise, in Arlington MA, Solectria Inc. plans to begin manufacturing two- and four-seat versions of its Force electric vehicle. Also based on lead-acid batteries, it will offer an optional 150W solar panel for supplemental power.

Other companies are working around the perimeter. Unique Mobility Inc., Englewood, CO, has developed a brushless dc motor for EV traction applications. The firm says it offers unprecedented power-to-weight ratios at about 2 hp per pound of motor. Meanwhile, Dreisbach Electromotive (DEMI), Santa Barbara, CA, is betting its future on advanced zinc-air batteries. Though the technology has a number of problems, DEMI contends that EVs based on zinc-air power packs that can travel 300 miles or more between recharges are only a few years away.

Japanese Challenge

Overseas, several Japanese automakers have announced plans to build small fleets of demonstration EVs for limited government use in Japan. Moreover, Nissan Motor Co. Ltd. stirred up industry interest this spring by announcing a "quick charge" EV battery technology. The approach, say company officials, can charge lead-acid and nickel-cadmium battery packs to 40% of capacity in as few as 12 minutes.

Isuzu Motors Ltd. likewise piqued U.S. research interests last year with an "ultracapacitor" technology said to store 30 to 50 times more power than conventional high-performance, double-layered capacitors. The quick release of so much stored energy could find applications in EV battery pack load leveling, industry officials say. Quick bursts of energy needed for acceleration, freeway merging, or emergency maneuvering could be provided by the ultracapacitor, which could quickly be recharged by the car's battery pack.

Today's ultracapacitors can store only about 1 W-h/kg of energy. But the DOE plans to launch a 36-month program this year aimed at ultracapacitors capable of 5 to 10 W-h/kg densities. Charge/discharge cycles are specified in seconds or minutes, instead of the hours required by batteries. "About 18 months ago, I was very dubious that the technology could be developed. But now, I've changed my mind," says Andrew Burke, principal program specialist in electric and hybrid vehicle programs at the DOE's Idaho National Engineering Laboratory (INEL).

Hybrid Vehicles

While work continues on zero-emission EVs, many believe that new generations of low-emission "hybrid" vehicles are likely to become part of America's future. By deploying a small, gasoline-powered engine on-board to

supplement an EV battery pack, automakers hope to extend vehicle range and battery life.

EPRI recently took delivery on an experimental hybrid version of the G-Van, for example, that can double the van's range to 120 miles. And early this year, GM showed off a five-passenger hybrid experimental vehicle, the HX3, with a 906-cc internal combustion engine that generates up to 40 kW of power. The battery pack consists of 32 10V Delco Remy gas recombinant lead-acid batteries. When the batteries are low, the gasoline engine starts automatically to recharge the batteries.

In addition, DOE is funding long-term work on low-polluting fuel cell technology that would serve as an on-board generating source to replace today's gasoline engines. "If you categorize a fuel cell and battery system as a hybrid, then I think without question that hybrids have long range potential," says DOE's Barber.

Others go even further. "There's a 50-50 chance that electric drive vehicles will be the dominant transportation form in the year 2005, and it's most likely that it will be hybrid, rather than straight battery technology," declares Paul MacCready, whose firm, AeroVironment, was the project contractor for the GM Impact car. His reasoning? It goes back to battery technology. "We keep hearing about battery breakthroughs, but I'd be hard pressed to pick a winner," MacCready says.

Only time can prove him right. For now, at least, the biggest focus remains the all-electric vehicle. ☺

Thanks to Deisign News for their permission to reprint this article. Thanks to Dick Veik for bringing this article to our attention.

Compare the Li Pollymer of Polly Plus with the USABC goals. Also the Impact's 94 lbs of torque + 10.5 gear reduction gives 987 lbs of push for acceleration. -ed

Mounting an ADVANCE Motor onto a Karman Giha

By Bruce Brooks - EAA

One of the most difficult problems I faced in doing my electric car conversion project is mating the new motor to the transmission. Everyone building an electric car faces this problem and so many approaches, opinions and even solutions exist. Some of the people I talked to were of the firm opinion that I should couple the motor directly to the transmission drive shaft without using a clutch. Others felt strongly that a clutch was the only way to go. I also found that some motors and transmissions need to have a bearing at the coupling and others don't. The two basic problems that must be solved however are the mechanical connection of the drive shaft and the physical mounting of the motor.

