Electric Auto Association

CURRENT EVENTS

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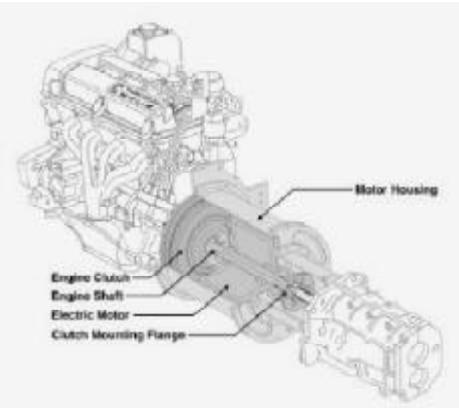
PLUG-IN HYBRID SUVS

By Dean Taylor
From Plug-in HEV news

This note is one of my very occasional notes on what's happening in the world of plug-in HEVs. As I'm an alumni of UC Davis, and proud supporter of the work of Dr. Andrew Frank, most of this note focuses on the prestigious student competition, the USDOE sponsored FutureTruck (held in June 2001) where a plug-in HEV from the University of Calif, Davis took the top prize (see the FutureTruck 2001 Score Summary Sheet on page 7). The UCD fact sheet (see page 6) shows the environmental benefits and other facts of the UCD plug-in hybrid SUV in detail.

A little-known alternative to consumer vehicles currently on the market is the plug-in hybrid electric vehicle. Plug-in HEVs provide much of the benefit of pure electric vehicles (such as significant improvements in energy consumption, lower operating costs, greatly reduced greenhouse gases, and capability of zero tailpipe emissions) while maintaining the long range of conventional vehicles and no-plug hybrids. While providing substantial benefits, plug-in hybrids are expected to have a lower up-front cost than many pure EVs (with mid to long ranges). With the proper incentives, the consumer price for plug-in HEVs may even reach the cost of a comparable "no-plug HEV" or conventional vehicle.



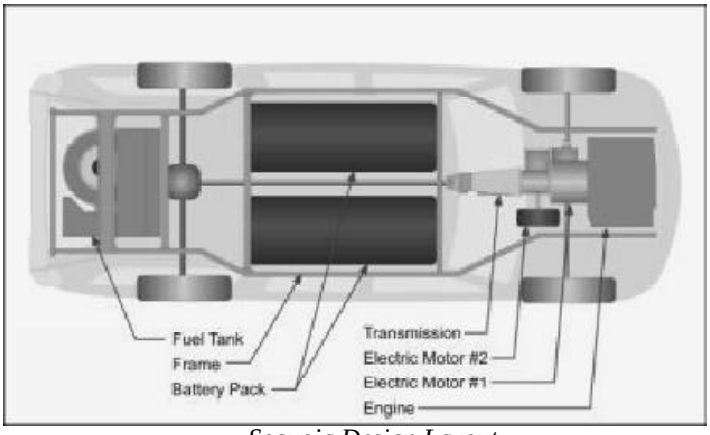
Primary Powertrain Design

A research group at UC Davis has been building plug-in HEVs for over nine years. Using plug-in HEVs, UC Davis has won four of the nine prestigious USDOE-sponsored advanced vehicle university competitions and recently won the FutureTruck competition with a plug-in hybrid version of a full-size sport utility vehicle. In fact, UC Davis is the only school that builds plug-in HEVs every year.

The specification sheet illustrates the performance results and environmental benefits of Sequoia, the winning UC Davis plug-in hybrid SUV. While the truck is a university-built prototype, Sequoia is a well-rounded, fully capable vehicle that is comfortable and maintains all the features of the stock vehicle. It is safe to assume that the results demonstrate the benefits and capabilities of plug-in HEVs in general. For the June 2001 FutureTruck competition, 15 student teams converted a GM Suburban sport-utility vehicle into an HEV. The 35 engineering students at UC Davis won the top prize for best HEV over 14 other universities with "one hand tied behind their back."

The emissions, energy use, and CO2 reduction benefits of plug-in HEVs (using EV mode) were dramatically undercounted in FutureTruck. This occurs because the FutureTruck rules assume every trip is a very long trip of 250 miles, rather than using the USDOT data base of real-world behavior (called the NPTS). For example, the mpg equivalent for Sequoia was about 25 mpg at FutureTruck, but when considering a correct mix of HEV and electric modes the mpg equivalent is over 40 mpg! This is excellent performance for a 6,200 pound SUV that provides 60 miles per charge of ZEV range using 29 kWh of batteries.

Unlike many of the other universities, UC Davis did not use a diesel engine (which has less CO2 and energy use). In addition, one competitor created a light weight aluminum frame, which can dramatically boost mpg by saving up to 800 pounds of mass.



Sequoia Design Layout

FutureTruck rules assume that the round-trip efficiency of batteries is 75%, when in fact Sequoia's battery measures over 92% efficient.

The fact sheet below was put together by UC Davis with test results from the FutureTruck competition at GM's Milford Proving Grounds near Detroit and illustrates environmental benefits based on various methodologies (e.g., based on work by the EPRI-led alliance called the HEV Working Group).

Please when you get a chance, congratulate the UC Davis engineering students and their faculty advisors (Dr. Andy Frank at aafrank@ucdavis.edu) and (Dr. Mark Duvall at msduvall@ucdavis.edu).

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Also printed in the Plug-in HEV News, with docs from www.futuretrucks.com

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THE DEMISE OF ZEBRA / XEBRA MOTORS

By Dave Goldstein

Many may have came across an article about the demise of Xebra Motors. Apparently their assets were auctioned off in June. It has been reported that they built 15 Xebra roadsters roadsters, including the Yasmin-Eyes blue one used in Nash Bridges, but nobody seems to know what happened to them. Don Johnson and Darrin Start apparently lost big on this venture.

The full article can be found at http://eastbay.bcentral.com/eastbay/stories/2001/06/18/story8.html

I read the article and in fact, provided background information to author Len Grzanka. It was an interesting and well-written piece, but I would like to clear up a misimpression that some readers may have that either Xebra or its predecessor, Zebra Motors *ever* produced any electric roadsters.

In fact, the "Z3 roadsters" were actually *Tropica* Sports Coupes produced years earlier by Renaissance Cars in Palm Bay, FL, under the guidance of Bob Beaumont, the father of the Sebring-Vanguard CitiCars of the mid 1970's. Zebra simply bought the assets of Renaissance Cars after the original company went belly-up, having failed to secure bridge financing during the height of the anti-ZEV press campaign led by the auto industry. Zebra then *rebadged* the 8 or 10 Tropicas they acquired as "Zebras" and proceeded to sell orders for "new" Zebras that they promised to produce.

Years later, when Zebra failed, having assembled perhaps *2* cars from some left-over Tropica test chassis and spare parts, the assets were sold to " Xebra" , which has now failed also.

The cars themselves were quite attractive in mostly white fiberglass, resembling a small Cobra, Miata or BMW Z3 with an integrated roll bar and only a very small wind-screen (like an early Jaguar?). A central battery tunnel held 72 volts of deep-cycle golf cart batteries with a central watering system. A nicely rounded trunk with an integrated center taillight (predating the Porsche Boxster design) held enough space for two golf bags and perhaps an overnight bag.

The all-aluminum chassis featured fully independent suspension, massive side guard beams integrated into the doors and many other safety features (but no air bags.) Top speed, however, was limited by a fixed gear reduction to 65 mph, because Renaissance CEO Beaumont wanted a *roadster* or *runabout* and NOT a "sports car." He was also concerned about the difficulties that a small manufacturer would have in meeting NHTSA safety regulations.

Even so, the car accelerated very nicely, handled beautifully and had excellent brakes. Most private owners modified their Tropicas for even greater speed and performance.

There are varying accounts of the number of Tropicas/Zebras produced. I believe that there were 14 original Tropicas built on the assembly line in Palm Bay, FL. This doesn't including 2 prototypes and at least 2 more rolling test chassis (which may have been later assembled into full cars by Zebra, using spare parts), for a total of 18 vehicles. Some say there were as many as 25. At least 8 Tropicas were delivered to private customers before Renaissance failed. The remaining 10 or so were shipped to Zebra motors in Alameda, CA where the Zebra/Xebra saga began.

I worked as a consultant to Bob Beaumont and Renaissance Cars in those early, heady days in Florida. Bob was subsequently forced out of the company when the Electric Power Research Institute (EPRI) bought in, in a misguided attempt to "rescue" the company. Neither Beaumont nor I had anything to do with the later activities of Renaissance, Zebra or Xebra Motors.

The Tropica/Zebra/Xebra story is far more complicated than could possibly be told in this brief recollection, and will no doubt be the subject of a book someday. The project was initially conceived at a time when Detroit was loudly proclaiming that a roadworthy electric car could not be produced for less than *$125,000*. Ironically, that was about the total cost to produce each Tropica when Renaissance Cars folded, leaving behind more than $2 million in debt from R&D and startup costs.

Behind the scenes, however, there was a brilliant team of "Space Coast" engineers, boat builders and a game plan for cost-effective limited-volume production that predated GM's later Craft Center attempts to build the EV1 in Lansing, MI. And in another irony, Beaumont had chosen GM chassis parts and lined up more than a dozen Florida GM dealerships to sell his car to the public.

In short, the Tropica was a serious contender. Its good looks and thoughtful design were part of its undoing. As costs began to rise and private investments declined, it outlived its designers and became a pawn in the hands of successive groups of investors who admired its style but had no idea what to do with it.

It may also represent the last gasp for small under-funded manufacturers to produce an attractive and affordable roadworthy EV. Today, there are far more stringent NHTSA safety standards for small manufacturers, including expensive air bag requirements and new rules that effectively prohibit the use of inexpensive golf cart batteries. Renaissance Car's initial $2 million investment would not even *begin* to get a car into production in today's business and regulatory climate. And the car that Bob Beaumont once expected to sell as an inexpensive runabout costing less than *$10K* would likely sell for $40K today — IF it could get past the regulatory hurdles and into production in the first place.

