



CURRENT EVENTS

October/November 1992

Promoting the Use of Electric Vehicles Since 1967

Vol. XXIV No. 6

90+ Mph Electric Vehicle

by Paul Brasch



Super—charged Porsche!!!

Ron Rasmussen allowed Dick Rahders of Electro Automotive and myself to demonstrate his Porsche 914 conversion to Santa Clara County Supervisor Rod Diridon on September 17. Rod was driven from his office in downtown San Jose to attend a transportation meeting in San Carlos, a distance of 28 miles. This was done at 75 mph on the freeway. The car was plugged into a 120 volt outlet and allowed to pull 12 amps during the meeting and our lunch afterward. Whereupon Rod was allowed to drive back. Rod has owned many Porsches so he is familiar with them. Well, he wanted to see if it really drove like one. He drove it back at speeds of 80-85 mph. He commented that it was slower to accelerate than a gas 914, though not badly so, but otherwise drove the same. He was most impressed.

The car was recharged, then on Saturday, the 19th, Ron drove it to downtown San Jose about 5 miles, again hitting speeds of 75 mph. He drove some in San Jose and then got a minor recharge for an hour in San Jose before he headed toward home on the

other side of the Santa Cruz mountains. He did not have a full charge.

Climbing the steepest part of the 1700 foot elevation change from San Jose to the summit over the Santa Cruz mountains he slowed to under the posted 50 mph. Then on to sea level at Santa Cruz at speeds approaching 100 mph and back up the mountain roads to his home at about 1200 foot elevation. This totaled almost a 3,000 foot elevation change on winding mountain roads and as it was getting dark, he used his headlights. He totalled 44 miles of hard & fast mountain driving on less than a full charge.

What was his magic trick? Nothing—just a standard conversion kit from Electro Automotive, good U.S. batteries, and Goodyear low rolling resistance tires. This kit uses the large advanced DC motor and PMC controller. In short, anyone can reproduce this car and its performance.

Now this is a REAL performance EV. By the way, Ron wants to do another one, so this one is for sale. You may call him at 408-459-7414.

World's Oldest EV Expo

by Clare Bell and Paul Brasch

Our September 19, 1992 version of the Rally was different in character from our previous EVentS. The change in location from the Lockheed parking lot to Plaza Park in front of the downtown San Jose Fairmont Hotel transformed the traditional Rally competition into an Expo that demonstrated the practicality of electric vehicles to the general public. The Expo was a resounding success despite major challenges. A total of 39 EVs were present. 26 electric cars were in the parade and static display while 13 Electrathon entries competed in the Electrathon race. The shift in location introduced various difficulties, including problems with permits for vehicle access and street lane closures for the parade and

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Editor's Corner

What Is Real?

Real is defined as being true, not merely show. It is defined as actual, rather than merely perceived or so-called. In the field of electric vehicles, this should also include the practical aspects of being reproducible, cost effective and reliable.

Why do I bring this up? Because there is a great deal of disagreement in this field as to what is real. I know EAA chapter presidents who only believe what is stated in academic studies by researchers who have based their information on the performance of the G-van and have not asked what EAA members' real experiences have been. These "researchers" make televised statements that EVs must have \$1,000 battery packs replaced every 1-2 years. This is absurd.

Our REAL experience is typically 4-5 years and less than \$1,000 with a minimum of 3 years. Just as the world outside the EV community has misperceptions of what an EV is like, there have grown to be many misperceptions of Reality in the EV community. It has been dogma that only small cars make adequate conversions. Recently I have seen a very fine conversion of an Oldsmobile Firenza station wagon and a Chevy Blazer truck. I also heard of a Wrangler 4-wheel drive conversion.

How about range? I have stated that a typical conversion will get 50-70 miles on a charge, yet we have many cars that can go 80-90 miles on a standard 96-108 volt system. We also have some cars that can only get 28 miles. These obviously have a half or undersized battery pack or other serious technical problems.

However, their builders, in order to protect their egos, may only believe that 28 miles is real and all other claims are bogus. I have even had members tell me that low rolling resistance tires will only improve range on the flat, not during hill-climbing. I call this the "don't confuse me with the facts" mindset.

Another public misperception in some parts of the EV world is that EVs are fine for a second or third car. Members who have both find that the EV is the primary car and the gas buggy is only started occasionally.

A misperception in some parts of the EV world is a lesson not learned from 1915. Before Mister Kettering proved that the self-starter worked —experts said that a motor to start a gas engine would have to be as big as the gas engine. Kettering knew from his own experience with cash drawer motors that electric motors could be overloaded tremendously for a short time. Ergo the self-starter that made the gasoline vehicle the car of the world.

But what do I see still being done in this country and others? The same mistakes that EAA members made 15-20 years ago. Using a 72 volt system on a 72 volt nameplate rated motor. This is stone knives and bearskins. 20 years ago, when we only had aircraft starter generator motors to use, we ran up to 72 volt systems on 24-30 volt motors. Today's Prestolite and Advanced D. C. motors may say they are designed for 72 volts, but they MUST be driven by a higher voltage system if you want to get any reasonable acceleration out of them.

The present standard in conversion is a minimum of a 96 volt system. Advanced D. C. now specifies their motors for up to 120 volts. Ed Ranberg applies over 200 volts to his Advanced DC motor in his racing motorcycle. It works. It is REAL.

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Article 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 above.)

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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Electro Automotive Crash Test Program

by Shari Prange

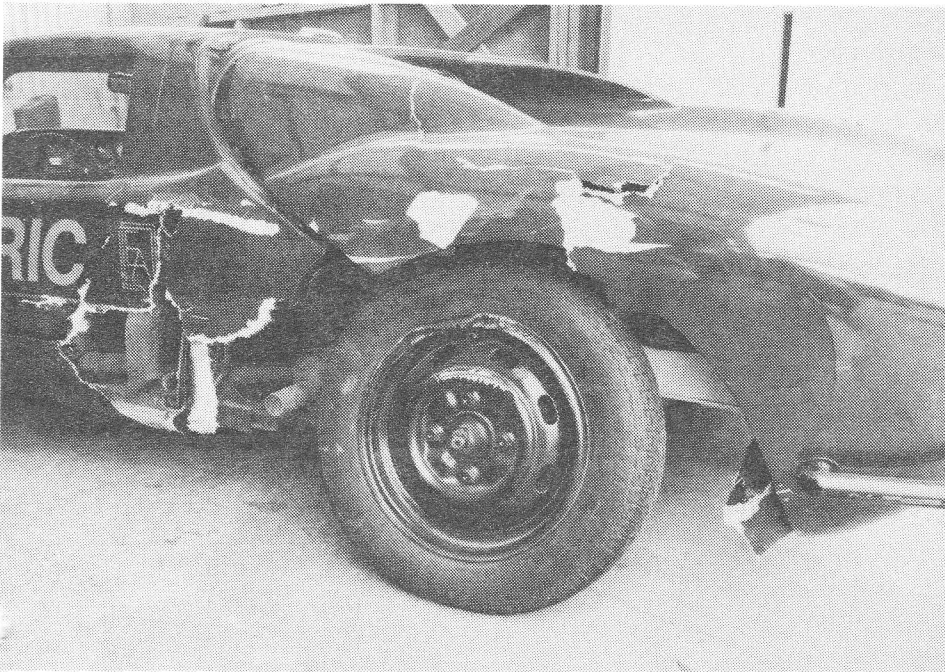
In 1991, in response to a shortage of hard crash test data on EV's, Electro Automotive conducted a surprise 5 mph crash test between a Voltsrabbit and a G-van, the latter generously supplied by Pacific Gas and Electric. This year, the program has escalated to a 30 mph side impact crash using the company's flagship electric Aztec. This test is being sponsored by State Farm Insurance.

The Aztec was traveling down a residential street at approximately 25 mph. A Buick approaching from the opposite direction drew alongside the Aztec and abruptly turned left into it. The Buick struck just behind the driver's seat, skidding the car sideways across the pavement and pinning it between the Buick's bumper and a signpost.

Volunteer crash test dummy Dick Rahders was shaken but undented. The Aztec suffered substantial damage. Of course, the fiberglass body broke in several places. Both rear wheel rims and the passenger side front wheel rim were bent. The rear suspension was seriously bent. Both rear frame rails (1 1/2 in. diameter steel pipe) were bent and one snapped in two where it was welded to the rear body bracket. The main battery box, made of plywood, separated at all the seams. The secondary battery boxes, made of welded polypropylene, broke at the welds, and one broke across the bottom when the frame rail broke and dropped it to the pavement. The Buick suffered abrasions to its bumper.

The encouraging data gained from this crash involved the safety of the battery pack. The battery boxes were of an old style with no holddowns, but none of the batteries were displaced from their positions. None of the interconnects were broken. Despite the substantial force involved and the lack of protection offered by a fiberglass body, there was no explosion, no fire and not a single drop of spilled acid.