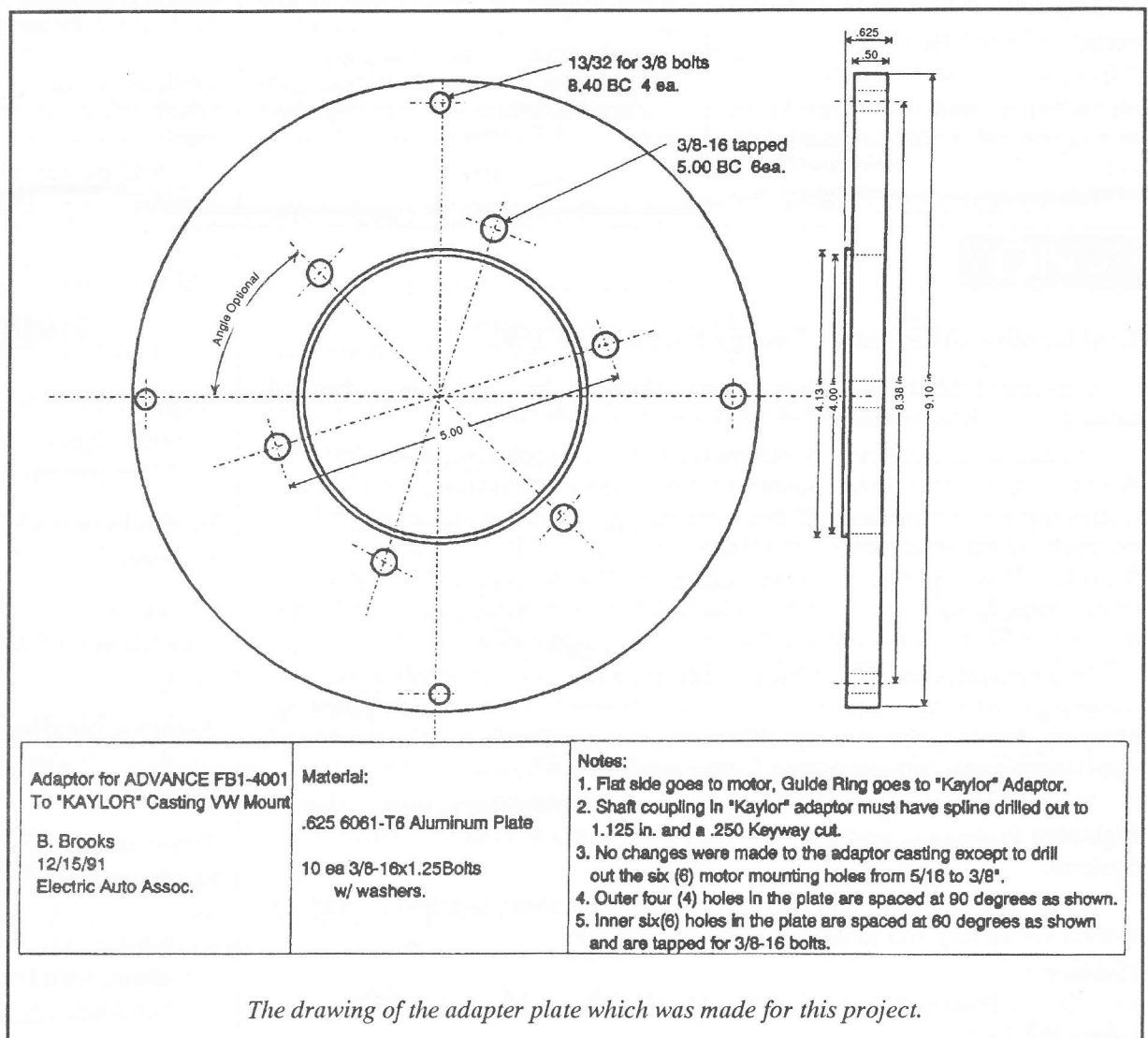
My project car is a VW Karman Giha with the standard four-speed transmission. I decided on the larger Advance DC Motor rated at 19-23 HP depending on which literature you read. I finally decided I really did want to use the clutch in my installation even though the big motor would undoubtedly have plenty of torque over the operating range to get by without it. The main reason I chose to stay with

the clutch was drivability; I wanted the car to seem as normal as possible to the uninitiated with as few special driving techniques as possible. The length of this motor is nearly the same as the small motor, and space in the VW engine compartment is limited in length. After careful measurements I determined that the motor would fit with only minimal sheet metal cut out around the back end of the motor without shortening the motor shaft or cutting off the pilot shaft on the transmission.

The Advance DC motor is quite new on the market and there are no

ready made adapter plates on the market that I could find for mating it to a VW. I was burning a lot of gray matter on the problem deciding just what I would tell the machinist I wanted and fretting over how much it was going to cost. I was discussing my problem with one of the long time EAA club members at the local chapter and he told me that he had an extra "Kaylor adaptor" he could not use with the motor he was now using on his VW Bug. The Kaylor adaptor was made specifically for VWs

(Continued on next page)



Mounting an ADVANCE Motor

(Continued from Page 7)

as an aluminum casting with a machined coupling mounted in a bearing—just what I needed. The problem was that the coupling and motor mounting holes were made for an aircraft generator not for the Advance motor. I took the unit home and tried various ideas and measurements. After talking to more friends, coworkers, other club members and machinists, I came up with a solution that seems to work very nicely.

With the Kaylor adaptor in place on the transmission I put the motor in place in the engine compartment and found that with the two shafts nearly touching (less than 1/8" clearance) I needed the motor face to be exactly 1/2" from the face of the adaptor. This was just perfect since I needed to change the way the motor bolts to the adaptor. By putting a 1/2 inch plate of aluminum between the motor and adaptor I was

able to easily bolt the plate to the adaptor and the motor to the plate. The actual machining was a little more complicated than this, but the guy who did the work was a wizzard and did it without problems.

With the mounting problem solved the other problem was the shaft coupling. The Kaylor adaptor comes with a coupling made to fit the flywheel of the VW so that was fine. The other end of the coupling had a spline fitting made to mate to an aircraft generator. Fortunately the spline had a maximum diameter of one inch in the wells and there was plenty of "meat" left around it. The Advance motor requires a 1-1/8 inch shaft with a 1/4" keyway. All the machinist had to do was bore out the spline hole to the larger diameter and then cut the Keyway with a broach. It was necessary for the broach to cut the keyway clear through the coupling including the threads where the flywheel is mounted, however this does not create a problem.