I have no idea what became of the powder blue Tropica/Zebra that was painted to match Yasmine Bleeth's eyes, but I do know of at least one other factory original white Tropica — perhaps the last unmodified version left in the country — for sale by private owner for $25K. If anyone is interested and willing to maintain the car in its original condition, please contact me for further information <goldie.ev1@juno.com>.

TIRE FITNESS

By Shari Prange, ©1999

When people talk about electric cars, they most often talk about endurance. How long will it run before I have to recharge? It's easy to fixate on the batteries as the most obvious factor in range. However, there are a lot of other, smaller factors that can make a difference. One of them is tires.

Feeling Sluggish?

Tires are the interface between the vehicle and the road. This interface is critical for acceleration, traction, handling, ride smoothness, and rolling resistance. That final item is the one you want to minimize to achieve the best possible range.

Electrical energy from the batteries becomes mechanical energy in the motor, then passes through the transmission and out to the wheels. Rolling resistance refers to anything that sucks away some of that energy from the wheels and diverts it from its useful function in moving the car. Usually, this means energy that is simply wasted as heat. If this waste can be reduced, then more energy is available to turn the wheels and move the car.

Lose Weight & Gain Energy

One way to improve rolling resistance is to decrease the weight load on the tire. This means making the vehicle as light as possible, but it also means making the tires as light as possible.

The weight of the tires may seem trivial in comparison with the rest of the car, especially the battery pack. However, tire weight is rotational weight — it spins. It takes more energy to spin this weight that it would to simply move it in a straight line. Saving ten pounds (4.5 kg) off each tire will have more effect on rolling resistance than saving the same forty pounds (18 kg) in battery weight.

Staying In Shape

Another way to improve rolling resistance is to decrease deflection of the tire. Tires are round, but as they bear down on the pavement, they flatten and the sidewalls bulge. As that portion of the tire rolls up off the pavement, it becomes round again. The tire also deflects even more if it rolls over bumps or potholes. This constant flexing and unflexing causes energy to be wasted as heat. This is the largest factor in rolling resistance in a tire.

As the tire rolls down the road, it deflects in both the tread and the sidewall. The deflection of the tread is the most critical to rolling resistance. If the tire can be redesigned so that a greater proportion of the deflection occurs in the sidewall and a lesser proportion in the tread, rolling resistance will be reduced.

Substitute Ingredients

Some of the same engineering techniques can be used to reduce both weight and deflection. For example, different materials and construction techniques can make a tire that is both lighter in weight and more rigid.

A tire is not just a big rubber doughnut. There may be as many as a dozen different compounds used in different parts of the tire. The tread will be made from a different compound than the sidewall. Then there will also be multiple materials used in the belts and various reinforcing layers.

In the past, our tires have been steel-belted radials. But in the future, they'll be textile-belted. No, I don't mean hemp cloth. In this use, "textile" refers to well known materials such as polyester and nylon, as well as less familiar strong-but-light materials, such as kevlar and aramid. These materials make the tire both lighter and more rigid.

The rubber is changing, too. Rolling resistance and traction used to be on opposite sides of a scale — if you improved one, you sacrificed the other. Then tire makers discovered that they could substitute silica for some of the carbon black in the rubber compound. This breaks the stalemate. Now you have a compound with low rolling resistance and good traction at the same time.

Building Up

Just as important as the materials used is the way in which they are put together. Some low rolling resistance tires have less tread depth than normal. This might also mean a shorter lifespan for the tire, but it might not, if the tread compound is also adjusted. Other low rolling resistance tires, such as Bridgestone/Firestone, will have the same tread depth as normal tires.

Different manufacturers may focus on different methods to reach the same end. Bart Thompson, tire engineer for Michelin, emphasizes a flatter crown, which is the shape of the top of the tire when seen head-on. Mike Weber, Goodyear tire engineer, stresses a taller sidewall and narrower relative tread.

A final structural issue deals, not with rolling resistance, but noise. Electric cars are quiet, so tire noise is more apparent. In addition to all of the factors we've already talked about, manufacturers have to design their tread patterns to try to minimize road noise.

The challenge manufacturers face is balancing all these factors to get the best total tire package. For example, traction and handling cannot be allowed to fall below acceptable levels in order to achieve low rolling resistance. A tire that deflects less will also give a stiffer ride, so driver comfort becomes an issue.

Lighter materials and thinner sidewalls may mean more susceptibility to sidewall damage. This is less of an issue on a car like the Honda EV Plus, where the tires are fully warrantied against road hazards as part of the overall car package. It might be more important on a conversion car without Honda's warranty.

Know Your Limits

Materials and construction are in the hands of the tire manufacturers, but there are things the car owner can control to reduce rolling resistance too.

The tire should be properly matched to the vehicle. It's very important to stay within a tire's rated specs. These are the conditions for which it was designed. Using it outside of these ranges will not yield the best performance, and may actually be unsafe.

Most conversions add several hundred pounds of weight to a car. For this reason, the tires originally specified for that model may no longer be the best choice. You should choose a tire in the correct size that is rated for the car's converted weight.

Ordinary tires, called "Standard Load P-metric" tires, are rated for maximum load

capacity per tire at a standardized 35-psi (pounds per square inch) inflation. Additionally, there are "Extra Load P-metric" tires, primarily available in sizes for light trucks. These tires can carry more weight because they are rated for maximum load capacity at a standardized 41-psi inflation. If your vehicle requires more load capacity than "Standard Load" tires can provide, you should investigate the availability of "Extra Load" tires.

A larger tire (larger in the sense of more air volume) is also capable of carrying more weight. Within the limits of the space available in your wheel well, a larger tire could help carry the extra weight and improve your range as well. If you are running a tire at its maximum load capacity, it will have poorer rolling resistance than a tire run at a fraction of its load capacity. This is because the tire at its load limit will have more deflection. In other words, tires that are rated higher than necessary for your vehicle's weight will give better range performance, all else being equal.

Breathe Deep & Stand Straight

Inflation is very important. A soggy tire will waste a lot of energy. But just how much should you inflate it? Many tires designed for electric cars have been engineered to run at higher than normal inflations. This is part of stiffening the tire. Troy Cottles of Dunlop says the Dunlop DEV-01 issued on the Honda EV Plus is rated for 51 psi. Jorge Pena of Michelin says the Proxima RR is rated for 55-psi.

It is not, however, a good idea to simply take an ordinary tire and run it at a higher inflation pressure. All of a tire's handling characteristics and ability to withstand stress (like hitting potholes) have been engineered for its designated ratings. Once your conversion is completed, it is a good idea to immediately confirm how much weight your vehicle's tires are carrying. Then select a tire size designed to carry that weight, and only use inflation pressures within that tire's specifications.

Higher inflation improves range by reducing tire deflection. In the past few years, many tire manufacturers have begun increasing the maximum allowable inflation on their tires, in the expectation of future fuel crises. Most of these tires can be inflated as high as 44 psi. This number will be stamped on the sidewall. Running these tires will allow you to use a higher inflation and save energy.

Your inflation needs to be keyed to your car's weight distribution as well. If your car is slightly lighter in the front or rear, reduce the inflation at that end. But don't go below 90 percent of the inflation pressure being used on the heavier end of the vehicle. Also, be sure your car is properly aligned. Bad alignment will wear out your tires unevenly and prematurely, and it will cost you range while it does so.

Same Shoes the Pros Wear

So how do you find a specific tire for your car? For starters, don't even think about using old-fashioned bias ply tires on your electric car. They simply will not stand up to the weight, torque, and handling stresses involved.

You need to look for tires developed for fuel economy on gas cars. Your best bet here is to look for tires that are issued as original equipment on new vehicles, particularly Japanese models. Auto manufacturers push for low rolling resistance tires to improve their Corporate Automotive Fuel Efficiency (CAFE) numbers. This number represents the combined fuel efficiency of their product line, and they are required to meet certain standards with it. The Japanese manufacturers have particularly strict standards for fuel efficiency.

Or Good Cross-Trainers

Conversely, there is very little interest in fuel economy from the public, so tires that are manufactured only for retail sale do not emphasize this feature. Goodyear went to some effort a few years ago to make and promote a low rolling resistance tire. While it was slightly more expensive than a standard tire, the fuel savings over the life of the tire paid for one tire out of four. The public, however, was uninterested.

There are still some low rolling resistance tires out there, though. Michelin's top sellers in this category are the Energy MXV4 and MXV4+. Other fuel efficient Michelin tires are distinguished by the "Green X" on the sidewall. In Dunlop tires, look for models with an "FE" (fuel efficient) or "RR" (rolling resistance) suffix on the model number.

While Goodyear is not promoting any specific models as fuel efficient, there are different models in various sizes that are suitable for electric cars, and have better than average rolling resistance. And Goodyear is offering personal consultation to help you choose your tires. Bill Egan has been a supporter of EVs for many years, and is generous in advising home converters. You can contact Bill at weegan@goodyear.com for help. Tell him your car model, car weight, and weight distribution fore and aft, and he will give you the product code for the most appropriate tire as well as the optimum inflation pressure to run.

Listen To The Experts

Consumer Reports runs tire tests about once a year. Sometimes they test all weather tires; other times it might be touring or performance tires. However, for any type of tire they include a rolling resistance rating based on their own tests. This is another source of information for your buying decisions.

Another resource is John Rastetter, product information specialist for The Tire Rack, a nationwide business selling tires by mail order. John has many years of experience in the tire industry, and has a great deal of detailed technical information on a wide range of tires. He contributed generously to this article on the subjects of load capacity, tire size, and inflation. You can call him at 1-800-428-8355, extension 347, and he will help you determine the best tire and inflation for your electric vehicle.