Electro Automotive founder Mike Brown feels that this crash evidence speaks strongly for the safety of electric cars in collision. He states emphatically, however, that Electro Automotive has no plans to conduct further crash tests.



Electro Automotive Crash Results

EV Goes 406 Miles on Single Charge

Joe LaStella, president of Battery Automated Transportation International, announced that on Sept. 12, 1992 he drove an electric Geo Metro 406 miles on a single charge, using a battery of undisclosed chemistry (not lead-acid). LaStella completed the 250 mile round-trip distance from Salt Lake City, Utah to Wendover, Nevada and back.

He then set out on a second excursion, reaching Wendover and heading back to Salt Lake City. He pulled over with depleted batteries 34 miles outside Wendover, having covered a total of 406 miles without recharging in 5 hours, 20 minutes at an average speed of 50 mph.

The record was set during the 250-Mile Utah World Challenge, a race sponsored by La Stella's company, B. A. T. International.

Although major automobile and battery manufacturers were invited, LaStella's was the only car in the race. The 2300 lb. red Geo Metro and its 750 lb battery pack was pre-race inspected by a certification team composed of Darrell Bunch of Ford, Bacon and Davies Technologies, Inc., a Salt Lake engineering firm, Bill Rogers and Gary Diedorf of Advanced DC Motors, and Lamar Luck, representing Utah Power and Light.

The team also followed the B.A.T. car during the entire race to verify mileage.

For more information, contact B.A.T. International, 2471 South 2570 West, Salt Lake City, UT 84119, (800) 255-0906.

World's Oldest EV Expo

(Continued from page 1)



Best show ever!

Electrathon. The Expo also had to compete with the Eco Expo being held the same weekend in San Francisco. In addition, people had trouble finding Plaza Park, since it is not listed by that name on any of the San Jose maps, although it has been there since the 1700's. The Rally committee got all these sorted out, only to run up against a last-minute show-stopper. When the Rally/Expo committee arrived at Plaza Park at 8:30, they were informed that the risk manager for the City of San Jose would not allow EAA members to give rides to the public!

Despite these last-minute roadblocks, the Expo drew an estimated attendance of 2000 over the day. Although the change in location caused problems, having the event in downtown San Jose allowed us to reach a different audience and gave us greater exposure.

Three motorcycle policemen were on hand to control traffic and assure pedestrian safety. Cars and Electrathon vehicles were lined up for display along the west side of the Plaza Park island and South Market Street. Vehicles came

from as far away as Oregon and Southern California. Some, such as Ron Rasmussen's 914 Porsche conversion, drove there on battery power.

The lane closure problem was resolved in time to get the Electrathon rolling by noon. The 13 entries ran a distance competition for one hour around the course. The winner was Evan Dagle, driving a low-slung go-kart-style vehicle at an average of 26 mph for approximately 70 laps. Congratulations, Evan!

At 1:15, the cars moved out for a 5 lap parade around the Plaza Park island while Silicon Valley President Paul Brasch described each one. Some of the more notable EV's included the 914 Porsche, converted with an

Electro Automotive kit, a Vortec 3-wheeler, Bruce Brooks' stunning new Karmann Ghia conversion, and the Stanford Hybrid Auto Research Project's Ford Tempo. John Thielking's 120 Volt Oldsmobile Firenza station wagon using 12 volt gell cells drove over the Santa Cruz mountains from Scotts Valley all the way to San Jose. The women made a good showing, with Mary Ann Walpert's Silver Rabbit equipped with solar panel assist, Anna Cornell's "Buz Bunny" (VW Rabbit) and Clare Bell's funky blue Baja VW, "Lightning Bug". A sleek-looking Bradley, an historic Sebring Zipper and an electric motorcycle were also in the parade. PG and E displayed its G-van and the City of Visalia had a 5-speed mini-van. Previous Rally classics also showed up, including Bill William's yellow Honda, Lee Hemstreet's white 67 VW bug, and Larry Burriesci's Plymouth Arrow.

The Expo food booth was manned and supplied by the Peninsula EAA chapter while the San Jose EAA members served up soft drinks on ice. Vari-



Some of the 34 Electric Vehicles in attendance.

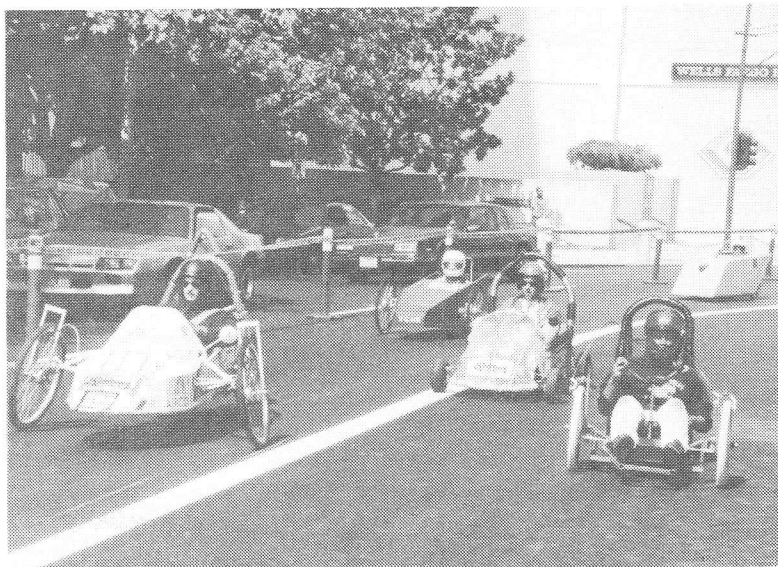
World's Oldest EV Expo

(Continued from page 4)

ous EV vendors were on hand to show the newest products and services. Mike Brown and Shari Prange offered the latest in EV T-shirt fashion along with their bolt-together conversion kit for VW Rabbits. The San Jose EAA chapter table showed a comparison of the size and weight of the old-type ferroresonant charger (Lester) and the new transistorized switching charger (K & W). There was also a sample case from the new US Battery deep-cycle 12 volt cell.

KNTV Channel 11 shot footage of the Expo and interviewed EV and Electrathon drivers. This was later broadcast on their local news.

CurrentEvents would like to thank the following people for their hard work on the Expo. A special thanks to Silicon Valley President Paul Brasch, who literally put the rest of his life "on hold" in order to devote time to the Expo and to Bob Murray who was the



Electrathon Fun '92

point man in dealing with the city and all of the frustrations that that entailed. Thank you Bob. It would not have been the success that it was without your help.

Thanks to Lee Hemstreet and Larry Burriesci, who helped in many many ways. Thanks to Michael Jones and

Bill Williams and Bruce Brooks for their help with publicity. Thanks to everyone who attended the EAA Rally Committee meetings or helped at the event —Stan Skokan, Bob Schneeveis, Don Gillis, Bill Carroll, Hal & June Munro, Gordon Schaeffer, Scot & Anna Cornell, Nick Hart, Dan Pliskin, Kurt Bohan, Mil Stults, Ed Oblander, Peter Barnes, Chuck Olson, Rick Stanley,

Rich Stiebel, Alan Downs and Clare Bell. Thanks also to Don Mignola who attempted to cut through the last minute sandbagging by the city of San Jose.

The Symposium will be reported on in the next issue of Current Events.

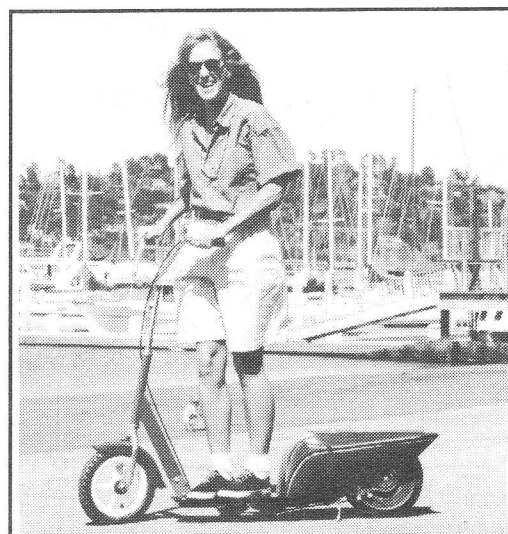
Electro-Skoot

Uses:

- ★ Intracity commuting (Stores & carries easily)
- ★ Campus use
- ★ Security patrols
- ★ Recreation & resort areas
- ★ Intraindustry transport
- ★ RV.'s, airplanes, marinas
- ★ Endless possibilities & just plain fun

Specifications:

- ★ Max speed: 18MPH
- ★ Motor: Permanent 1/2 hp, 3500RPM
- ★ Controls: Mosfet 150AMP, 25Khz Pulse width modulator
- ★ Charger: 1 lb electronic, 5 AMP, self regulating
- ★ Max range: 10-12Mi (Distance per charge)
- ★ Weight: 27 lbs without battery 52 lbs with 31 AMP Hr. sealed battery
- ★ Size: Ships UPS takes 1 Sq Ft. standing on end
- ★ Suggested retail: \$695.00



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CALSTART gets \$6 Million to Start

Burbank—Sept 1, 1992—CALSTART, the consortium of more than 40 public and private organizations mobilized to develop an advanced transportation industry in California, announced today that it has received a \$4 million Federal Transit Administration (FTA) grant and a \$2 million grant from the State of California.