One other minor change that was done because of the higher weight of the motor was to enlarge the six motor mounting holes in the casting from 5/16" to 3/8". One and one quarter inch 3/8-16 bolts were used for mounting the plate (which was tapped) to the adaptor and also from the plate to the motor.

I assembled the casting, flywheel, clutch and motor on the bench and then installed it into the car as a unit. It was necessary to lift the body from the frame a few inches to install the motor due to lack of length clearance doing it this way, but since the car was mostly disassembled anyway and the body had already been off once, it seemed the easiest thing to do. In the future if it is necessary to remove the motor I may decide to cut away the sheetmetal in the back of the motor and then reinstall it with bolts when reassembling it.

I have not applied power to the whole thing yet, but everything turns freely and the clutch functions normally so I am very confident the system will work.

REVIEW

Real Goods—Alternative Energy Sourcebook 1991

I reviewed this book with reluctance, thinking that it was just a glorified catalog to sell Real Goods' products. I was pleasantly surprised.

While chapter 8 on EVs is somewhat lacking (especially compared with 'Why Wait For Detroit?') and has outdated EAA Chapter information, it still is quite interesting and entertaining. If this were all that there was of interest to EAA members then it would not be worth the \$14 retail price. Happily it is not. Chapter 3 is titled "Power Storage and Management" and has several outstanding articles on batteries, battery care, chargers, adapters, wire, connectors, etc. As a 21 year member of the EAA I still learned a few things about lead-acid batteries.

Other chapters are titled "Power Generating Devices and Whole Systems" - including wind, solar, hydro, etc; "Alternative Power Loads" - including lighting, pumping, heating, and cooling; "Conservation and Purification"; "Tools and Appliances"; and "Education and Consumer Products".

There is also a large Glossary of Electronic Terminology, information on Lightning Protection, and the 1990 National Electrical Code for Photovoltaic Systems.

Every EAA member will find this book/catalog a very worthwhile addition to their EV library and to their own knowledge. -Pb

Contact:

Real Goods Trading Corporation, 966 Mazzoni Street, Ukiah, CA 95482
1-800-762-7325

91 EAA Symposium Reprints

We have available a limited number of reprints of 3 of the talks given at the '91 EAA Symposium. Those available are:

Dr. Richard Post

Flywheel Energy Storage

Chuck Lemme

"Team Tucson" Land Speed Record Plans

Ambrose Manikowski

Dr. Billing's Hydrogen Fuel Cell
(handout)

Please send a \$5.00 donation (check payable to EAA) for each copy ordered to:

EAA

1968 Elden Drive
San Jose, CA 95124-1313

The 1992 Solar & Electric 500

The 1992 Solar & Electric 500, the exciting focal point of a three-day event conceived to showcase the development and advancement of alternative transportation technologies is scheduled for April 24-26, 1992, at Phoenix International Raceway, Phoenix, Arizona - and will feature ...

The Solar Car Race of exotic, lightweight experimental racers, powered only by the sun.

The Electric Stock Car Race features street-registerable stock automobiles with electric powerplants.

Electric Hybrid Competition of stock electrics with auxiliary internal combustion engine for longer range.

Open Competition Race - "Funny Car" types, three-wheelers, "rail jobs." Wide open to new concepts!

Manufacturers' Prototype - Zero emission, battery only.

Manufacturers' Hybrid Prototype - Electric with auxiliary power units

PLUS: The Debut of the First Electric Indy-Car? (Stay tuned)

Looking back 80 years, the fledgling auto industry used the Indianapolis 500 as a highly visible stage to present their new products, and a competitive arena to prove their performance. Industry leaders met there, exchanged ideas and the industry grew rapidly. Today, the 1992 Solar & Electric 500 plans to provide the same format and catalyst for the growth of solar and electric-powered vehicles.

For information, contact: **The Solar & Electric Racing Association**
11811 N. Tatum Boulevard, #3031
Phoenix, Arizona 85028
Phone: (602) 953-6672
FAX: (602) 953-7733

Search for a New Logo and Moto

The EAA is looking for a new logo. Our present one is "too busy". It has served us well for these past years, especially considering that it reportedly was put together in only about 5 minutes near the start of the organization. But, now we need something less visually cluttered that represents electric vehicles and the EAA at a glance.

We would also like to develop a moto for the association. For example, "Clean, Quiet, Cordless", "Drive Better Electrically". I am sure that we can do better than these. We would like all of our members to please give this some thought and submit a rough or finished copy of your idea(s). The Board of Directors will then either select one or put a few choices up to a vote by the membership.

One example of a new logo, created by John Broenen, who created the new look and name of "Current EVents".

Please send your logo and motto ideas to: EAA Logo, 1249 Lane Street, Belmont CA 94002-3756



ELECTRIC AUTO ASSOCIATION

ADS WANTED!

We want advertisements for the Current **EVents** newsletter.

If you would like to submit an ad, please contact Susan Hollis for rate sheets and specifications.

Susan Hollis
18297 Baylor Avenue
Saratoga, CA 95070
(408) 374-8605

California Tax Incentive for Low Emission Vehicles (S.B. 2600)

By Bruce Brooks - EAA

Effective January 1, 1991 the California Legislature put into law a new tax incentive (S.B.-2600) for "Low Emission Vehicles" (LEVs). The law set aside \$750,000 per year for five years allowing California residents to claim up to \$1000 in income tax credits for the purchase of LEVs or "Devices" for conversion of existing cars to LEVs. The credit is for 55% of the purchase price up to a maximum of \$1000 for each certified vehicle or conversion device. The law also provides for an exemption to sales tax for these same LEVs or devices. The income tax credit includes automobiles, motorcycles, and "two person passenger vehicles". A special provision is made for vehicles over 5,750 Lbs. GVW, in this case the tax credit can go up to \$3500.