Knowledge Is Power

Now that you have all this nifty tire information, how do you use it? First, you need to know what size tires fit on your vehicle, and how much the vehicle weighs. You can often find public scales at landfills, sand and gravel yards, and feed stores. While you're at it, get separate weights for each axle as well. Armed with this info, you can start tire shopping.

Here's where Bill Egan and John Rastetter can be of help, or you can do research on your own. You know how much weight you need to support, and you would like the tire

to be rated for even more weight if possible, to improve your rolling resistance. Shop for tires that have the right size and weight ratings.

Next, search among these tire choices for any that indicate they were designed for fuel economy. This might show up as the "Green X" of Michelin, or the "FE" or "RR" suffixes of Dunlop. You can also check the Consumer Reports ratings, and you might find an excellent rating for one of your "dark horse" contenders.

In the end, you might bring it down to a short list of possibilities. Find a knowledgeable tire seller, explain your needs, and let him or her help you make the decision among the final candidates. Just don't be led astray at the last minute by a sales pitch for some other tire unless the salesman can back it up with specifications.

The Holistic Approach

As you can see, there are a lot of factors involved in making a good electric vehicle tire, and these factors interact with each other in sometimes complex ways. What this means to you is that there is a lot more to buying tires than finding the best price, or even the best warranty. If you want to get the best performance from your electric car, you should think of the tires as an integral and important part of the overall system. In the long run, the best match of tires to vehicle will be the best bargain.

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This article also appeared in ***Home Power*** magazine.

UC Davis Sequoia: A "Plug-In" HEV Sport-Utility Vehicle

Sequoia is a 2000 Chevrolet Suburban modified to operate as a hybrid-electric vehicle. The truck uses a "plug-in" control strategy that maximizes all-electric operation in urban and freeway driving; the battery is recharged from the grid electric supply. The engine is used occasionally for long trips (to sustain the battery charge when the battery becomes partially depleted) and for additional power during towing or maximum acceleration. The stock Suburban features a 5.3L V8 engine, four-wheel drive, and an automatic transmission and has a curb mass of 2523 kg.

Vehicle Specifications

Vehicle Curb Mass	2807 kg, including fluids	
Engine		
Manufacturer / Type:	General Motors (Saturn) / 1.9 liter Inline 4-cylinder, Dual Overhead Cam	
Maximum Power:	95 kW @ 5600 rpm	
Maximum Torque:	158 N-m @ 4800 rpm	
Fuel System:	Sequential Electronic Fuel Injection	
Emissions System:	Close-Coupled Catalyst; Hydrocarbon Trap; Electrically Heated Three-Way Catalyst; Air Injection	
Throttle Control:	UC Davis drive-by-wire	
Transmission	Primary (rear wheels)	Secondary (front wheels)
Manufacturer:	Richmond Gear	Bay City Iron Works/Richmond Gear
Type:	6-speed manual	single speed
Gear Ratio:	4.41, 2.45, 1.57, 1.24, 1.00, 0.81	2.5
Final Drive Ratio:	4.56 (General Motors)	3.73 (General Motors)
Electric Motors	Primary (rear wheels)	Secondary (front wheels)
Manufacturer:	Unique Mobility	Precision Magnetic Bearing Systems
Type:	DC Brushless w/regen brk'g	DC Brushless w/regen brk'g
Maximum Power:	75 kW @ 3500 rpm	75 kW @ 3500 rpm
Maximum Torque:	240 N-m @ 0 rpm	239 N-m @ 0 rpm
Energy Storage		
Manufacturer / Type:	Ovonic Battery Company / Sealed Nickel-Metal Hydride	
Capacity:	29.0 kWh (@ C/3)	
Peak Power:	185 kW (@ 50% DOD)	
Mass:	441 kg	
Fuel Type:	Reformulated Gasoline	
Capacity:	15 gallons	
Battery Charger		
Manufacturer / Type:	General Motors "MagneCharge" / Inductive	
Output Power:	6.6 kW	
Input Voltage:	220 V AC	
Control System		
Software:	All UC Davis designed	
Hardware:	UC Davis designed, except PCM microcontroller (Microsys)	
Data Communication:	CAN Bus	
Accessories		
Air Conditioning:	Electric (Sanden)	
Power Steering:	Electric (Delphi)	
Telematics:	Advanced Vehicle Information System with rear-view camera, powertrainstatus feedback and wireless interface; audio-video entertainment system with three independent displays and wireless interface to household network	

FutureTruck 2001 Results

	Sequoia		GM Suburban		(units)
Energy Economy [1]	City	Hwy	City	Hwy	
All-electric (EV)	367	403	N/A	N/A	DC Wh/mi
Charge-sustaining (HEV)	23.6	27.2	N/A	N/A	mpg
Combined driving [2]					
Consumer perspective [3]	49.3	48.7	15.6	20.5	mpegg
Societal perspective [4]	4,384	4,496	8,910	6,760	Btu/mi
Petroleum use [5]	84% less	80% less	baseline	baseline	
Refueling Cost [6]					
All-electric (EV)		2.8		N/A	cents/mile
Charge-sustaining (HEV)		6.6		N/A	cents/mile
Combined driving		3.7		9.5	cents/mile
Range	City	Hwy	City	Hwy	
All-electric (EV) [7]	64	59	N/A	N/A	miles
Charge-sustaining (HEV)	355	408	N/A	N/A	miles
Total, typical driving		460		560	miles
Tailpipe Emissions					
All-electric (EV)	California ZEV			N/A	
Charge-sustaining (HEV)	California ULEV			N/Z	
Combined driving	below California SULEV [8]			California LEV	
Greenhouse Gas Impact [9]	GHGI	Reduction		GHGI	
FutureTruck calculation [10]	432	48%		828	grams/mile
FutureTruck corrected [11]	413	50%		828	grams/mile
NPTS/Nationwide 2010 [12]	273	67%		828	grams/mile
NPTS/California long-term [13]	213	74%		828	grams/mile
Acceleration					
0-60 mph time		8.9		8.9	seconds
Time to ¼ mile		17.7 [14]		17.3	seconds
Trailer Towing (estimated)					
Charge-sustainable speed with 7000-lb trailer					
0% average grade:		65		N/A	mph
2% average grade:		60		N/A	mph
7.2% average grade:		35		N/A	mph
Top speed with 7000-lb trailer					
0% grade:		80+		80+	mph
2% grade:		80+		80+	mph
7.2% grade:		65		65	mph

Notes

1. Energy Economy figures are uncorrected results of dynamometer testing on the FUDS (city) and FHDS (highway) federal driving cycles.

2. "Combined driving" represents a weighted average of EV and HEV modes based on Sequoia's all-electric capability. The percentage of all-electric operation is derived from driving statistics in the 1995 US. Department of Transportation Nationwide Personal Transportation Survey (NPTS), and assumes the vehicle is recharged every night. For a vehicle with 60 miles of all-electric range per charge, the NPTS statistics indicate that EV mode can be utilized for 74% of total driving miles.

3. Represents the refueling energy supplied to the vehicle by the consumer. The amount of electric recharging energy drawn from the consumer's wall plug is converted to an equivalent amount of gasoline and added to actual gasoline consumed to obtain an equivalent gas mileage ("mpegg" = miles per equivalent gasoline gallon). Battery and charger losses have been applied to the electricity usage. Note that mpegg values increase dramatically with increasing all-electric operation; the equivalent fuel economy of Sequoia during all-electric operation is 75.0 mpegg on the city cycle.

4. All "upstream" energy (including refining, transportation, and power plants) has been included in order to calculate the total "well-to-wheels" energy consumption on a national basis. The amount of upstream energy is calculated using Argonne National Laboratory's Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model, Version 1.5a. Electricity production is based on the nationwide generation mix forecasted for 2005. Due to higher electricity production efficiency, Sequoia's upstream energy use in California would be approximately 12% less.

5. Sequoia's all-electric capability permits a reduction in petroleum use of approximately 75%; the remainder of the reduction is due to improved gasoline fuel economy.

6. The gasoline price is assumed to be $1.65/gallon, a national average; the electricity price is assumed to be $0.06/kWh, a weighted average of on-peak and off-peak electricity rates available to electric vehicle users (source: "Comparing the Benefits and Impacts of Hybrid Electric Vehicle Options," Electric Power Research Institute). Note that the gasoline price in California is currently approximately $1.80/gallon, and the off-peak electricity rates of some California utilities have recently increased to about $0.08/kWh (July 2001).

7. Battery discharged to 80% depth-of-discharge.

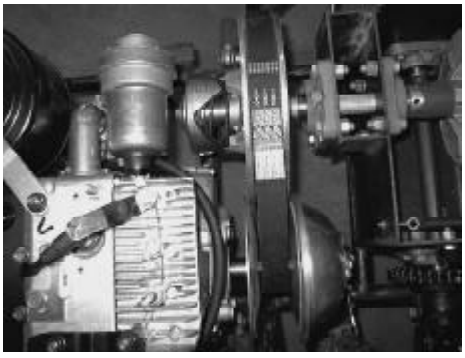
continued on page 21

USE AN AUTOMATIC TRANSMISSION IN AN EV

by Will Byars, with editing by Bob Oldham

You can use an automatic transmission in a late model electric vehicle conversion; you just need to put a little more thought into it and get a few different pieces made. By far the easiest transmissions to use are the variants of the TH350, TH400, TH700R4, TF727, C4, C6 and other such long-lived designs from rear wheel drive platforms of the big three. Why? Their new versions, the electronically controlled ones, share the same bolt patterns and mounting provisions of the old ones! For example, a 4L80E (Chevy) is just a newer version of the old TH400 transmission. There are also a few front-wheel-drive transmissions that are variants of the rear-wheel-drive transmissions that preceded them. You have a few options: hack the computer to make it do what you want (custom chip), use an aftermarket shift controller with a custom chip, or replace the computerized transmission with a non-computerized version. It's possible that aftermarket hot-rod parts meant that for the rear wheel drive version of the same transmission would fit, giving you the option of manually controlling the shift points.