The grants allow CALSTART to reach the \$20 million funding goal for its 1992-93 program. This funding will support several interrelated CALSTART programs to develop a California-based electric vehicle component industry, a statewide electric vehicle infrastructure, electric buses and other forms of mass transit.

The consortium's president, Lon Bell, said, "CALSTART is a prime example of the kind of economic initiatives we need to keep America strong and Californians fully employed. Cost-efficient, environmentally sound transportation will move our nation into the 21st century, and into the forefront of the global economy."

"California's world-class defense industry is in an excellent position to be transformed into a center for advanced transportation," said U.S. Sen. John Seymour (R-California). "Our industry is technically equipped to take on this new challenge and its skilled workers will ensure California's continued role as a high technology powerhouse."

"California has always been a technological leader," said U.S. Congressman Howard Berman (D-Panorama City), author of the 1991 federal funding amendment. "This grant will help us retain that leadership as well as gain a foothold in the rapidly growing electric vehicle industry."

"Creating an electric vehicle industry in California will not only boost the state's aerospace, defense and electronics industries but will also play a critical role in meeting air quality standards," said Charles Imbrecht, chairman of the California Energy Commission.

"Nine other states, representing 36 percent of the U.S. auto market, plan to adopt California's requirements for electric vehicles in 1998," said Carl D. Covitz, Secretary of California's Business, Transportation and Housing Agency. "This creates an incredible economic opportunity for California businesses."

Financing Now Available for Electric Cars

Santa Rosa, CA (August 27, 1992) Bringing zero-emission electric cars into the realm of affordability has been a major roadblock to widespread use. But now an electric vehicle manufacturer has agreed to start financing the purchase of its electric cars, enabling buyers to spread their payments over a longer period rather than paying the entire cost up-front. "This is a major breakthrough for electric vehicles and the environment," said Gary Starr, president of Santa Rosa based Solar Electric Engineering, Inc.

"Until now, only people who could pay cash could purchase our cars. Financing will help get more of these cars into the hands of the average consumer who doesn't have that much cash on-hand." Starr notes that without financing, most people would not be able to afford gasoline cars which he says cost comparably to the cars built by Solar Electric.

Funny Side of EVs

by Stan Skokan

As we were coming to line up the cars by the side of the Plaza Park, we had to enter a traffic cone separated lane. It kept the downtown traffic away from our vehicles. The police officer on duty at the entrance to this reserved traffic lane was screening incoming vehicles to make sure only electrics could enter.

As I was coming, he was talking to somebody but noticed me entering the lane. I slowed and looked at him, waiting for his approval to proceed. Suddenly he leaned toward my car and looked probingly inside. He did not like what he saw and called, "Halt, is this an electric car?" I stopped, opened my window and replied, "Yes it is, just read my license plate." (1ELTRIC)

What happened? Well as the officer watched incoming electric cars he quickly learned how to recognize one. It usually looked different from normal cars on the outside, or a quick look inside revealed a battery box instead of passenger seats or a bunch of heavy cables, wires or chargers.

The notion that an electric car could look like any other car, have four seats and give no visible clue of any conversion was foreign to him. He would have been even more surprised if he had opened the trunk and found plenty of luggage space instead of batteries.

There is an ongoing debate as to how many electric cars are really on the roads in California today. As you can see even the "Law" can be easily fooled!

Mike Brown's "Clutch, Flywheel and Adaptor"

by Bruce Brooks

One of the problems facing a do-it-yourself electric vehicle conversion is trying to gather the "how to" information. It can take months of looking, reading, thinking, talking to others who have tried (and perhaps failed), and just tinkering around a bit to get the level of confidence required to get started on such a major project.

There are a few books, most written in the '70s, which tell about some of the considerations and options available; tell how to calculate performance numbers; and show overall schematics. One or two more recent books like Mike Brown's "Convert it" manual give a brief tutorial on the major steps, but even they don't really prepare you to go to work.

Although I have done minor car repairs and feel reasonably mechanically inclined, I am not an auto mechanic and I don't know some basics that perhaps the authors have assumed I do. I recently spent several hours over a month or so disassembling and reassembling the clutch and flywheel assembly from the gas engine of my VW trying to understand it so I could have an adaptor made to mate my electric motor to the transmission.

A week after I finally got the adaptor plate made, and mounted the new motor in my project car, I attended an EAA meeting where they announced the availability of a new video tape by Mike Brown on installing the adaptor, clutch and flywheel.

I jumped at the chance to borrow the tape in exchange for this review and looked to see what I might have missed (or perhaps even done right) as Mike has a reputation for sound advice and lots of experience with both gas and electric cars and has been an advocate of electric cars for many years.

The videotape (VHS format) is about an hour long, and is broken into two parts, the first half deals with the VW Rabbit/Scirocco/Jetta transmis-

sion, the second half deals with a more typical transmission from an Oldsmobile Firenza.

The VW was chosen for two reasons, first because they are one of the most popular cars to convert today; and second, because Mike sells a complete kit for converting these cars. Since the VW clutch and flywheel mount in reverse order from most other cars, Mike felt it was necessary to include the second segment for the rest of us who are not converting a Rabbit.

The tape starts out going right to work, there is no introduction following the credits. The motor is sitting on the workbench; Mike immediately mounts the first of the two parts of the motor adaptor and then the shaft coupling. Having just been through this on my car I did not have any trouble following the process, but for someone who has not yet arrived at this step in their project, a little orientation would have been useful.

In defense of the format, I believe this is intended to be just one of a complete series of videos called "Electro Tech Sessions with Mike Brown". In that context perhaps it makes some sense to abandon the introduction, but I always like to have the big picture before I start.

As expected, the video demonstrates installing the motor, adaptor plate and coupling assembly that Mike sells through his Electro Automotive business. While not everyone viewing this tape will be installing that adaptor or motor, the information is the type that anyone doing their first conversion could use.

The description of the process is liberally sprinkled with some of Mike's accumulated wisdom from many years of experience working on cars. During a few of the steps the tape seems to move quite slowly watching each bolt being tightened in turn, but even then Mike kept up a monologue of interest-

ing tips and trivia. A fair amount of the demonstrations are not specifically related to electric cars, since the clutch and flywheel assembly is the same for a gasoline engine. An auto mechanic (one of the target audiences) may not need to watch those portions, but for someone like me doing it for the first time, it is valuable.

One melodramatic demonstration, that in my opinion was not necessary, showed why aluminum is not used for shaft couplings by showing how easily a piece of steel, normally used as a key, cuts through a soft aluminum rod using a lathe.

One of the things you couldn't help but notice is that all of the necessary tools and jigs required were close at hand in Electro Automotive's well equipped shop. I suspect most other do-it-yourselfers are more like me, and need to improvise a bit. I would also complement Mike on following good safety practices in each step of his work.

The quality of the production is not quite up to what a professional studio would produce, but it is at least as good as the best home videos. However, since the value is in the information provided, not entertainment, *I would strongly recommend watching this tape*, and probably others in the series, to anyone doing their first EV conversion whether they buy their parts from Electro Automotive or not.

If Mike includes these tapes with the kits he provides to builders and mechanics, they will be getting more of the valuable service Mike Brown is known for.

The tape may be purchased from Electro Automotive directly.

Bruce Brooks is a member of the Electric Auto Association and recently converted a 1973 VW Karmann Ghia to electric.

The Dodge EPIC (Electric Power Inter-urban Commuter)

EPIC showcases Chrysler's current state of development for electric powered vehicles. The complete powertrain assembly is taken from Chrysler's TEVan program, an electric minivan feasibility program within Chrysler Engineering that is investigating the potential for future production.

EPIC is powered by nickel iron batteries with a range of approximately 120 miles on a single charge. The 54 kilowatt, direct current motor combines with solidstate microprocessors developed by Chrysler's Pentastar Electronics subsidiary to reach a top speed of 65 mph. The EPIC has a two speed automatic transmission, power steering and brakes, and air conditioning.