The purpose of this new tax incentive is to encourage the move from cars with normal gasoline or diesel internal combustion engines to cars which produce low amounts of emissions or no emissions. When the law was enacted it did not include a definition of "low emission vehicle" therefore there has been some delay in the implementation of the tax credit. The first cars to qualify for the tax credit are pure electric vehicles, since it could not be argued that these cars emit pollutants. Later, when LEV is clearly defined, other types of vehicles can be included in the tax credit program and there is some speculation that it may even be expanded to include "alternative energy vehicles".

Implementation and administration of this program is the responsibility of the California Energy Commission (CEC). However, since the CEC does not have the expertise or staff to deal with automotive suppliers and monitor the pollution levels from vehicles, the responsibility for the qualification process falls with the California Air Resources Board (CARB). Since the program involves a tax credit for state income tax, the Franchise Tax Board (FTB) is also involved in the process.

The CEC has the job of keeping track of who applies for the tax credit; how many applications there are; and when the pool of money runs out for a given year. The CEC requires a prospective purchaser to submit an application form showing their intentions to purchase a "certified LEV" or "certified device" and to estimate the amount of tax credit they will be entitled to. The application will reserve a place in line for the tax credit for that individual for up to sixty days. Then, within the sixty days, the purchaser must submit a second form (the Purchase/Installation form) to the CEC stating the purchase was made, or that the "device" was installed. This form must be signed by the seller who obtained the certification. Once the application has been acknowledged, the CEC issues a certificate and the tax credit can be filed along with the buyers income tax return. The purpose of all the paperwork is to insure that no more than the \$750,000 are promised to taxpayers in a given year, and that applications are processed in a first-come first-served manner. Any funds not claimed in a given year are returned to the state and are not rolled over to the following year(s).

The tax credit can only be applied for in the year the vehicle was first purchased or the year in which the device installation was completed. It is important to note that the credit is for each vehicle or vehicle conversion, not for each taxpayer, so it is possible for a business to buy a fleet of cars and get more than one credit.

The California Air Resources Board is the state agency which sets standards for automobile pollution and deals with both automobile manufacturers and after-market parts suppliers. Therefore the CEC has given it the task of certifying vehicles and "devices" which qualify as LEVs for the purpose of this tax credit. As stated earlier only pure electric vehicles will be certified until the

definition of LEV is clarified. Pure electric vehicles cannot have any system on board which consumes any fuel other than electricity for any reason, not even a gas heater.

There seems to be several ways a vehicle qualifies for the tax credit. Some cars are manufactured new as LEVs, and others are converted to LEVs and then sold by the "manufacturer" or dealer. In addition, there are kit cars which are sold complete but are assembled by the buyer; these appear to be in the new car category. As of early December 1991, only Solar Electric Engineering of Santa Rosa, CA has certified a vehicle under this program and it is considered a conversion rather than a new vehicle.

Applying the tax credit to a "device" is only a little bit clearer. CARB has chosen to interpret "device" to mean a "kit" which includes a collection of parts and instructions for use on particular makes and models of vehicles. CARB does not want to deal with individuals in certifying cars which are converted, so they are certifying products sold by aftermarket retrofit manufacturers. In my discussions with CARB, it seems they are being quite reasonable in the definition of a "kit". A "manufacturer" seems to be any business that puts a collection of parts appropriate to the vehicle to be converted together with instructions on how to do the conversion to electricity using the kit. The application for certification requires the make and models of vehicles that can be converted with the kit, expected quantity of vehicles to be converted. The application also requires information on the number and type of batteries to be used as well as information on battery disposal procedures. The manufacturer must provide a sticker or decal to be attached to the vehicle showing that the vehicle qualifies as a "Low Emission Vehicle", the

(Continued on next Page)

California Tax Incentive

(Continued from Page 10)

manufacturer's name and address and the certification number assigned by the CARB. As of early December 1991, only Electro Automotive of Felton, CA has a kit that is certified.

Since CARB is interpreting device to be a kit used for conversion, it is unlikely that the real manufacturers of components for electric vehicles will be able to get the certification for their products which could then be sold by their dealers. For example, the Advance DC motors or PMC controller would not be certified unless they are part of a complete retrofit package.

The Franchise Tax Board has provided a new tax form (California Form 3554) to be submitted with the state tax return when claiming the tax credit. If verification is required during an audit or review of the return, the certificate from the CEC will be required for verification. A few special rules apply to the credit. This credit can only be applied for in the *tax year* the car was first purchased or the installation of the device was completed. For most people their tax-year is the same as the calendar year, but if your tax year ends in June for example, a vehicle(s) purchased in October of the preceding calendar year can qualify. The credit can only apply up to the limit of the taxpayer's liability and cannot be carried over into the following tax years. That is, if the taxpayer owes less than the credit might allow, the credit can only take the tax liability to zero.

This program seems to be a worthwhile first step toward the monumental task of replacing the high pollution cars on our roads today. Obviously a tax break for an average of only 750 cars per year for five years (probably only a handful in 1991) will not make a dent in the problem, but the help it gives small manufacturers getting started developing and building low emission vehicles and components is a long term benefit.