To run an automatic most efficiently in an EV, you need to remove its worst part: the torque converter. You can potentially hack it up and get the various splined coupling bits off of it and use them to make your connection from motor to transmission. Here's where you make your next choice: internal pump or external pump? Run the internal pump with the traction motor or with a separate motor?



The "drive shaft", or input shaft, is normally hooked to the engine. The engine driveshaft is connected solidly to the outer case of the torque converter, and, hence, spins the whole thing whenever the engine is running. Inside the torque converter is a rotor that is spun by the fluid pushed by the spinning outer case. The transmission input has two concentric shafts; the outer torque converter casing is connected to the outer splined input shaft of the transmission, which turns the pump in the transmission that supplies the hydraulic pressure to operate the various systems in the transmission. The inner part of the torque converter, the "driven shaft" in the picture, is connected to the inner input shaft of the transmission, which is what supplies the torque that passes through the gears, bands, clutches etc. inside the transmission.

If you want to use an external pump, you have to rip out the existing pump and reroute some internal passages to allow the input of pressurized hydraulic fluid from your external pump and to allow access to the transmission sump to get it back to the pump. If you want to use the internal pump and drive it with a separate motor than the main drive motor, use the two splined connectors you cut out of the torque converter to make two separate connectors. One of the connectors with a pulley on it to drive the pump, and one with a solid connector to connect the traction motor to the torque input shaft. If you want to run the internal pump from the idling traction motor, just connect both splined bits to the same direct coupler from motor to transmission. However, this means that when the vehicle is stopped the traction motor must run at an "idle" speed to keep hydraulic pressure up – a finicky adjustment on the controller side of the equation.

The factors that go into how you want to do it are complexity, weight, cost, and efficiency. Bigger motors are more efficient, but possibly not at low power outputs. For what it's worth, since you have to re-program the transmission anyway, it may be easier to just run everything off the traction motor. Put a pulley on the other end of the motor or build it into your coupler to run the power steering pump, the A/C, and whatever else you want to provide rotary power to when the car is "on" and in "drive". (This will of course necessitate a governor to maintain motor speed with changing loads.) If you pick the right power steering system (one compatible with regular ATF) you can run the power steering off the pump inside the transmission. This can eliminate one extra motor and pump, at the expense of needing some more high-pressure lines and adding another return to the automatic transmission sump, plus most likely an additional oil cooler to keep the ATF happy. For those with heavier vehicles, there is available a "Hydroboost" brake booster system (in many larger diesel vehicles, like GM and Dodge and Ford pickups) that runs off the power steering system. If it is also compatible with the ATF, there goes the vacuum pump as well! If the transmission pump can't "keep up" with that entire load, you can add a hydraulic accumulator and/or buy an aftermarket higher-volume pump. These are available from the heavy-duty version of the transmission and/or racing parts suppliers, if available at all for that transmission. Do your homework! :-) An alternative method might be to combine the auxiliary functions above – brake boost, power steering — into one hydraulic system with accumulator and run a separate motorized hydraulic pump with a pressure switch. Alternatively, you can add a solenoid-controlled hydraulic accumulator that "charges" while driving and will "dump" a slug of pressurized ATF to the transmission when you want to start moving. Adding a pressure switch somewhere in the hydraulic circuit in the transmission would allow delaying power input to the traction motor until the transmission has sufficient pressure to operate.

Next up is re-programming the transmission. You need to modify the programming either electronically or mechanically depending on your application. Basically, you want the transmission in a lower gear for acceleration and a higher gear (but not TOO high) for cruising. If a custom chip or transmission controller is available for your transmission then it is possible that you can get the supplier to burn you one with the parameters you want for a nominal fee over the regular cost, or possibly free if they are enthused by the idea! :-) For mechanical reprogramming, you can get "shift kits" that firm up the shifting and raise the shift points for the transmission. Then you "reverse the sense" of the "kickdown" mechanism to "kick up" instead, causing the transmission to run in low or 2nd gear normally and shift up to high for acceleration, etc. For a number of transmissions, you can get a fully

manual valve body, which allows you to shift it without a clutch any time you want.

There are internal friction clutches and bands that do the de-coupling and coupling for you, and with racing parts there is no need to drop power to the traction motor during shifting, though it may be desirable for "smoothing" the shifting. If you are running an external or externally driven internal pump, you're done.

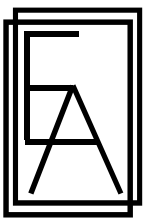
If you run the internal pump off the traction motor, you have one more thing to do. You need to add something akin to a "clutch pedal" circuit. Basically, you find the hydraulic actuator that connects input torque to first gear and rig it so that it drops pressure to that band and/or clutch when the vehicle gets below a certain speed and/or when a switch or pedal is depressed. Probably the simplest arrangement would be a microswitch on the potbox that disconnects the torque whenever the "throttle pedal" is not pressed. The actual details of how to do the hydraulic connections will have to be figured out by whomever are doing the converting.

Ditching the torque converter cuts the losses of an automatic transmission significantly, and "firming up" the shifts, as with a racing-style shift kit, also cuts the losses by reducing the "slip" in the bands and clutches during shifting. Both also dramatically cut the heat added to the fluid, making it run cooler and last longer. Planetary gearsets are possibly more efficient than the gears found in a manual transmission as well, and ATF is a much lower viscosity fluid, which further reduces drivetrain drag.

Lastly, you can add to the programming/ switching/controlling/ design, such that power input to the traction motor is locked out whenever the transmission is shifted to neutral or park, greatly alleviating the danger of runaway on a series-wound motor.

Done right, this could make for a very pleasing and easy to drive vehicle. For long-established transmission designs there are even a number of different gear ratio combinations available in either different vehicle models or from aftermarket sources, allowing you to "tune" the transmission to your particular motor/controller/vehicle combination. Some cars even have 5 and 6 speed automatic transmissions available, making a more efficient match between motor speed and vehicle speed possible.

It is also worth mentioning that several of the newer automatic transmissions use an electric solenoid valve to control the flow of pressurized hydraulic fluid in the transmission. Armed with a schematic, an exploded diagram of the transmission and a hydraulic circuit diagram it should be relatively easy for someone to devise an adjustable shift controller for the transmission to replace the interface with the vehicle's main computer. With a little more work, one could potentially build a replacement computer module that would fit in place of the donor vehicle's computer and allow use of a number of existing circuits in the ICE wiring harness for EV purposes. This would allow a very seamless integration between the electric components and the vehicle.



CONVERSION WORKSHOP, STEP 6
INSTALLING THE MOTOR/ADAPTOR/TRANSMISSION ASSEMBLY

By Michael P. Brown, ©2001

In the last issue, we talked about the types of motors and adaptors available. In this article we will discuss installing the adaptor on the motor, joining the motor/adaptor assembly to the transmission, and finally, the installation of electric drive system in the car or truck. Note: The adaptor installation procedure is for the adaptor system I sell. Other suppliers have different procedures. Follow the instructions that come with your adaptor.

Motor Handling

Since the motors we are installing weigh from 100 to 150 pounds, they should be handled with care to avoid damage to the motor or yourself. It isn't easy to pick up a heavy motor with smooth sides and no big projections to get a grip on, To make it easier, thread two 3" bolts of the right thread size in two of the mounting holes opposite each other on the drive end of the motor. If you have an Advanced DC motor, you can do the same thing on the brush end because mount holes are provided at that end, too.

Be sure to thread the bolts all the way into the holes to avoid damage to the threads. If you have a Prestolite or GE motor, removing the brush cover and holding on to the motor through the brush access holes in the end bell is about your best bet.

The Advanced DC motors have a hole in the side of the motor tapped 5/8"-11 for an eye bolt used for handling the motor during the manufacturing process. If you decide to use this method to move the motor around, be very careful to thread the bolt in finger tight only, and lock it in place with a lock nut placed on the bolt before it is threaded into the hole in the motor. The reason for this is that the bottom of the hole is one of the field coil shoes and trying to tighten a bolt against it will force it into the armature and damage the motor.

Bench Work

Now that we can pick the motor up and move it around safely, let's talk about where we are going to put it and how we are going to keep it there. The usual destination is a workbench or freestanding worktable, but once the motor is there, it needs to be held in place so it can be worked on without moving around and possibly falling off the bench.

The way I do this involves two 3/8" holes I have drilled into the top of my work bench about 20" from each other. The motor is placed between the holes. Two 3/8" eyebolts are inserted in the holes and held in place with nuts threaded on from under the bench top. Next, a piece of 5/16" chain is hooked to one eyebolt and passed over the motor toward the other eyebolt (with some padding, such as rags, foam rubber, or cardboard between the chain and the motor to prevent damage to the motor).

Then a threaded turnbuckle, with its ends extended to almost their maximum length, is fastened between the end of the chain and the remaining eyebolt. When the turnbuckle is tightened, it gets shorter and the chain pulls the motor tightly to the bench.

If you don't want to drill holes in the top of your workbench, get a piece of 2"x6" wood plank about 36" long, drill the holes, and install two "T" nuts into the holes from what will be the bottom of the board. This gives metal threads in the wood plank to screw the eyebolts into. Put lock nuts and flat washers on the eyebolts before threading them into the "T" nuts. Put this holddown board on the top of your workbench and fasten the motor to it instead of the bench.

Which Way Is Up?

The reason for holding the motor so firmly to the workbench is to keep it from moving around while we are installing the adaptor. But before we cinch it down, we need to make sure everything is pointing in the right direction. It is critical that the motor terminals are oriented in a position relative to the top edge of the transmission bellhousing that allows them to be accessed for service. At the same time, you want to be sure they aren't interfering with things like battery racks, drive axles, or frame crossmembers.