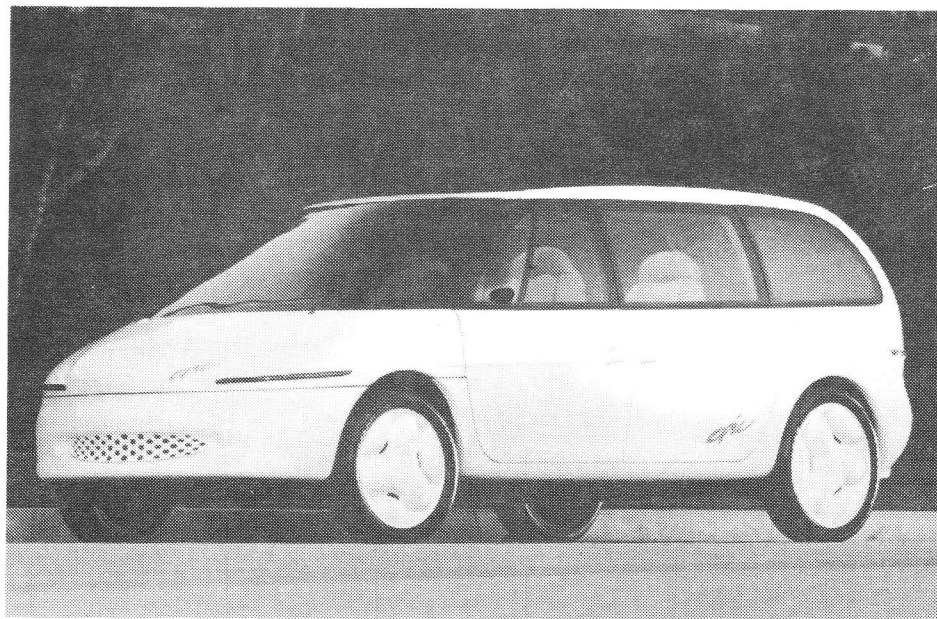
The battery assembly uses an automatic watering system to minimize maintenance and an onboard charging system to simplify battery recharging. The interior and exterior were both designed for function, a feature that makes today's Chrysler minivans leaders in their class.

The exterior features sliding rear doors on both sides of the vehicle. The rear hatch follows a track that hugs the vehicle more closely than today's minivan to make cargo loading and unloading even easier.

Interior highlights include a "stow-and-go" rear seat that folds completely into the floor for flat cargo space when it is not being used, a small steering wheel for better visibility of the instrumentation and a cockpit-like instrument panel with all controls easily within the reach of the driver. EPIC also maintains the low step in height advantage of Chrysler's current minivans, even though the battery pack is stored below the vehicle.

Vehicle specifications are:

Overall Length:	190.1 inches
Wheelbase:	119.3 inches
Overall Width:	77.4
Overall Height:	68.3
Front Track:	66.0
Rear Track:	67.0
Tires	Front: 195/55/R19
	Rear: 195/55/R22



The Dodge EPIC (Electric Power Inter-urban Commuter)

Maine Applies for Federal Funding

The non-profit Maine Energy Coalition—a group of developers, scientists, artists and businessmen, have applied for a \$385,000 federal grant to help finance an "electric car barn".

To be located in the Portland area, the facility would encourage the use of electric cars by selling and servicing them. Furthermore, hydrogen-powered cars and low-emission, high-efficiency internal combustion vehicles would be displayed. To appeal to the tourist industry, the group hopes to start an energy information center, as well.

(AUTOMOTIVE NEWS: 7/6)

Ed. A fine example to us all.

Nomination for EAA Fellow Award

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

Each nomination should be accompanied by a B & W photograph photo, if possible, and up to a maximum 300-word description of the EV activities and accomplishments of the nominee.

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

Please postmark your entry by December 1st and send to EAA Fellow Nomination, 1249 Lane Street, Belmont CA 94002-3756.

Sizing the Power Boost Trailer

by Robert E. May, Phoenix Chapter

The Dec./Jan. "Current EVents" contained my discussion of the power boost trailer with motor generator set to provide hybrid characteristics to a stock electric car. The major question was whether to use an AC or DC motor generator set. In discussions with other electric car users, the question of electric power requirements seems to have clarified. There seems to be a 5 by 5 rule of thumb for modern electric cars: 5 kW of power to the motor provides 50 mph speed. Most onboard battery chargers can provide a maximum of about 2.5 kW into the battery bus, or motor if in the hybrid mode. Using a cubic relationship between power and speed, this means that the charger alone, 2.5 kW, will provide a speed of only 40 mph. Does this mean that the AC approach is not feasible? Not necessarily.

Consider a hypothetical fleet of 100 modern electric cars. For most trips the pure electric car will be adequate. However, some trips will be out of range and require the power boost trailer. What characteristics should it have? Let us consider the short trip and the long trip, the difference being that the short trip is one of 150 miles or less, the long trip being greater than 150 miles. It turns out that slightly different configurations can be used. With a fleet, both types of power boost trailers can be made available.

Short trip—Consider a hypothetical situation. Home is LA and the trip is to an all-day meeting at Palm Springs, about 75 miles away. The car has a range of about 90 miles normally. For this trip an AC MG, connected to the onboard charger can be used. The MG is used driving to the meeting, augmenting power pulled from the battery. Making the trip at 65 mph will nearly completely discharge the battery. (about 11 kW is required to maintain 65 mph, 8.5 from the battery and 2.5 from the charger). During the meet-

ing, the power boost trailer MG set will recharge the battery, for a return trip comparable to the earlier trip. The simple trailer, supplying AC power only to the onboard charger is adequate. The end result is not only a greater range, but also a higher transit speed.

Long trip—This is like a cross country trip. The configuration for the short trip will provide only 2.5 kW by itself, enough for 40 mph, not enough for practical use. The most simple solution is to add a second charger, mounted on the power boost trailer. The trailer then provides two power inputs to the car, the AC input to the onboard charger, and the DC input to the battery/motor bus from the second charger. This increases the total boost power to 5 kW, enough for 50 mph. Again, the speed can be increased if any stops are planned along the way, during which the battery can catch up. My goal for my next electric car is to develop one which will go from Phoenix to San Diego (360 miles) in less than 8 hours. The trailer configuration for the long trip seems to be adequate for the trip, but just barely. To really meet my goal, I will probably install a third battery charger in the trailer. The total steady state power available to the motor then becomes 7.5 kW, enough for a steady speed of 57 mph. The advantage of this approach is that all of the necessary equipment is standard, off the shelf. There is an additional advantage in redundancy.

One last thought. With so many ins and outs for the battery, it will be difficult to keep track of the state of charge of the battery. What WW II vintage submarines used to make a quick assessment of battery state, while under load, was the ampere-hour meter. These provide a running total of amps in and out of the battery. They should be a useful instrument for a hybrid car.

New Inventory for NU-KAR

NU-KAR electric vehicles, in conjunction with Assembled Products, Inc., is happy to announce that we have recently acquired the remaining inventory of electric vehicle parts from Sebring-Auto Cycle. This now enables us to provide a full line of replacement parts for the Citi-car, Commuta-car, Zipper and Postal Vanelectric vehicles, including technical manuals.

As part of this new service, we are also offering full restoration and repair work on all alternatively fueled vehicles. This, combined with our excellent technical support, should enable us to help with all your electric car questions and problems.

We are also excited to announce plans are under way for the construction of a more efficient and practical electric car kit. We look forward to having kits available in early 1993.

For more information, technical support, or pricing, please call us at (901) 853 8021 (8:00-4:00 Central Time)

Ed. Note: See Also Aug./Sept. issue for another source for these parts.

Washington Mandates Clean Vehicles

At least 30 percent of new vehicles purchased by the state of Washington will be clean fuel vehicles, according to recently passed legislation, and the figure must increase by five percent annually. The law also established a school bus compressed natural gas fuel advisory committee to study use of CNG as fuel, and the report was submitted to the legislature in December of 1991. The measure further required that barriers to development of CNG refueling stations be identified and removed by the Utilities and Transportation Commission. Funds have been set aside to pay for certain costs of clean fuel vehicles used for public transportation.

(THE CLEAN FUELS REPORT: JUNE/JULY/AUGUST 1992)

News in Brief

Charging Paddle

GM Hughes Electronics Corporation has developed an insertable lightweight, plastic covered paddle for recharging electric cars. Among its advantages over the plug-and-outlet system include its speed in recharging at less than an hour for a routine charge and two to three hours for a full recharge, its elimination of possible electric shock, and its ability to quickly determine the amount of charge the car needs.

As Hughes Aircraft vice-president, James Abramson, points out, the recharging, "will be done safely without fear of shock, even in rain or in very moist weather." The challenge will be for electric car makers to decide on a single charging system. "If electric vehicles are to be successful in the marketplace, it is essential that drivers have convenient access to charging stations to support their cars, just as today's driver of internal-combustion vehicles have," said Abramson.