The awareness it brings to the public of the problem and possible solutions is also valuable if we are to gain acceptance of these vehicles and reduce air pollution and dependence on fossil fuels. ☺

For More Information Contact:

California Energy Commission

(800) 822-6228

Transportation Technology and Fuels Office

1516 Ninth St.

Sacramento, CA 95814-5512

Ms. Jennifer Allen

(916) 654-4634 or (916) 653-0291

California Air Resources Board

Aftermarket Parts Section

9528 Telstar Ave.

El Monte, CA 91713-2990

Ms. Rose Castro

(818) 575-6848

Franchise Tax Board

Sacramento, CA

Ms. Marion Mann DeJong

Electro Automotive

P.O. Box 1113

Felton, CA. 95018

Mr. Mike Brown

(408) 429-1989

Solar Electric Engineering

116 Fourth St.

Santa Rosa, CA 95401

Mr. Gary Starr

(707) 542-1990

Sacramento Chapter First Meeting

On February 22, 1992 President Richard Minner will chair the first monthly meeting of the newly organized Sacramento chapter. The Sacramento Municipal Utility District has provided their General Purpose conference room No. 150 in the T & F Building located in 11708 59th Street, the off ramp and Highway 50. Meetings are held on the 4th Saturday of each month from 10:00 AM to noon.

Two members of the EAA board of directors will speak at the meeting. Paul Brasch, editor of "Current Events" will discuss the future goals of the EAA and how he sees the roll of the EAA in increasing public awareness of EVs. Bob Wing, Chair of the membership and chapter relations committee, will compare today's EV interest with that of a decade ago, and present a view of personal transportation in the year 2000.

For more information contact:

Richard Minner

at 1-916-454-5524

(day or evening)

or write:

5201 Dover

Sacramento, CA 95819-3824

OOPS!

Two corrections to the December/January issue of Current Events.

Pg 2 - Editorial

The correct phone number to SERA is (602) 953-6672.

Pg 15 - Want Ads

Beyond Oil

The correct phone number to reach Dan is (415) 388-0838.

LETTERS TO THE EDITOR

Dear Friends,

This automobile situation is getting ridiculous! The gas price keeps going up, and the cars keep breaking down. I drive an old Dodge that has a standing appointment with my friendly neighborhood mechanic. I asked him what would be a good new car to buy, and he told me that it didn't make any difference because no matter what new car I bought, I'd see him as often as I do with my vintage Dodge.

Even my wife is ready to consider an electric car. That's a real change!

I have this old material about the EAA and I don't know if the address is current or if the EAA still exists. But if you are the right person, please send me some information about the EAA and some information on how to get in contact with electric car owners. I need information as soon as I can reasonably get it.

Thank you in advance for your information and help, I will be waiting with impatience to get started on this learning experience.

J.A. Engler - Pittsburg, Kansas

Kansas should be a great place for wind generators to recharge your electric. Your maintenance will drop so that you won't be such friends with your mechanic. -Ed.

Dear Paul:

Would like information on getting services for electric vehicles, especially repair services from already established service stations, especially those of the chain firms, just like now exists for gas-powered vehicles. Mine requires a recharge by plug-in, for varying times, but would like to use on the road the same as other vehicles as much as possible. Need names of stores, motels, gas companies (like Exxon and Chev-

ron), etc., who would okay such plug-in recharges at a modest metered price, and who would furnish emergency road service, like the Auto Club, and make repairs like flat tires and locks, etc. at intervals of 25 to 30 miles along all streets, roads, and even highways. If you know of an existing organization and/or one forming, please let me know promptly.

Helen Marx - Bellflower, CA

Sounds like a great concept. Would anybody like to pursue these ideas through the EAA? Yet another reason for more help and an office! -Ed.

Dear EAA,

I have just finished reading the report on battery service by Bill Williams. How about some EAA data on things like:

Battery pack costs - How much should we expect to pay for batteries when buying 20 of them?

Do any manufacturers build golf cart-type batteries, with acid splash recirculation baffles like the one Sears Gold Diehard uses?

If not, what about a letter from EAA to several battery manufacturers requesting such a battery be made available? Put me down for 20 of them, my 007 needs a new pack soon. How many members cars times the number of batteries = ?. This would be a good number to use to get the attention of a manufacturer.

What about a circuit to monitor battery charging temperature and adjust the charge rate when it becomes too hot?

The report on the Phoenix Race was nice. Anyone have a video tape to rent for an EAA donation? Might be able to raise some funds for EAA by offering tapes of some events.

The Newsletter on white paper is a lot easier to read. Keep up the good job.

Joe McCarthy - Woodlands, Texas

Presently \$55-65 ea. are the numbers that I hear. Any form of recirculation would help. Nice idea about a video, but the rights were all locked up by the host in hopes of defraying the cost of the race. -Ed

Dear Paul:

I am a member of the EAA and have just received your latest Newsletter. The message as regards a new battery is very pertinent. A much more efficient battery, one that takes only 5 to 10 minutes to recharge is necessary in order to compete successfully with gas-powered vehicles.

Why not encourage your knowledgeable and interested specialists to examine the whole system of electrical generation and use, so as to improve the efficiency of the system, step-by-step, from the solar panels through brakes, etc. By streamlining the existing system(s), an improved system could emerge that would eliminate large, heavy, storage batteries and replace them with small ones at crucial points. Or replace batteries entirely.

That type of work is not my specialty, but those who have the knowledge, education, training, experience, tools, workplace, etc. and will work on that type of effort would be much appreciated by me and others.