When this orientation has been determined, place the motor on the work bench or holddown board with the terminals pointing in the desired direction, and tighten the turnbuckle. This system will keep the motor in one place on the bench, but it will not keep it from rotating when the fasteners holding parts of the adaptor to the motor are tightened.

I use a metal bar with a hole in one end as an anti-rotation bar. The bar is fastened to the brush end bell of the motor with a bolt through the hole in the bar and threaded into one of the mount holes on the motor. The other end of the bar is pointed toward the right side of the motor, and under another bolt threaded into one of the other mount holes in the end bell. The free end of the bar rests on the bench top which keeps the motor from rotating by forcing the bar against the second bolt.

It might be necessary to rotate the motor a little to achieve this, which is ok. However, if there is more than one inch between the end of the bar and the bench top when the bar is against the stop bolt, use a block of wood to make up the distance.

Adaptor Installation

Note: The following instructions describe the installation of an adaptor on an Advanced DC motor. However, adapter installation on other brands of motors is a similar sequence of events.

The ¼" square key provided in the adaptor kit is the first part installed. Since it is a loose press fit in the key slot of the motor shaft, it is gently tapped into place with a brass hammer until it is fully seated and the end of the key is even with the end of the motor shaft. Temporarily install the tapered bushing over the shaft, and key to check that it slides along the shaft freely. If it doesn't, check that the key is seated properly and that there are no burrs on the key or shaft. Free back and forth movement of the bushing on the shaft will be important very soon.

Next, the motor ring is fitted over the locat-

ing projection on the motor face, and bolted to the motor with the four 3/8"-16 socket head cap screws provided in the adaptor kit. Place a drop of red Loctite thread locker on the bolt's threads before installation. Tighten all the bolts firmly, then torque them to 35 ft/lbs.

With the motor ring in place, the next part to install is the profile plate. The profile plate has a locating recess on its motor side that fits over a locating projection on the motor ring. Place the plate on the ring, with the top of the plate in the position it needs to be in relative to the motor lugs. Secure the plate to the ring using Loctite as above on the bolts, tighten the bolts firmly, and torque them to 35 ft/lbs.

Two types of bolts are used here, depending on the amount of room between the back of the flywheel and the profile plate. If there is a lot of room, a regular ½"-13 hex head bolt with a ½" flat washer is used. If clearances are tight, a ½"-13 flat head bolt is used. The correct bolts for the adaptor are provided in the kit.

Installing the adaptor hub and bushing assembly is the most critical part of the process. First, we slide the bushing on the motor shaft, with the large diameter end facing the motor. Next, slip the hub over the bushing, and align the counterbored holes in the center of the hub with the threaded holes in the bushing. Thread the 10-24 cap screws, included with the adaptor kit, through the hub and into the bushing. Tighten the cap screws gradually in a criss-cross pattern, drawing the bushing into the hub until you start to feel resistance when sliding the hub back and forth on the motor shaft.

At this point, tighten the screws a little bit more until it takes an effort to move the hub along the shaft. Now place the flywheel on the hub and temporarily bolt it to the hub using two of the original flywheel bolts. Tighten the bolts hand tight.

With the flywheel in place, we can duplicate the "magic distance": the measurement we took when the flywheel was still bolted to the IC engine. Slide the flywheel/hub assembly along the shaft until the distance from rearmost flat surface of the flywheel to the profile plate is your "magic distance", plus .020" to allow for pull-in when the cap screws are fully tightened.

Now, if the cap screws are still visible, tighten them snugly. Note: Do not over tighten the cap screws, as they will break. The taper action between the hub and bushing is where the holding power is. The cap screws just set that taper action in place. Recheck the "magic distance", and it should be whatever your distance was, plus or minus .010".

If the flywheel covers the cap screws after you have set the "magic distance" plus .020", gently remove the flywheel, tighten the cap screws, reinstall the flywheel, and recheck the "magic distance". If you miss the "magic distance" even within the plus or minus .010" tolerance, just loosen all the cap screws until they stick out above the face of the hub, hit them sharply with a brass hammer to break the taper, and start over. If the capscrews don't stick out far enough, or you are nervous about hammering on them, buy two 10-24 capscrews ¼" to ½" longer than the ones that came with the adaptor kit and tap them with the hammer instead.

Flywheel and Clutch Installation

After the hub and bushing are locked in place with the "magic distance" set, we can permanently install the flywheel. Now is the time to have the flywheel's friction area resurfaced, starter ring gear removed, and have the flywheel lightened if you think it's necessary.

I do not recommend flywheel lightening being done by anybody other than an automotive machine shop that does high performance engines and knows where to take the weight off safely. This kind of shop would also have ability and machinery necessary to re-balance the flywheel after lightening. If you are having the flywheel balanced, give the shop the new clutch pressure plate you are going to install, and have them balanced as a unit.

Before installing the flywheel, check to see if there is a pilot bearing or bushing that needs to be lubricated or replaced. Since this small but critical part is in the very center of the drive system, now is the time to pay some attention to it.

Some pilot bearings are sealed permanently lubricated ball bearings that are installed in the hub or flywheel. Replace this type of bearing with a new one. Another type of pilot bearing is a caged roller bearing with the rollers exposed in the center of the bearing where the pilot shaft runs. This type of bearing is usually installed in the hub. I install a new bearing in the hub as part of the kit when this type of pilot bearing is used.

The pilot bushing is usually made of a brass or bronze alloy and is pressed into the hub. It is a very simple part that has been in use since the dawn of the automotive age. My machinist makes our pilot bushings to suit when they are called for, and they come pressed into the hub as part of the kit. Both the caged roller bearing and the pilot bushing need to be lubed prior to use. A sparing amount of molybdenum based grease (moly grease) packed between the rollers or coated on the inside of the bushing is usually enough for the life of the clutch. Too much grease might find its way onto the clutch disc causing slippage.

Install the flywheel, using the original bolts and lockplate if one was used (check your factory service manual to see if they specify the use of new bolts or lockplate). Use a flywheel lock to prevent rotation, and torque the flywheel bolts, using the criss-cross tightening pattern, to the torque given in the factory service manual.

Flywheel locks are tools that prevent the flywheel from turning when the flywheel or clutch bolts are being tightened and torqued. They usually work by being inserted between the moveable flywheel ring gear teeth and immobile bolt on the adaptor plate. Some can be purchased quite cheaply while others can be fabricated by the user much more economically. Go to a repair shop that works on your donor's make of car, and see what they use to get some idea of what you have to build. If you had the ring gear knocked off the flywheel, you will have to get more creative in your flywheel lock design.

Now we are ready to install the NEW clutch. Note the emphasis on the word new. It not an economical idea to install used clutch

parts, or even new parts of questionable quality, in the center of a drive system that is buried under several hundred pounds of batteries. Buy new brand name parts, install them correctly, and you won't have to worry about them for many thousands of miles.

Use a clutch pilot tool to center the clutch disc on the flywheel. The clutch pilot tool is a short shaft that mimics the transmission main shaft. It has splines that match the splines on the inside of the clutch disc hub, and has a diameter on one end that fits into the pilot bearing. This tool makes sure that the clutch disc hub is concentric with the centerline of the motor shaft. Inexpensive plastic clutch pilots are available for almost all makes of cars and trucks at the parts house where you buy the rest of the clutch parts.

Install the new pressure plate over the pilot tool and centered clutch disc. Line up the locating holes on the plate with the locating pins on the flywheel. If you had the pressure plate and flywheel balanced as an assembly, line up the locating marks for the balance point at the same time. Slide the plate over the pins as far as it will go. Thread the original pressure plate bolts into the holes in the flywheel and tighten them finger tight.

Reinstall the flywheel lock, and tighten the bolts in a criss-cross pattern an equal number of times for each bolt in several passes until the bolts are snug. This method keeps the pressure plate from being warped as the clutch springs are compressed when the plate is being pulled down to the surface of the flywheel. Finally, torque the bolts to their specified torque and remove the flywheel lock and clutch pilot.

Install a new throwout bearing (a.k.a. clutch release bearing) in the transmission bell housing. Be sure and lube any sliding surfaces between the bearing and operating arm, or bearing and guide tube, with moly grease. Your service manual will show these lube points.

Joining the Motor/Adaptor Assembly to the Transmission

This operation gets a little tricky, as we are joining a fairly heavy motor and adaptor assembly to a transmission or transaxle that weighs almost as much. The best way to do this is to use the engine hoist you have rented or borrowed to pick the assembly off the bench. Use the engine sling that came with the hoist, with one end fastened to one of the mount holes on the front of the motor, and other end to one of the adaptor-to-transmission bolt holes in the profile plate.

Lower the motor and adaptor down onto some wood blocks that are thick enough to hold them off the ground with a few inches under the bottom of the profile plate. Remove the bolt holding the end of the engine sling to the profile plate. Prepare the transmission by applying a small amount of white grease to the clutch splines. Don't overdo this, as too much grease could damage the clutch disc in operation. Also at this time, tap the locating dowels into their holes in the transmission.

By now you should have selected the fasteners you are going to use to fasten the transmission to the adaptor. Put them within easy reach of the motor. Next, round up two assistants, one to steady the motor/adaptor assembly, and another to help you lift and position the transmission.

Pick up the transmission and carry it to the motor assembly. Insert the mainshaft into the clutch hub and wiggle it around a little until the splines on the clutch hub and the mainshaft line up, and the transmission starts to move toward the adaptor. Line the dowels in the transmission up with the corresponding holes in the adaptor plate, and continue pushing the transmission in until the mating surfaces touch.

Bolt the two joined pieces together with the selected fasteners and block up the transmission to keep it from tipping the assembly over. Install as many of the joining fasteners as you can reach, and reattach the end of the engine sling previously removed.