Hughes plans to offer several recharging options including: a 220-volt, wall-mounted home unit; a kiosk-like "energy station" designed for electric fleet vehicles, and a portable unit with

a 110-volt adapter that can be carried in the car and plugged into any electrical outlet for recharging.

(NEW YORK TIMES/USA TODAY: 7/21)

Ed. Sounds like Hughes/GM want to establish a proprietary standard for the \$500 production price connector.

Electric McDonalds?

Southern California Edison says that McDonald; has suggested the idea of installing quick-recharge stands for the coming wave of electric cars at its restaurants. The customers could recharge themselves with a Big Mac during the 12 minutes or so it would take to "quick charge" their automobile.

The Big Three's support of electric vehicles (EVs) was more than evident when the U.S. Advanced Battery Consortium, made up of Chrysler, Ford and GM awarded a contract for \$18.5 million to Ovonic Battery Company for development of a nickel metal hydride battery for EVs. USABC expects to award more contracts before fall.

A recent Southern California Edison survey showed that 89 percent

of its respondents believed EVs would be good for short commutes and errands and nearly 50% said they would buy one even if they had to spend \$1,000 per year on battery replacement. Ninety-two percent said they'd feel good about helping clean up the air.

Also in California, Hughes Aircraft, which is developing charging systems for GM's Impact, and Pacific Gas & Electric have joined forces to test an EV refueling station at PG&E's San Ramon facility.

(ELECTRIC PERSPECTIVES: JULY/AUGUST 1992)

\$2.5 Billion Growth Industry

With the implementation of more rigid pollution control laws, the Canadian consulting firm of Ernst & Young is predicting continued growth for firms that specialize in providing products and services that dispose of waste or control pollution. Between 1987 and 1990, firms that specialize in garbage disposal and cleaning up the air saw their sales increase by \$500 million a year. The study which was released after surveying 2,000 environmental companies projects a 9 to 13% growth in firms that control air pollution, with the overall average at 14% for all firms — well above the anticipated overall economic growth.

"There's no doubt the regulatory environment is the most critical element in terms of supporting growth," commented Ernst & Young's chief economist, Steve Tanney. Furthermore, Canada's green firms see great export opportunities, particularly in Eastern Europe and Mexico.

The firms, forty per cent of which are located in Ontario, employ approximately 30,000 people and have sales of \$2.5 billion per year.

(TORONTO GLOBE & MAIL: 7/6)

(Continued on next page)

ELECTRIC CAR

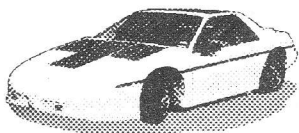
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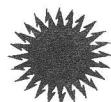
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US Losing Clean Air Jobs

The Japanese have sprinted to the forefront in exports of stationary emissions controls. It's no coincidence that they also got an earlier start on legislation and regulations for clean air back in the late 70's and '80's, according to Jeffrey Smith of the Institute of Clean Air Companies.

That's why it drives him nuts to see the US dallying and deferring on its own Clean Air Act regulations. He says, "Regulatory delay not only slows attainment of the amendments' public health and environmental goals, but costs American jobs and handicaps the US industry's ability to compete successfully in the world environmental control market."

He sees on the horizon some 4,500 to 15,000 lifetime jobs just from the acid rain provisions, and 15,000-20,000 construction, engineering, and equipment manufacturing jobs from the overall act by 1995. That number could double in the following four years. But

it's all contingent on getting regulations in place. Says Smith, "No one company wants to redesign a chemical process or install an emissions control system until that company or utility is sure that its competitors will be required to do the same thing."

This all hurts on the export level, he explains. Smith says that the US has consistently competed well globally in areas where we got regulations in place before others. Where other countries first imposed strict pollution control rules, their industries have dominated the international marketplace.

(THE ENERGY REPORT: 8/10)

'93 Solar & Electric 500

Phoenix, Ariz. Arizona's largest electric utility announced today it will again title sponsor the world's premier race for electric vehicles, the Arizona Public Service (APS) Solar and Electric 500. The event is scheduled for March 5-7, at Phoenix International Raceway.

"The success of the '92 event more than exceeded our expectations in terms of the level of the quality of cars and the enthusiasm and participation of sponsors and exhibitors," said Paul Wiggs, APS director of marketing and economic development. "The 1993 event will lift electric vehicle racing and development to still a higher plain." Despite record high temperatures, more than 50 cars competed in four racing categories on Phoenix's one mile oval last April, more than double the field in the 1991 inaugural event. "The March date will ensure we get the mild winter weather for which Arizona is famous," Wiggs said.

Race organizers are also beefing up safety procedures and requirements, slashing ticket prices (despite ticket sales 40 percent higher than 1991 sales), and adding new and improved racing categories. "We see a long, bright future for this race and for electric vehicles as a practical, emissions free form of transportation," Wiggs said.

Organizer and sanctioning body for the event is the Phoenix based Solar and Electric Racing Association (SERA).

Orbital's 2-Stroke Tested

Ford Motor Company is conducting its own test of the two-stroke Orbital engine produced by Orbital Engine Co. USA, Inc., to see if they can meet California's Ultra Low Emission Vehicle (ULEV) standards. An earlier test by EPA indicated that the engine met the ULEV standards with 4,000 miles. However, to meet the standards, the engine must last 100,000 miles.

Orbital President, Peter Simons, indicated that the company would be

(Continued on next page)

News in Brief

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(AUTOMOTIVE NEWS: 8/17)

Electric Lawn Mowers

On August 7th, at 9:30 am, William Reilly, administrator of the EPA; Thomas Kuhn, president of Edison Electric Institute; and Mark Mills of the National Consortium for Emissions Reductions in Lawn Care will speak at a press conference to discuss electric lawn mowers. The nation's 83 million gasoline-run lawn mowers produce as much air pollution each year as 3.5 million new cars, aggravating urban smog. The electric utility industry, along with the Environmental Protection Agency, is launching an effort to deal with this problem. In a new twist on the "cash for clunkers" program, electric utilities across the country will be distributing 1000 cordless electric mowers to customers who turn in their old gasoline mowers.

A new group, The National Consortium for Emissions Reduction in Lawn Care, will then ship these mowers to EPA for emissions testing. This information will help evaluate the benefits of electric lawn mowers, as well as identify the impact on air quality created by their gasoline. The press conference will be held in front of Edison Electric Institute, 701 Pennsylvania Ave. NW. For more information, call Mary Kenkel at (202) 508-5662.

(EIN STAFF: 8/6)

Anti-Smog Regulations in LA

The following are excerpts from an editorial entitled "Making a Major Dent in Smog," which appeared in the July 22 Los Angeles Times: "The Southern California basin, sometimes called the 'super bowl of smog,' has become significantly less smoggy, according to a new study from the California Air Resources Board. The number of hours each year when air pollution has exceeded the state health standard has fallen by 50% throughout much of the basin since 1981. Moreover, dangerous peak levels of smog dropped more than 25% over the same decade.

"What's responsible for the improvement? California has led the nation in tough regulations against air pollution. The increasingly expensive and complex rules adopted in recent

years by state and local agencies, as well as by the Federal Environmental Protection Agency, have generated understandable concern about their adverse economic impact. *But they work.*

"Auto emissions standards in California, the world's largest single market for gasoline, are the toughest in the nation, and biannual smog-check inspections are required for all cars. Gas stations must have vapor recovery systems on pumps, and new or expanded industrial facilities must have the best available air pollution control technology and must offset any new pollution they create. Many local businesses must now take steps to encourage employee ride-sharing. "With the EPA's announcement last week of rules that will toughen automobile emission inspection and maintenance requirements in California and elsewhere - measures that will take more out of the pocket-books of many car owners - it is at least comforting to know that all these efforts pay off."

(LOS ANGELES TIMES: 7/22)

EPA Calls for Tougher Emission Testing

William K. Reilly spoke of car inspection programs on Monday, saying that "the testing methods we've used up to this point . . . are simply not capable of doing a good job." EPA called for expansion of the number of areas that must test for emissions from 122 to 177, and for tougher requirements in the most polluted areas.

Car owners failing tests would have to spend up to \$450 in repairs before being excused from compliance. Since the proposal doesn't bar states from allowing emissions testers from repairing cars, that "opens the door for abuse" such as price gouging, said Chester Davenport of Envirotech Systems Corp. of Bethesda, Md., the country's largest

(Continued on next page)

News in Brief

supplier of inspection services. Reilly said that repairs to lower emissions would also improve fuel economy and offset repair costs.

The new standards would go into effect in July 1994 and would affect parts of 38 states requiring a \$17 test every two years rather than annually. Seriously polluted areas would have to test also for fuel vapor leaks and under simulated driving conditions which could require new expenses for test equipment.