Keep up the good work now! The future looks bright, with many opportunities for creating a better world, so, keep in touch!

Ms. Helen Marx - Bellflower, California

The Lithium Polymer solid re-dox battery just might be the one to make it all happen. -Ed.

More Letters . . .

Dear Paul:

I am a brand new member of EAA East Bay chapter and haven't attended a meeting yet. I don't at this writing contemplate building an EV but I have had a long time interest in the subject because of the positive impact that form of transportation could have on our cities and the air we breathe.

I read your article "More Power to the People" in the April issue of the News and while I have little "hands on" knowledge of the problems, maybe I can contribute a few ideas that may or may not have merit.

It would seem that if EV transportation is going to go anywhere it is up to the enthusiasts of the clubs to help make it practical and viable. To this end I suggest the following:

(1) A dynamometer arrangement would provide the ultimate test bed to prove range and capacity under varying load conditions. I believe that this would not be an impossible home built task if a suitable location would be available. As an alternative, perhaps a supplier of motors, batteries, etc. would donate use of such equipment.

(2) Lacking that ability, a standard plan of city streets/country roads could be used almost as well. The idea of course is to set the standard that all must meet.

(3) To monitor performance, recording gauges would be nice but they are very expensive and I believe that this would be overcome by the following. A small portable instrument panel that contains conventional and test instruments even if it duplicates those already in the auto. Besides voltmeter, ammeter, clock w/ sweep hand, motor temp, speed/odom, G-meter and inclinometer would be a panel for write in info (items like VIN, date, driver, tire pressure, and any additional facts). All will be recorded by an inexpensive short focus video camera on a fixed mount. In essence the whole thing could go into a box and be self contained with few external connections. The speedo could be run from a home-built fifth wheel (bike like) type arrangement for

simplicity and accuracy. The ammeter which would be a hard connection to make ordinarily might be done by using a modified clamp type ammeter.

Such a unit would adapt to any EV which could then run the standard course and the results under any condition of charge, load would then be there to interpret. It would seem to me that this would not be a particularly expensive project. Much of the necessary instrumentation is readily available cheaply, mostly a matter of assembly. Once a prototype is made a plan of the project could be published so that interchange of ideas could be made. I don't know much about the present state of EVs but it seems that cooperation between manufacturers of products and hobbyist-engineers would be what brings EVs into the fore in this decade.

Don George - San Leandro, CA

More wonderful technical ideas, some of which are being worked on now. These are the types of ideas that if acted on by a more organized and structured EAA can make a major difference in this world. We are after all the premiere EV organization! -Ed.

Paul:

Twenty to twenty-five years ago I was involved with 6 groups at different times trying to build electric cars. Only one was a winner. The other 5 fell by the wayside—funds and temperament were the main causes of the failures.

Why not do the same? Convert old cars—small cars are plentiful and cheap. More and better technicians are available at present so completing a conversion should be a lot easier and quicker than 20 years ago.

Let's set up small groups of 2-3-4 people who know a bit about mechanics and start to produce EVs that are fit for the road and look conventional.

The cost—after \$200-\$500 for a chassis—would be perhaps \$5,000. Let's check part prices and come up with a realistic ballpark figure (price).

David Senet - Las Vegas

Reply to R.B. Stockstill:

I am told that Bradley drawings may be obtained from John Stockberger at (708) 879-0207 -ed.

Dear Paul,

My battery pack in the Jet 007 is getting old and I will be replacing it this year. Have any manufacturers begun to use the splash circulation of acid in golf cart size batteries yet?

The Sears Gold Diehard is the only place I have seen it used. This might be valuable information to put in our newsletter.

Joe McCarthy - Woodlands, TX

I don't know of any. If anyone does know of such a battery, please let us know too! -Ed.

Dear EAA News,

I loved your 100th monkey article. Its the way to go.

Electric autos need good bumper stickers to make people realize that they aren't just gasoline cars.

Hope that you let us know what your stickers say in your newsletter or that I can order some for my two cars which arrive (hopefully) early fall.

Jay Harris - Berwyn, PA.

Glad that you liked the 100th Monk. Note the start of a search for a new Logo and Motto in the last issue. -Ed.

Dear Paul,

I really enjoyed reading the Aug/Sept issue of the Current EVents. I came across this article in our local newspaper about the G.E. plant in Salem, VA designing the motor and electronic controls for Ford's electric cars.

It might be an interesting article for the Newsletter. (See article on next page.)

Thank you for a wonderful newsletter. I became a new member a few months ago.

Joan Zorr - Salem, VA

SALEM GE ON FORD'S ELECTRIC CAR TEAM

George Kegley, Business Editor - June 1991

General Electric Drive Systems in Salem confirmed Friday it will be a major subcontractor in the design of electric cars Ford Motor Co. is building. The project is under a \$14.5 million grant from the federal Department of Energy.

The Salem plant has a three-year subcontract to design the car's electric subsystem, part of the power train.

GE would not disclose the dollar value of its contract. Ralph Benson, manager of the program, said a small team of development engineers has already started work.

Ford has received a research and development contract from the Department of Energy for work on the Modular Electric Vehicle Program, designed to enable manufacturers to build electric cars in greater volume at lower costs and sooner than in traditional operations.

The project is intended to produce three sizes of power trains to operate a two-seat, small passenger car; a sub-compact station wagon; and a minivan.

These development vehicles will be designed for acceleration from 0 to 50 miles an hour in less than 18 seconds and reach a top speed of 70 miles an hour. The program is aimed at developing an environmentally attractive alternative to gas-powered vehicles.