Re-hook the sling to the engine hoist and lift the motor and transmission unit off the blocks. Install any previously unreachable fasteners. Before we install the drive system in the car or truck we should check the transmission mounts for damage or wear and replace them as necessary.

Installing the Motor & Transmission in the Vehicle

Installing the new drive system is the reverse of the procedure used to remove the old IC engine and transmission. However, this is not yet the time to reinstall things like axles or shift linkages. Wait until you are sure you will not have to remove the motor and transmission for any further work.

With the transmission mounts secured we have to figure out a way to support the motor end of the drive system until we can design and build a motor mount. A combination of wood blocks and your floor jack will work if you don't have to move the car or truck. A piece of chain that runs under the motor from one frame rail to the other works on the front engine-rear drive cars and trucks. If you have a front engine-front wheel drive car, a piece of chain looped around the motor and fastened to a strong wood or metal bar resting across the fenders is one way to do it. Try not to use any of the mount holes on the front of the motor for this purpose, or run the chain where you might want to put your motor mount.

The paragraph above sets the stage for our next article: designing motor mounts. Talk to you then.

=The =Racing = Scene

There was one particular day recently that was a standout, Thursday, June 14th, and I'd like to share it with you.

For those who have visited Mike Chancey's EV Photo Album (http://www.austinev.org/evalbum/), you may have seen that crazed lightning bolt picture of me standing in front of my electric car 'Blue Meanie' inside the north power house of Bonneville Dam on the mighty Columbia River. This picture was taken as part of the photo shoot we did way back in the Fall of '94 for the March '95 issue of *Car Audio and Electronics* magazine (CA&E). CA&E caters to the 18-25 year old, mostly male segment that is into hot cars and hot tunes. My whole experience in doing that particular bit for the magazine was a lot of fun, and the article helped put a different, more exciting face on the

whole EV scene. Being featured in that magazine kind of turned Blue Meanie into something of a celebrity, and when I'd take the car to soundoffs, there was usually quite a crowd forming around the 'magazine car'.

Though the years have faded away much of the excitement, I am surprised at how many guys I run into who still know the car, and still remember that March issue. And now CA&E wanted to do another story, this time about Sniffer, my Honda Insight.

Photographer John Skalicky, whose images I've followed for many years, is probably my favorite car photographer. John had this idea, and when he arrived on Thursday morning, he had brought along some interesting props...a gas hose and fuel nozzle from a gas pump, and a Frankenstein-like old knife switch with a couple of fake fuses. His idea was that he wanted to expand on the original theme of my being this whacked out, electric car guy, experimenter type (wonder how close to the truth this is?) and with a cue to my past appearance in the magazine with those lightning bolts and all, this time I would be portrayed as having experimented a bit too far with mixing gas and electricity!

Before I get to the fun stuff, a bit about the interior shots this guy took...wow! As I did years ago with another photographer from CA&E, John and I used my backyard EV shop to do all the interior shots. They were all shot in total darkness, with him using all of his lights, flashes, and timed exposures to get that surreal look needed for the magazine. A particular trick that he used, was a way in which he would flash the scene, then as lights died out he'd speak out loud and count as he'd let the LED displays of the dash, head unit, and amps 'burn in'...cool, huh?

Later in the day, it was time for the big outside shots. To get the look he was after, John went to extremes that I hadn't planned on. He gave my daughter cash and sent her to the store to buy certain makeup pieces. While we waited for her return, using a butane torch, we burnt my jeans and T-shirt full of holes and singe marks...I took them off first, of course! We also took brand new safety glasses and melted and burnt them, too. I also attached a pair of dangling thick black wires to the knife switch, per John's instructions. Upon her return from the store, my daughter handed over the bag of makeup stuff, and after loading up his rental car, John and I took off to the 'location'.

I led in Sniffer as John followed me to Portland's Lloyd Center shopping mall. We went to one of the many parking structures and up to the rooftop level where the cityscape was in the background and we had a wide-open expanse to do our thing. As it was now in the early evening, we pretty much had this top level expanse all to ourselves, and after getting permission from the orbiting security patrol whom had their eye on us, we set up the site.

With Sniffer poised just so with a modern skyscraper in the background, and with the sun about to set for that 'perfect light' John was waiting for, and with the day's weather absolutely perfect at around 75 and with clear skies, the scene was almost set...just one more thing to do...time to prep Plasma Boy!

After I changed into the singed clothes, it was time to get that 'just blown up' look. I told John that all he had to do was visit me at a race track or my backyard EV shop on any given day to capture such a look, but anyway...John smeared me with makeup and charcoal, and had me place the glasses on crooked. He then used copious amounts of gel to spike my hair, and had me take off my shoes and socks...you know, like the explosion had blown my shoes off. He then posed me in what seemed like a hundred different ways, in front of Sniffer as I held the gas hose and nozzle in one hand, and the knife switch with dangling wires in the other, with my hand gripping the lever.

Occasionally, a stray shopper would meander across our area in their car, but one guy was classic, and when he came through, he evidently only saw me and not the nearby camera man with the tripod and all the photo gear...nope, he only saw this singed, badly burnt wild-eyed dude standing with a gas hose and electricity stuff:

Good citizen shopper dude...(screech of tires, window down, head out the window) "Hey, are you alright?"

Singed Plasma Boy...(looking awful to those around me, but having totally forgotten how I looked after hours of shooting) "Yeah, I'm fine."

Good citizen shopper dude..." You don't look too good, sure you're OK?... Looks like you've been in an accident of some kind."

Singed Plasma Boy...(coming to my senses now and realizing how I must look to him) "Oh, sorry...yeah I'm fine, we're doing a photo shoot...see? (now pointing away from me over to John and his tripod)

Good citizen shopper dude...." Oh...thank God...didn't see him. Hmmm, why you got all those wires and stuff?"

Singed Plasma Boy...The car's a gas/electric hybrid...we're kinda playing off the theme about mixing gas and 'lectricity. It's a joke, you know..."

With that, the guy moved on, but for a moment, I thought he was to jump in and perform CPR on me!

Right when the sun slipped behind the west hills, John really got into it, proclaiming the Insight as the most gorgeous car he'd ever shot, and going on and on about how the lines looked so cool through his camera's lens.

When we finished at near 10:00 pm, it was time for John's treat. As he explained, he always waits until after the shoot is done, to hear the system, and he was now anxious for a test listen. We had a great time in the car together, and with the doors swung open and about 600 watts RMS of concert level power, we attracted a small crowd of music fans to the scene...what fun!

Anyway folks, that's about it, another fun day with Sniffer, another magazine opportunity to spread the alternative transportation message. Sniffer will actually grace the cover of the October issue of CA&E and it will be on newsstands in September.

See Ya....John Wayland

THE POWER OF DC

By Wallace Rumbarger

June 23, 2001 did not start out as a day for the record books. It had been raining all night, and by dawn there were still intermittent showers. Not good weather for a 2 hour trip, and especially bad when you are planning to be in a Drag Race. This was the day that Greg Pokorny had been dreaming of for 3 years. He is the EVent Coordinator for "The POWER of DC", the first NEDRA Drag Race on the East Coast.

I arrived at the Mason-Dixon Dragway in Hagerstown, Maryland at 10AM; there were still intermittent showers and overcast. There were a dozen hard core EV enthusiasts already there wondering what would happen to "The POWER of DC." Would it actually happen, or would we be rained out?

The track schedule called for racing to begin at 11:00 with EV-only races on the half-hour till 5pm. At 11 the track officials began Tech Inspections of all race vehicles. This was a "Test and tune" day so ICErs were there as well.

At 11:30 the track officials finally announced that racing could begin. At 11:46 Bill Gingras from Annapolis, MD became the first East Coast NEDRA Racer down the track. His 36-volt home built "NO GAS" fired down the track at a blazing 48.35-mph (14.356 sec) for the 1/8 mile. Not bad for an EV built for low speed commuting in 1976. This may not have impressed the ICE observers, but it did set a NEDRA record. (First of four records, possibly five, set that day.)

Bill Gingras's home-built 36Ver

Battley's Sparrow races against Gribben's Escort

In all 13 EVs raced in "The POWER of DC." "Bad Amplitude" the 336-volt Electric Rail from NetGain Technologies came from Lockport, IL. Brian Methany came down from Bellinham, Massachusetts with his 192volt Toyota MR2. Darin Gilbert (Detroit, MI) ran his 48-volt motorcycle, and set a NEDRA record. The other racers were just slightly more local (MD, VA, PA, DC)

"Bad Amplitude" posted the fastest EV times of the day (DUH), but was only running at 40% power due to a blown controller.

Dave Mueller of E-Kart of Pennsylvania made a few runs with his Day-Glo Orange Electric Go-Kart and set a Nedra record.

The Central Shenandoah Valley Regional Governor's School showed up to show all the old fogies what a group of motivated High School Students can do to a 240-Z. Not only did they impress us, they also set a record.

Devin Battley, owner of Battley Cycles in Gaithersburg, MD, brought the EV that everyone (including the ICErs) thought was the "cutest thing". Devin has recently become a dealer for the Corbin Sparrow. Although he did not set any records, he did have the largest number of spectators hanging around his Sparrow (Lime Green with Mauve polka dots) in the pit area between races.

Central Shenandoah's Z-240 burns down the raceway

Chip Gribben (Laurel, MD) raced his blue 144-volt Ford Escort against the Corbin Sparrow and came in second. There were no losers at "The POWER of DC." Chip recently received an award from Montgomery County Maryland for "Environmental Commuting." He drives his EV to work every day.

There was even a featured "Battle of the Brands" between 2 factory-stock EVs: Charlie Garlow and his Chevy S-10 vs. Brian Murtha and his Ford Ranger. (The Chevy won). Charlie also had the most num-

Darin Gilbert's motorcycle really shows the speed.

ber of people drive (6) his S-10 down the track.