(NEW YORK TIMES: 7/14)

Electric Cars will Clean the Air

Critics who have said that replacing gas guzzlers with electric cars will mean that emissions would emanate from the power plants rather than the exhaust are wrong, according to a recent study. The Northeast States for Coordinated Air Use Management (NESCAUM) study claims that pollutants would be significantly reduced if electric cars were used. If less-polluting powerplants come into the picture, the reduction could be even greater than projected today, says NESCAUM

executive Michael Bradley.

In the Northeast, there will be more than 3.3 million electric cars on the road by 2015, says the study, and most electric cars would be recharged at night, not during peak demand hours, meaning that introduction of the mandated number of cars into the Northeast would improve air quality significantly while not requiring additional power generation.

On a national scope, The Electric Power Research Institute (EPRI) estimates that 50 million electric cars could be recharged with the excess generating capacity produced today during off-peak hours.

(BOSTON GLOBE: 8/23)

France Steps Up Electric Car Race

The French government was joined by Electricite de France (EDF) and the chairmen of Peugeot SA and Renault just recently in a pledge to equip 10 of the country's cities with electric cars and battery-recharging stations by 1995 in an agreement that underscored France's commitment to stay in the

race to market an affordable electric car and cut dependence on imported oil.

The pact reflects the French government's growing sensitivity to ecological aims. "The 20th century has seen the development of the car and of electricity," Environment Minister Segolene Royal said in a statement. "It's time to merge the two and enable the electric car to develop in the heart of our cities." Royal said that in France every other trip is under three km (two miles) and that each year 500,000 households buy a second car that covers an average of 40 km (25 miles) per week.

In April the government announced it would increase expenditure on electric car research and development over two years to 500 million francs (\$100 million) from 200 million (\$40 million) and offered a tax incentive to firms that bought electric cars. In addition, the government will underwrite the purchase by local authorities of 1,000 electric cars. Peugeot SA announced that in the second half of 1993 it would provide the port of La Rochelle with 50 battery-powered Peugeot 106 and Citroen AX cars.

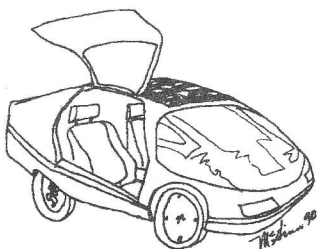
Up northward a ways, the Netherlands joined the international chase for a marketable electric car just last Wednesday when it announced that it would spend \$9 million to promote electric cars, particularly in town centers.

(REUTER: 7/28)

Solar Energy Advance

A lightweight, flexible, and less expensive solar energy conversion method that utilizes a continuous ribbon, or web of silicon, has been developed by Ferrofluidics Corporation and Blue Ridge Industrial Development Group.

(Continued on next page)



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The photovoltaic technology, which is highly efficient and less costly than traditional methods, is designed to replace other solar conversion methods such as wafers. It is also the only commercially proven solar conversion device that utilizes this particular silicon technology.

(SOLAR TODAY: JULY/AUGUST 1992)

SEC Calls Nuclear Battery a Fake

Portland Ore.—Peripheral Systems Inc.'s former chairman and its principle researcher went to great lengths to promote a nuclear-battery power source in an effort to charge up the company's stock. Trouble was, the battery didn't exist, the Securities and Exchange Commission charged in a suit filed Wednesday. In 1987, 1988 and 1989, the pair issued news releases, gave interviews to news organizations and filed false information with the SEC to promote the "resonant nuclear battery" product and hype the company's stock, the SEC charged. The suit claims then-Chairman Philip Talbert and Vice President Paul Brown falsely claimed that a subsidiary, Nucell Inc., had developed small energy devices using radioactive isotopes.

In fact, the device—invented by Brown—never worked, and the developer eventually abandoned the system on which its patent was issued, the SEC claims. Except for a laboratory model that reportedly burned up during experiments in 1987, the product consisted only of Brown's undemonstrated theory, the suit said.

(BLOOMBERG BUSINESS NEWS)

Maine Debates CA Emissions Standards

Maine's Board of Environmental Protection is examining the issue of whether the state should adopt California emission standards for vehicles. Exxon spokesman, Doug Walt, said

that the adoption of the California measure was unnecessary, because enactment of the Clean Air Act requirements would bring down emissions by 85%. The California standards would add only 1 or 2% to the reduction. However, Maine's Natural Resources Council disagrees with those figures and supports adoption of the standards.

(ZAPNEWS: 7/3)

Future of Old Cars?

Should older, more polluting cars be removed from the road through a system of cash incentives? That's one strategy analyzed in a new report from the Office of Technology assessment, which sees environmental benefits but delicate problems when low income relinquishers of these cars seek affordable replacements.

EPA estimates that cars from 1971 and before are only 3.4% of all cars on the road, but spew out 6% of the hydrocarbon, 7.5% of the carbon monoxide, and 4.7% of nitrogen oxide emissions. That makes a good case for a cash incentive program to get these clunkers turned in and scrapped. But OTA points out that low income drivers will have difficulty replacing their old gasguzzlers at prices they can afford. And many of the older cars are in areas in which already have inspection programs which skim the worst polluters off the streets. Clean Air Act requirements for reformulated gasoline in many areas will also help reduce emissions from all vehicles—and perhaps lower the pay off for a cash incentive program to the vanishing point.

(CONGRESSIONALACTIVITIES: 7/27)

SMUD Builds First Solar Power Charging Station

Preparing for the increase of electric cars on California's roadways, the Sacramento Municipal Utility District recently unveiled the first public solar powered charging station in the western United States. The electric vehicle "filling station" will serve as a proto-

type for future stations, both in Sacramento and in other parts of the nation.

"A lot of people are talking about solar-electric cars, but SMUD is actually doing something about it," said SMUD General Manager Freedman. "Electric vehicles are the key to a clean-air future and we're preparing now for their use. Here in sunny Sacramento it just makes sense to use the clean energy of the sun to make EVs a reality. We want to be an example for the state and the nation."

The charging station features eight solar panels containing "photovoltaic" cells, which convert the sun's energy into direct current electricity. Inverters change the direct current into alternating current which in turn is used to charge the electric vehicle batteries.

Chile Declares Air Emergency

Last week saw the National Environmental Commission in Santiago Chile adopting some of the most drastic measures ever undertaken to meet an air quality emergency. With concentrations of toxic particles soaring past 500 on the pollution index, they feared immediate danger to human health.

Elementary school children were ordered home. Older children were given relaxed hours, and those with respiratory illnesses were urged to stay home. Other measures put into effect:

Some 100 factories were closed down because their industrial processes contribute to air pollution. Hotels were ordered to shut down their boilers. Some 40% of private cars were ordered off the streets. Public transportation was curtailed. Use of fireplaces was banned, along with rubbish-burning. The ministry pointed out to citizens that high levels of air pollution are especially hazardous to pregnant women, babies, young children, and the elderly.

(INTER-PRESS SERVICE: 7/8)

TRANSMITTATRON

Mr. Sparks began by describing an exciting new way to power an electric car ... and then told you that it was practically impractical to build it! His basic concept really is exciting, but it is not new. We know we have been working on it for a long time, but look at his hardware! The CVT is of a heavy, bulky, speed-limited medium-efficiency type, unsuited for any vehicular drive. And the rest of the gear takes up a lot of space. It's too bad that sparks hadn't heard of our new development, the **TRANSMITION**, before he sounded off. It is relatively small and light. The CVT and all the gearing is one unit directly coupled to the motor. Efficiency projections top 85% across the whole speed range. Speed and power are not limited and it is easy to control. We are confident that our future electric car using the **TRANSMITION** will excel in performance, economy and affordability, and will be just as much fun as Sparks said it would.

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EVs Cheaper to Run

It may turn out that electric cars will be cheaper to operate than thought, says Jim Janasik, transportation program manager at the Electric Power Research Institute (EPRI) in Palo Alto, CA.

Reason: Utilities always have a "trough" in demand from midnight to 4 AM. Janasik estimates that 10-20 million electric vehicles could be recharged during that period without costing utilities anything for extra capacity. Power during these hours could be sold at a discount to electric vehicle owners. Janasik envisions two-way "smart" electric meters that could use telephone lines to advise the power company of the state of the car's battery. This in turn would permit an overnight supply of interruptible energy, with a guarantee that the car would be road-ready in the morning. Under this scenario, 220-volt, 30-ampere outlets which recharged a vehicle a vehicle in three to six hours would be preferable to 110-volt current use, says Janasik.

POPULAR SCIENCE: August 1992)

What is Real?

(Continued from Page 2)

A major misperception of the public is that they think that they drive 200 miles a day. Very, very few do this. The National Personal Transportation study for 1990 done by the US. Government finds that the entire nation's average mileage is 29 miles per vehicle, per day, with the total average trip length of only 9 miles. Yet the major print media constantly say that a car that cannot go 150 miles on a charge is not practical. This is hogwash. Ron's Porsche 914 is REAL (see cover story).