GE said it will design the motor and the electronic controls for the cars.

In an announcement this week, Ford said it will build a demonstration fleet of as many as 100 cars late next year in order to gain operating experience before going in large-scale production.

The Salem plant and a corporate research and development group in Schenectady, N.Y., have worked on several different electric car programs in the past.

Ford said some of the demonstration vehicles will have an expected range of at least 250 miles.

GE will deliver its part of the power train to Ford, Benson said. As market demand develops for the cars, GE said it will shift its contract from government business to commercial marketing and production. ☺

PBS To Run EV Story

On February 20 "Silicon Valley Reports" is scheduled to show a story on EVs, with mention of the EAA and an interview with Dr. Steven Visco of Lithium Polymer battery fame and possibly myself.

This show is produced by channel 54, the local PBS station in San Jose, and I am told is shown by selected stations throughout the PBS network. Look for it.

Locally it is shown at 9:00 PM on Thursday with rebroadcast at 7:30 PM, Friday and 5:00 PM, Saturday.

My thanks go to Bob Grove for his interest in telling this story.

-Pb

FOR CONVERSIONS, WE'VE GOT IT ALL.



PARTS A complete line of conversion components--all new production built for EVs, not surplus or adapted.

KITS Basic and Deluxe Kits for any compact manual transmission car, the bolt-in *VOLTSRABBIT™* Kit, and even a Retrofit Kit for upgrading older EVs.

VIDEOS Videos range from the general interest level to introductory hobbyist to detailed tech info, including the best-selling *Electric Vehicle Components Primer*.

BOOKS Books range from general interest to technical, including the definitive how-to manual *Convert It*.

TAX CREDITS All kits (except the Retrofit Kit) are certified by the state of California to be exempt from sales tax and eligible for up to \$1,000 in state income tax credits. Our kits were the first to be so certified.

For Complete Catalogue, Send \$5.00 To:

ELECTRO AUTOMOTIVE
THE SYMBOL OF EXCELLENCE
IN ELECTRIC VEHICLES.



P.O. BOX 1113-E4A, FELTON, CA 95018

(408) 429-1989

Since 1979

EAA Chapters

ARIZONA

- Phoenix
Lee Clouse (602) 943-7950
P.O. Box 11371, Phoenix
AZ 85061
Meetings: 4th Saturday/month 9am
- Noon
Even months: Chapman Chev.,
Baseline Av.
at McClintock.
Odd months: Lou Grubb Chev., 27th
at Camelback, Phoenix
- Tucson
Philip Terpstra (602) 822-2030
Publisher Electric Vehicle Directory
FAX (602) 741-2774

CALIFORNIA

- East Bay
Jim Danaher (510) 339-1984
1986 Gouldin Rd., Oakland
CA 94611
Meetings: 2nd Saturday/month 9:30
- Noon
PG&E Service Center, 4801
Oakport St. (880 frontage road
south of High St.), Oakland
- Los Angeles
Irv L. Wiess (818) 841-5994
2034 N. Brighton "C", Burbank
CA 91504
Meetings: 1st Saturday/month 11am
- 1pm
Pasadena City College, 1570 E.
Colorado
Blvd., Rm. E220, Pasadena
- North Bay
Bob Wing (415) 669-7402
P.O. Box 277, Inverness, CA 94937
Meetings: 2nd Saturday 10am -
noon, PG&E business center, 111
Stony Circle, Santa Rosa, CA
Peninsula
- Jean Bardon (415) 355-3060
540 Moana Way, Pacifica
CA 94044
Meetings: 1st Saturday/month 10am
- Noon
San Bruno Public Library (down-
stairs), San Bruno.
- Silicon Valley (Founding Chapter)
Paul Brasch (408) 371-5969
1968 Elden Dr., San Jose
CA 95124-1313
Meetings: 3rd Saturday/month 10am
- 1pm
Hewlett Packard Santa Clara
facility, Stevens Creek Blvd. at
Lawrence Expwy., Santa Clara
- San Jose
Don Gillis (408) 225-5446
5820 Herma, San Jose, CA 95123
Meetings: 2nd Saturday/month
10am - Noon
1592 Jacob Ave. (near Meridian),
San Jose
- Sacramento
Richard Minner (916) 454-5524
5201 Dover Avenue, Sacramento,
CA 95819-3824

- San Diego
San Diego Electric Vehicle
Association
Ron Larrea (619) 443-3017
9011 Los Coches Road, Lakeside
CA 92046
Meetings: First Tuesday at 7pm at
Eldyne Corp, 9775 Chairemeont
Mesa Blvd, one block, East of I-15.
- San Luis Obispo (Chapter Forming)
Rick Doran (805) 541-9216
PO Box 976, SLO, CA 93406

NEVADA

- Las Vegas
Gail Lucas (702) 736-1910
Desert Research institute
PO Box 19040
Las Vegas, NV 89132-0040

NEW ENGLAND

- Maynard
Bob Batson (508) 897-8288
1 Fletcher St., Maynard
MA 01754

NEW JERSEY

- Tri-State EAA
Kasimir Wysocki (201) 342-3684
293 Hudson St., Hackensack
NJ 07601

FLORIDA

- South Florida EAA
Steve McCrea (305) 463-0158
101 SE 15th Av., #5, Ft. Lauderdale
FL 33301