By 5 o'clock, all of the attendees had had a great time; everyone had raced at least twice and some as many as 9 times. We even had a few ICErs as potential EV converts. It was time for the awards, a group photo, and then back home till next year. The Electric Vehicle Association of Greater Washington, D.C. (www.evadc.org) sponsored this EVent.

<u>97 Volts and Up Division</u>

1st Net Gain Technologies - "Bad Amplitude" Dragster 12.046 sec.

2nd Brian Matheny - 192v Toyota MR2 18.177 sec.

3rd Bob Salem - VW pickup 18.832 sec.

4th Charlie Garlow - Factory Chevy S-10 EV 20.402 sec.

5th Chip Gribben - 144v Escort 20.737 sec.

6th Wallace Rumbarger EEI RAV-4 20.973 sec.

7th Bryan Murtha Factory Ford Ranger EV 21.016 sec.

8th Devin Battley - Corbin Sparrow 21.594 sec.

<u>96v and Below (1/8th mile) Division</u>

1st Dave Mueller - electric go cart 10.107 sec.

2nd Darin Gilbert - 48v motorcycle 12.086 sec.

3rd Tracey Miller - Jr. Dragster 13.33 sec.

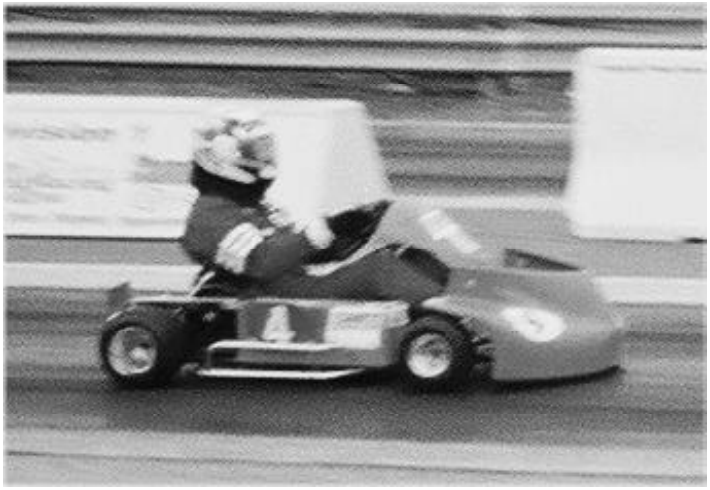
4th Central Shenandoah Valley Regional Governors School - 240-Z 13.78 sec.

5th Bill Gingras - 36v home built EV 14.356 sec.

NEDRA records
Dave Mueller GE/I
Darin Gilbert MT/I
MT/I Bill Gingras CV/I
Central Shenandoah Valley Regional Governors School HM/G

NEDRA Race Classes
SP - Street Production
MP - Modified Production
SC - Street Conversion
MC - Modified Conversion
MT - Motorcycle-Trike
DR - Dragster
GE - Go Cart
HS - High School Street
HM - High School Modified
SF - Class 64
CV - Concept Vehicle

Voltage Divisions
A - 241 V and above
B - 193V - 240V
C - 169V - 192V
D - 145V - 168V
E - 121V - 144V
F - 97V - 120V
G - 73V - 96V
H - 49V - 72V
I - 25V - 48V
J - 24V and below



Even EV go-carts catch the thrill at the raceway

Not all EVs fit the mold...

A VISIT TO THE GISMO FACTORY

by Michael Everett

The Neighborhood Electric Vehicle Company was formed in 1995 to develop and produce an electric vehicle that would be environmentally friendly, fun to drive, efficient, and affordable. For NEVCO, making a difference in personal transportation involves creating an entirely new type of vehicle, a Neighborhood Electric vehicle, the Gizmo, a revolutionary concept in personal transportation. The Gizmo is a three-wheeled single-person vehicle that is designed for commuters traveling under 45 miles per trip, or 75% of all drive time.

On August 14, while in Eugene OR, I had a chance to see the Neighborhood Electric Vehicle Co. factory and offices, and meet Carl Watkins, owner/manager. He was kind enough to give my family and me a tour of the manufacturing area and let me test drive one of their production vehicles. Impressions follow:

Even a 'simple' car is pretty complicated; there were jigs and paint booths and jigs and wiring layout boards and jigs everywhere, and of course lots of car parts. Looked like a pretty 'together' setup, but with some room to grow as production volumes increase. He said they're doing several a month now.

There are a whole bunch of neat design details in the vehicle. It appears well thought out. The little rubber 'floor mat' that retracts so you can stand up when opening the front was just one of many examples.

It's easy to open and get into, and comfortable to sit in. Everything falls readily to hand. The controls take a moment to get used to but I was confident enough to venture out onto the street after 90 sec or so. The battery pack was mostly depleted (in the yellow zone on the gauge) but even so acceleration was more than adequate and it was up through 35 and heading for 40 before I was quite ready. Handling seemed remarkably steady even near top speed, though I didn't have much chance to try higher speed cornering.

Side of Gismo ☟ ☝ Top of Gismo

Visibility is very good and the chain noise is barely noticeable and completely masked by regular road/tire noise above 25 mph. The only thing I'd add is that I wish it had a bit faster top speed.

We quite enjoyed our time there. Thanks Carl!

To learn more about the Gizmo, visit their website at http://www.nevco.com.

Rear view of Gismo

SPECS

Vehicle Weight: 340 lb.
Battery Weight: 320 - 520 lbs.
Payload: 250 - 500 lbs.
Storage Capacity: 10 cubic feet
Dimensions: 4' W x 4.5' H x 8' L
Motor: 12 HP series DC
Batteries: Deepcycle Lead Acid, 48V

Chassis:	steel tube truss
Body:	fiberglass
Transmission:	chain drive, single speed
Brakes:	hydraulic disc, hand act
Speed:	up to 40 mph
Range:	45 miles std per charge
Range w/ rechg:	up to 90 miles in 8 hours with recharging
Full Recharge:	8 hours
Life of Batteries:	3 to 5 years
Recharge Power:	std 110V AC outlet
Price:	**$8650** plus shipping Base configuration with 45 mile battery pack

EVAA Urges Committee to Support EV Efforts

Electric Vehicle Association of America (EVAA) co-chairman Eugene Zeltmann testified before the U.S. Senate Energy and Natural Resource Committee on ways to reduce petroleum use in the transportation sector. Zeltmann suggested that the government adopt comprehensive alternative fuel vehicle (AFV) tax incentive legislation that supports the purchase and use of electric, hybrid electric and fuel cell-powered cars, trucks, and buses, as well as electric vehicle (EV) charging infrastructure.

Honda HEVs to Be Used in ICVS Program

Honda Motor Company recently announced it will introduce a new commercial car-sharing scheme next year that will feature the automaker's Civic hybrid electric vehicle (HEV). The company said the scheme, known as the "Intelligent Community Vehicle System," will be launched in Singapore next February on a three-month trial basis, after which the scheme will be launched on a commercial basis.

The company said that Singapore is an ideal location for the program because the government there has implemented a policy that discourages residents from owning a car. The scheme has already been tested in Japan and the U.S.

World's Longest Solar Car Race Underway

The American Solar Challenge, the longest solar car race in the world, is underway on historic U.S. Route 66, with 28 solar-powered cars plodding (sic) along to see who can be the first to Los Angeles, CA. The race, which began July 15 at Chicago's Museum of Science and Industry, will take racers 2,300 miles through plains, mountains, and desert before reaching the finish line in Claremont, CA, on or about July 25th. The team with the lowest cumulative time for the race will win.

Honda HEV is Prize in Sweepstakes

Working Assets, a telecommunications company promoting activism for progressive causes, recently launched the first-ever "Global Warming Sweepstakes" in an effort to protest the Bush administration's policies on energy and the environment. The company said visitors to its website will become eligible to win one of more than 500 prizes by e-mailing the Bush administration, corporations and the U.S. Senate in order to demand "that decision-makers take steps to preserve the environment." "The Bush administration's current energy plan will accelerate global warming and damage the environment," said Working Assets president Michael Kieschnick. "We also need to take individual responsibility, by using energy-efficient cars and light bulbs as well as riding bikes or taking public transportation. The prizes of this sweepstakes fit right into that plan."

TransTeq HEV Bus Featured at NREL Forum

The Department of Energy's National Renewable Energy Laboratory (NREL) recently hosted a one-day forum for transportation officials to discuss how emerging technologies, market drivers and barriers, and public policy affect advanced vehicle technologies. The forum included two panel discussions intended to explore potential areas of collaboration. Denver, CO-based TransTeq president Dale Hill was a featured speaker on one of the panels. In addition, TransTeq's EcoMark hybrid electric bus was displayed at NREL's Visitors Center. The company said the bus is the backbone of the Denver Regional Transportation District's service and connects major light rail lines and bus terminals in downtown Denver.

Enova, Hyundai Deliver Electric SUVs to Hawaii

Torrance, CA-based Enova Systems recently announced that it has joined with Hyundai Motor Company to deliver 15 electric vehicles (EVs) to the state of Hawaii. The EVs provided to the state are Hyundai's electric-powered Santa Fe sport-utility vehicles (SUVs). The cars were commissioned by Hawaii as part of a joint federal, state and industry project called "EV-Ready," which seeks to build EV infrastructure and provide EV vehicles for states. Enova said Hyundai used the project to roll out its Santa Fe electric SUV.

EFC Completes Electric Bus Tests

Electric Fuel Corporation recently announced that it has achieved a milestone in the second phase of its zinc-air all-electric transit bus program with the Federal Transit Administration. In a recently completed test drive, the bus traveled 97 miles on a single charge under typical city bus driving conditions, including stop and go, acceleration and constant speed. The company said it believes this distance to be a world record.