It has a top speed of over 90 mph and a range of 126 miles at legal speeds. And it can climb the Santa Cruz mountains with the flow of traffic. It is reproducible, cost effective and reliable. Just exactly what should be our definition of a REAL EV! A vehicle that can make even 406 miles as a publicity stunt is not REAL if its battery is not cost effective either by price or cycle life.

Joe LaStella, who spoke at our symposium, would not say what the battery chemistry was other than to say that it was not lead-acid and it was very expensive at this time. Evidence points to it being silver-zinc, which would mean a \$30,000 to \$60,000 battery with less than 4 dozen cycles.

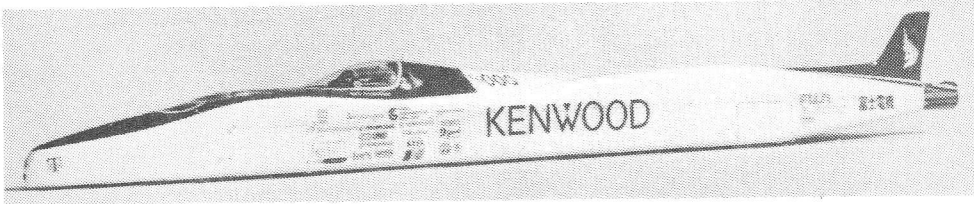
It was great to bring the distance record back to the states, but for me the 914 at 90+ mph and 126 mile range and ability to climb mountains too, plus the fact that anyone can duplicate it for the price of a used car, says that today's standard conversion kits make EV's REAL now! Things will only get still better in the future. (Read about Alan Cocconi's car in the Oct. Road and Track.)

REAL is REAL—It is reproducible, cost-effective and reliable. Today's conversions are real

- Pb, Editor

New World's EV Land Speed Record Attempt

by Ken Koch EVA of Southern California



It seems that man has always had a thirst for speed. Two of the most common questions asked of electric vehicle owners has been, "How fast will it go?" and "How far will it go?", usually in that order. One of the earliest speed records noted for an electric car was set by Camille Jenatzy, whose torpedo-shaped "La Jamais Contente" race car was clocked at 68.8 MPH way back in 1899. More recently, the world's land speed record for an electric-powered motorcycle was set on the salt flats at Bonneville, Utah, by Mike Corbin in August, 1974. His top speed was 171.1 MPH. Also in August of '74, Roger Hedlund's "Battery Box" streamlined 4-wheeler captured the flying mile record at Bonneville with a speed of 175.0 MPH. Not much has happened to assault the Corbin and Hedlund records during the past 18 years—at Bonneville or elsewhere—until this year.

After one year of careful planning and design, Mr. Saturo Sugiyama of Japan brought his streamlined electric to the salt for a new world land speed record attempt that figured to exceed 250 MPH. Sponsored by Kenwood and Fuji Electric of Japan, and Collmer Semiconductor of Dallas, Texas, the car was named the "Clean Liner" by its major sponsor, Kenwood. Powered by 117 lead-acid batteries, the motor is of the type Fuji supplies for the famous Shinkansen or "bullet trains". Fuji, a specialist in high-power electric and electronic applications, furnished the sophisticated GTO thyristor motor speed control rated at 1500 VDC and 615 amps. Collmer Semiconductor, Fuji Electric's exclu-

sive distributor in North America, provides technological support to U.S. firms using Fuji semiconductors in motor control systems for many applications, including electric vehicles. Collmer provided tech support to the "Clean Liner" at Bonneville.

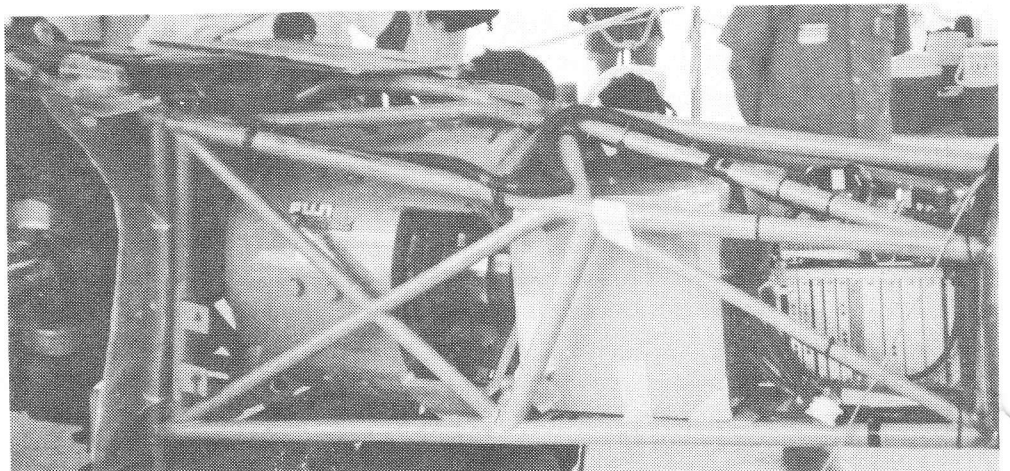
In addition to supplying the motor speed control, Fuji Electric furnished the electric drive motor. Japanese "bullet trains" are powered by AC motors. However, for the "Clean Liner", Fuji's motor had to be adapted for DC battery power. The motor was converted to a series-wound, 4-pole unit capable of more than 600 horsepower (480 kW) at 1000 VDC and 520 amps. Motor speed rating is 5500 RPM. Physical dimensions are 22 in. diameter and 30 in. length. The motor tips the scales at 1320 lbs., and is cooled by forced air with carbon dioxide gas. It couples directly into a fixed ratio differential from a Coleman sprint car with quickchange ratios ranging from 1.6 to 2.4. The motor, controller, and differential can be seen below.

The streamline-class "Clean Liner" features a chassis fabricated by Pro Chassis of Hacienda Heights, CA. It is fabricated from 1.5 in. 4230 chromemoly tubing, and had to be sturdy to hold up to the vehicle's approximate total weight of 8800 lbs. The streamliner's body is constructed of 9 panels of carbon fiber, honeycomb core. It measures 33 ft. long, 32 in. wide, and 36 in. high at the canopy. Drag coefficient is estimated to be 0.26.

Other mechanical aspects of the "Clean Liner" suspension is a torsion bar with 4-link wishbone. The brakes are JFZ billet calipers with 14 in. GTP road racer rotors. Axles are heavy duty with NASCAR type floating hubs and bearings. The tires are 27 in. diameter in front and 30 in. diameter in the rear. They are from an F-4 Phantom jet fighter. Custom forged aluminum wheels to hold the F-4 tires were provided by Enkei. Highspeed slowing of the "Clean Liner", one of its most important features, is a set of safety chutes designed by Jim Deist of Deist Safety.

The 120 batteries used are conventional 12-volt lead-acids ("ROAD" model) furnished by Panasonic. 3 of the batteries are dedicated to auxiliary electronic power, while 117 are dedicated to

(Continued on next page)



Speed Record Attempt

(Continued from previous page)

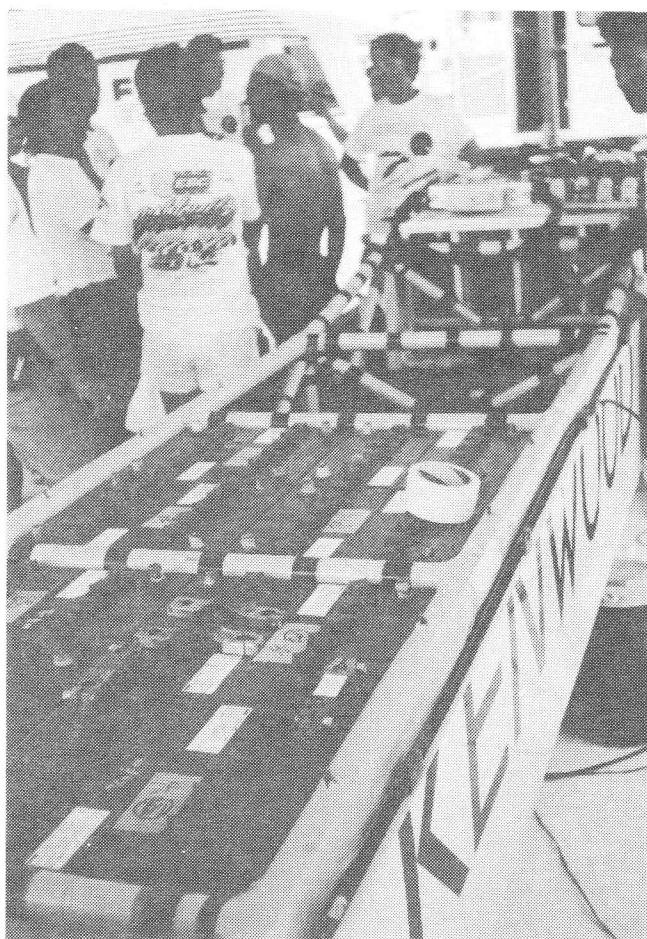
propulsion. Nominal propulsion voltage is 1400 VDC, although under full current during the 5-minute, 9-mile run, system voltage was expected to drop below 1000 VDC.