HAWAII

- EVA of Hawaii
Dave Hill (808) 943-2784 (Bus)
3620 #C Alohea, Honolulu
HI 96816

TEXAS

- Houston EAA
Ken Bancroft (713) 729-8668
4301 Kingfisher St., Houston
TX 77035

WASHINGTON

- Hadlock (Being organized)
Roderick Erwin (414) 385-2962
221 Kennedy Road, Pt. Hadlock
WA 98339

WASHINGTON, DC

- EVA of Greater Washington, D.C.
David Goldstein (301) 213-3990
(301) 869-4954
9140 Centerway Road, Gaithersburg,
Md 20879

- Seattle EVA
Ray Nadreau (206) 542-5612
19547 23rd N.W., Seattle
WA 98177

WISCONSIN

- Milwaukee
Dave Parez (414) 481-9655
3251 S. Illinois, Milwaukee, WI
Meetings: Meets on irregular basis,
but he would like to hear from
interested persons

Want Ads

4 Govt. Surplus Electric Vehicles: 2 cars, 2 trucks; outstanding value. Also, new PMC parts, incl. controllers. Beyond Oil. (415) 388-0838

Harbilt Electric Postal Van, 22K mi., all lights, horn, direct., roof vent, 4 1/2' x 6' bed. Street legal, 3 locking doors. Needs paint, tires, chopper and batteries. \$5,800/firm. Call Tony @ 1-510-837-5345 after 5 pm.

3 Wheel (4' x 8') Harvester, flatbed, re-built with new chopper. 36V insulated pack with automatic charger. Runs great. \$1,950/firm. Call tony @ 1-510-837-5345 after 5 pm.

For Sale: EV Ford Courier/Jet Industries pickup w/camper shell. 1981, 16K mi. on truck. GE series motor, 20 new batts, new PMCMosfet contrllr. Peppy! Must sell - owner afraid of electricity! \$7500. (510) 841-1900.

For Sale: '81 Bradley, good batts, Curtis PMC contr., custom disc brakes. \$10,000/OBO (310) 357-2700 Ask for Ed Begley

\$5 for 5 lines (minimum) Want Ad

The EAA is not responsible for the accuracy of ads

Calendar

March 14 Dr. John Reuyl on the successful XA-100 EV hybrid sponsored by the California Energy Commission. (North Bay Chapter at the Santa Rosa PG&E Conference Room.)

March 25-26 Globalcon '92, Energy Engineers and the Environment Conference and Exhibits (404) 447-5083

April 25-26 Solar & Electric 500 2nd Annual Competition. Saturday and Sunday. Phoenix Int'l Raceway. Call (602) 953-6672

May 17-23 4th Annual American Tour de Sol, Solar and Electric Car Championship. Contact NESEA, Northeast Sustainable Energy Association. (413) 774-6051.

May 25-27 The Urban Electric Vehicle, an International Conference. Stockholm, Sweden. Phone no. 46 8 23 0990

June 28 Palo Alto Concourse De Elegance.

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

September 9-13 Al Tran Ex '92, International Alternative Transportation Exposition, Santa Monica Civic Auditorium. (310) 285-0093.

September 19-20 World's Oldest EAA Rally and Electrathon.

September 27-30th The 11th International Electric Vehicle Symposium.

For info on the EAA, send SASE to the address below or call (415) 591-6698, (415) 685-7580 or (408) 371-5969. Please call weekdays 10am - 5pm Pacific Time.

KTA SERVICES

12531 BREEZY WAY ORANGE, CA 92669
714/639-9799 or 714/821-2000 X5396

Established in 1984, KTA SERVICES caters to electric vehicle hobbyists and manufacturers by supplying EV components, publications, and design/consulting services. We are, at last, a complete supplier of EV components....everything you need except for the batteries. All components we recommend and sell have been selected with safety and reliability foremost in mind. All components have been proof-tested in electric vehicles. All components are new, competitively-priced, and come with full manufacturer's warranties. We proudly stock the following:

- *CURTIS-PMC Motor Controllers
- *ADVANCED DC Series-Wound Motors
- *ALBRIGHT ENGINEERING Contactors
- *GENERAL ELECTRIC Circuit Breakers
- *BUSSMAN & RELIANCE Safety Fuses
- *SEVCON DC-DC Converters
- *K & W ENGINEERING Onboard Chargers
- *An ever-growing lineup of EV Publications

- *CURTIS-PMC Throttle Pots
- *CURTIS INSTRUMENTS Battery 'Fuel' Gauges
- *KTA SERVICES' Expanded-Scale Meters
- *DELTEC Meter Shunts
- *EVCC Adapter Plates & Hubs
- *CAROL Ultra-flexible Welding Cable
- *THOMAS & BETTS Welding Cable Lugs
- *Battery Cables custom-made to spec.

You can purchase your components from us with the confidence of knowing that we specialize in user-friendly customer service. With 10 years of EV experience and engineering expertise, we can answer just about any EV question you can come up with. Additionally, we offer engineering services:

- *Complete System Quotations (free)
- *Project Overview with Schematic & Recommendations

- *Project Consulting/Engineering Design
- *Computer-based EV Performance Predictions

Call or write us for your EV needs. For a COMPONENTS & PUBLICATIONS CATALOG, send \$5.00 (refundable).



February/March 1992

ELECTRIC AUTO ASSOCIATION

1249 Lane Street, Belmont, CA 94002-3756

Forwarding and Return Postage Guaranteed
Address Correction Requested

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

F92

• TIME DATED MATERIAL - PLEASE DO NOT HOLD •