Even with the most carefully planned project, things can still go awry. An enormous amount of effort was required to finish assembling the car. There was much installation of batteries, testing, and other critical details to tend to. And Speed Week at Bonneville represents only 7 days during which time everything must be accomplished assembly, testing, safety inspections, trial runs, and the actual record run itself. Bonneville race veterans know that the weather can be very unpredictable at the salt, even in the month of

August. Given all of the above factors, the team was able to manage only a single run with the car—for a distance of about 100 yards. After it was determined that an incorrect setting of the motor controller current caused the shutdown, the sky opened up. Four days of rain and 60 MPH winds ended the party, so no record run could be attempted.

Many thanks to the two gentlemen who contributed photos, narrative, and other information that made this article possible: Jim Mathis of Collmer Semiconductor, and Jim Ludiker of the EVAOSC.

Ed. Thanks to Ken Koch for reprint permission



Clean Air Act Spurs Growth

The Pollution Research and Control Corporation, a Glendale, California organization whose major business is ambient air and stack monitoring has announced satisfactory second quarter growth. The company manufactures air pollution microprocessor-based air pollution monitoring instruments.

Company president and chief executive officer A.E. Gosselin, Jr. says business is accelerating under the impetus of the 1990 Clean Air Act amendments opposed to the pollution direct control market which has been slowed by government delays. The company's trade name for its instruments is "Dasibi," and it also markets unrelated products to Japan and Korea through a subsidiary, Pacific Region Commerce Corp.

(BUSINESS WIRE: 7/14)

Electric Car Visionary Faces Hurdles

Doug Cobb of Melbourne, Florida builds electric vehicles because he says, "You can't put dollar bill signs on life. people are dying because of pollution." Cobb and a partner founded their company, Solar Car Corp. in 1989, but Cobb has been building and testing electric cars for over a decade. Now, three years and hundreds of thousands of dollars later, he says the Solar Car's development work is complete and the products are ready to roll. A monumental task is convincing potential customers that it's worth spending \$21,000 for a small truck or \$20,000 for a small car— twice the cost of the gasoline-burning vehicles that are converted to produce the cars. To date, there is also no infrastructure to support electric cars, but this man with a mission has an inspiration. "Thomas Edison went through 10,000 filaments until he found the one that worked. That's what inspires me," Cobb says.

(ORLANDO SENTINEL: 8/22)

Calendar

November 1-4, Planning our Electric Future NOW Conference & Exhibition, The Queen Elizabeth Hotel, Montreal, Canada. Contact: Mr. Erik Haites (416) 369-0900.

November 17-19, WESCON, The Western Electronics Show & Convention will highlight electric cars at the Nov. '92 show. Panels, talks and some EVs to be exhibited. For more information, call WESCON (800-877-2668).

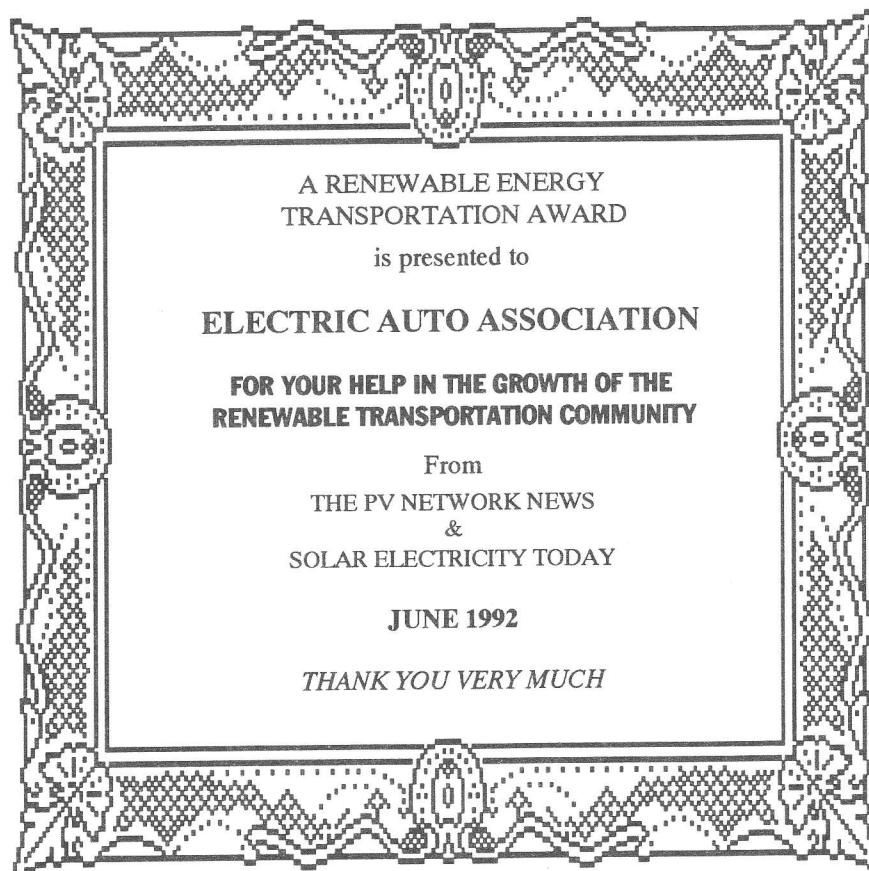
Nov. 16-18, 1992 Energy Opportunities '92 Ramada Renaissance Hotel, Saratoga Springs, NY.

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

March 3-6, 1993, Building Solutions Uniting Excellence & Innovation Boston Park Plaza Hotel, Boston, MA.

March 5-7, 1993, Solar & Electric 500. Phoenix Arizona. (602) 953-6672.

May 23-29 1993, Fifth American Tour de Sol Solar and Electric Car Championship, Massachusetts, New Hampshire and Vermont. Contact NESEA, 23 Ames St., Greenfield, MA 01301, Tel. (415) 774-6051.



EAA gains recognition from PV Network News & Solar Electricity Today

Letters to the Editor



Dear Paul;

I will not be able to attend the gathering in San Jose this year, and I imagine quite a few members will be in a similar situation. Are you planning to have these papers printed, so that, for a fee, we can all share the material being presented?

Hector Gasquet - El Paso, TX

Ed. - A video is in the works.

Dear Paul,

Thanks for the useful conversation we had on the phone the other day. The car I am building is going well. To recap our discussion briefly, I am building an electric from the ground up. This car has an aluminum chassis with a central battery tray (that will crush independent of the chassis in the event of an accident), independent front and rear suspension, and a light weight stainless steel roll cage. The body is a radically modified Bradley GTII, fitted to the chassis and bolted in many places to contribute to the overall stiffness and strength of the car. I hope to come in under 1800 lb. and still maintain a safe sturdy car that handles well. I believe the amount of effort myself (an electrical engineer), a friend (a mechanical engineer) and my brother (a fiberglass boat repair expert) are devoting to this project will pay off.

I have for sometime believed that electric cars could be both safe and

(Continued on next page)

Letters to the Editor

(Continued from previous page)

powerful, but only now do I have the resources to build this dream into reality. Initially this car will be powered by a DC starter-generator, however the aim of this effort is to reinforce the very idea you addressed in your editorial on the dreaded wimpmobile. We hope to develop a low-cost high output induction motor and control, and an acceleration boosting flywheel package, using two counter-rotating flywheels.

I work for a small R&D company that makes frequency standards, and have much experience with high vacuum work that I believe will help this effort. I would like to talk with anyone in the fields of high-speed rotating machinery, or high speed induction motors. If anyone would like to trade ideas or prototypes, please let me know.

Thanks for the help, and keep up the good work.

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Work: (205) 553-0038

East Coast Follows West

Many northeast states are catching on to a new west-coast trend: strict environmental regulations. Clean air regulations in California are the toughest in the nation. Many east-coast states, including Maine and New York, have contemplated implementing California's air regulations. New Jersey could possibly be the next state to incorporate the regulations. The Northeast Ozone Transport Commission has appointed a die-hard supporter of California's clean air regulations as its new vice chairman. Scott Weiner, the Department of Environmental Protection and Energy Commissioner for New Jersey, will assume the post. From his new position, Weiner will automatically become chairman of the commission next year.

Want Ads

1980 Green Commuta-Car, good condition with batteries, on-board charger and owner's manuals. \$1,200. Call Norm @ (314) 364-5423.

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