As a measure of comparison, the average normal full day cycle for New York City buses is less than 90 miles. EFC said it believes that these test results indicate that all-electric buses utilizing EFC's zinc-air technology have sufficient range to offer a practical solution for helping to eliminate bus pollution in central cities.

CARB Amends ZEV Rule

The California Air Resources Board (CARB) recently amended its zero emission vehicle (ZEV) rule to standardize conductive charging equipment for electric vehicles (EV).

CARB adopted the conductive charging system, already in use by vehicles from Ford, Honda and others, because it is less expensive and more reliable than inductive

charging technology. Existing conductive charging systems, used for vehicles from General Motors, Toyota and Nissan, will remain in service but will not be expanded as part of the state's EV charging infrastructure.

In addition, the formula used to calculate the number of pure ZEVs each manufacturer is required to make available in 2010 was refined. The formula will now include percentages for smaller companies owned by larger vehicle manufacturers.

Professor Introduces Kaz Vehicle

Keio University professor Hiroshi Shimizu is heading a research team that is developing a fully electric Kaz passenger vehicle, which is able to reach maximum speeds of 186 miles an hour and is able to travel that same distance on a single charge.

Shimizu said that electric cars will be consumers' choice in the future. His creation, the Kaz passenger vehicle, is a 590 horsepower, eight wheel vehicle that looks like "a cross between a ballistic missile and a stretch limousine."

Shimizu said that the eight wheels give the vehicle added stability and improves handling around curves. The car seats eight and is powered by rows of 3.75-volt lithium ion batteries stored along its underside.

Isuzu to Launch Small Hybrid Truck

Isuzu Motors, Ltd. recently announced plans to launch a small hybrid electric truck powered by an electric motor and a diesel engine as early as next year. The company said it has plans to offer the hybrid technology to General Motors Corporation (GM) by 2004.

Car manufacturers are looking more and more towards hybrid technology, which combines two or more sources of power, such as a gasoline engine and an electric motor or a fuel cell. The goal is to reduce emissions of toxic gases and achieve better fuel efficiency.

Isuzu said the new hybrid electric truck is based on its Elf trucks with loading capacity of about two metric tons each. In addition, the company said the vehicle will emit 20 percent less carbon dioxide than a regular truck.

DaimlerChrysler NEV Featured in CA Fair

DaimlerChrysler recently announced that a neighborhood electric vehicle (NEV) produced by its subsidiary Global Electric Motorcars (GEM), was featured at the Hearst Castle Alternative Energy Fair in San Simeon, CA, earlier this month. The company said the NEVs are specially designed for low-speed driving in and around city centers, planned communities, resorts and large industrial campuses.

GEM said the vehicles, which start at about $7,000, are constructed of a light-weight aluminum frame, and feature a plastic body. The vehicles are available in two- and four-seat models, as well as in long- or short-box utility vehicles.

The company said that its NEVs feature a front-wheel drive system, rack and pinion steering, independent suspension and a regenerative braking system. Additionally, the vehicles feature safety equipment, including safety glass windshield and wipers, high-mounted brakelights, rearview mirrors, hydraulic brakes and safety belts.

GEM said that the vehicles can achieve a top speed of 25 miles per hour and a single-charge range of about 30 to 35 miles. The vehicles also feature standard automotive-type batteries which can be charged from a standard household outlet without special adapters.

Texaco, ECD Join to Develop EV, HEV Batteries

Texaco announced this week it is stepping up its commitment to commercializing nickel metal hydride (NiMH) batteries for electric vehicles in a new partnership with Energy Conversion Devices Inc. The alliance — a 50-50 joint venture between Texaco's Texaco Energy Systems, Inc. (TESI) and ECD's Ovonic Battery Company, Inc. — will create a new company called Texaco Ovonic Battery Systems.

Texaco officials said the company has committed to spending more than $150 million over the next few years to increase its presence in the NiMH battery market, including expanding development and manufacturing facilities in Kettering, OH, and Troy, MI. Texaco and ECD said the new company will undertake a multi-million dollar effort to produce a prototype of the new Ovonic NiMH monoblock battery, a compact unit designed to run the electrical systems of gasoline-powered cars.

Prius Nearing Cult Status After First Year

A recent article in the Washington Times compared the popularity of Toyota's Prius hybrid electric vehicle (HEV) to the to "cult status" of Volkswagen's (VW) Beetle and microbus. After its first full-year as part of Toyota's vehicle lineup, Prius customers are "lining up" to purchase the vehicles, with some waiting up to six months for delivery.

Although the Prius is not as affordable as VW's old Beetle, it does offer high fuel economy and low pollution. The base price for the Prius is $20,450, which is "fairly stiff" for a compact economy car. The Prius features a 44-horsepower electric motor paired with a 1.5-liter, four-cylinder engine that provides another 70 horsepower.

The article noted that the Prius' continuously variable transmission (CVT) is "smoother and quieter than some luxury cars."

SKI Delivers Electric Trolley to FL Customer

SK International (SKI) recently announced it has delivered a 27-foot, hybrid electric trolley to a customer in Florida. The company said the trolley is powered by an "industrial, off-the-shelf [alternating current] (A/C) induction motor" paired with a 1.9-liter Volkswagen aspirated diesel engine. In addition, the trolley features absorbed electrolyte, valve-regulated lead acid batteries used in conjunction with SKI's patented high-current, module-level charge balancers.

The vehicle's energy management system coordinates energy flow among batteries, charge balancers, traction drive and the diesel engine. SKI noted that the trolley can operate in zero-emission, low-emission or

full hybrid mode. The company said the vehicle can be recharged overnight using a 115 volt, 20 ampere wall outlet. The trolley does not require the use of an external charger.

Big Three Think Small to Meet CA ZEV Rule

As California prepares to implement its zero emission vehicle (ZEV) rule in 2003, the prospect of losing sales in the Golden State is causing the Big Three to think small.

Ford Motor Company, DaimlerChrysler and General Motors Corporation (GM) are moving forward with plans to market "neighborhood electric vehicles" (NEV) in California and elsewhere. These cars, basically souped-up golf carts, are battery powered, can travel up to 25 miles per hour and cover roughly a 30-mile range.

"Our vehicle is the one you can use to go to Blockbuster or 7-Eleven or Home Depot," said Tom Zabriskie, a car dealer who markets DaimlerChrysler's GEM NEV. "You don't need to start up your big Suburban to do that."

Ford plans to roll out its TH!NK Neighbor NEV over the next several months, and in addition to California, hopes to market the vehicle in New York, Massachusetts and Vermont, all of which are planning similar zero-emission vehicle laws.

THE MAN WHO NEVER RECHARGED

By Victor Wouk

I got QUITE a charge out of Lee Hart's EXCELLENT adaptation (I would not call it a "parody") of the song THE MAN WHO NEVER RETURNED.

No apologies are needed to the Kingston Trio. Here's the scoop about the genesis of the song: IT WAS AN ELECTION CAMPAIGN SONG!The Kingston Trio did NOT originate it. They adapted the song, and gave it the wonderful delivery that we now are so familiar with.

The MTA (Metropolitan Transit Authority) of Boston was planning to raise the fare 5c from 10c, I believe. There was a complication involved difficult to explain that would require some riders to pay the 5c AFTER they got off the train. Hence, poor Charlie, who did not have the 5c with him, would never be able to get off the train, and return home.

A candidate for some Boston elected office was AGAINST the fare increase, and commissioned this song as a radio commercial. I am having a Senior Moment, and do not remember specific dates, which won the election, etc.

To establish my bone fides as a Senior Momenter:

- The subway fare was 5c in NYC when I became sentient.
- The fare was raised to 10c around 1949.
- I remember the campaign, in 1928-9, of the NYC IRT (Interboro Rapid Transit) Company, a PRIVATELY HELD, for-profit company, that wanted to raise the fare from 5c to 7c. The Board was so sure that they would receive permission, that they minted millions of 7c tokens. Pictures of the token, and the campaign against the 7c fare, were front-page items in the NYC papers.

About 8 EVs showed up to display to the public.

Lots of interest, from mini-bikes to Sparrows to VW conversions.

Excellent layout of engine (below), controller (left), batteries and more. VW's provide great fit for all the componients.

Proud to drive an EV - every owner had a story to tell.

Clean front layout, with plastic display covers over batteries.

Even on-board chargers need a well-ventilated space.

By Peter VanDerWal

Some who are new to EV's wonder if you construct a fan (moved by the air while the vehicle is moving) or a low amperage electric motor to turn one or more high amp. Alternators they should charge the batteries, the speed of rotation can be adjusted by different pulley ratios. On a Fiero, for instance, there is plenty of room in the front (under the hood) to do this, but shouldn't something like this work?

Ignoring matter-to-energy conversion, it takes energy to convert energy. If you are going to spin an alternator it needs mechanical energy. Part of the mechanical energy is lost in the conversion to electricity due to friction, electrical losses, etc. So to get 1 hp of electricity (746 watts) you have to put in typically 1.3 hp of mechanical energy. Now if you are going to use a motor to drive the alternator, it also has losses (just like the alternator). So in order to get 1.3 hp of mechanical energy out of the motor you have to put in something like 1.7 hp (1670 watts) of electricity into the motor.

Net result is a loss of around 1,000 watts. This idea sucks power from your batteries and gives you nothing (but a bit of extra heat) in return. And of course that doesn't take into account the losses in the belt drive system.

You don't get anything for free in this universe. In fact that's (more or less) the first law of thermodynamics. The second law of thermodynamics says you can't even break even (as shown above).

As for using the fan, it works by slowing down the air (creates drag). Your EV's main motor has to work harder to make up for the extra drag. The net result is even higher losses than above because you have more mechanical stuff (transmission, wheels, air, etc.) in-between the drive motor and the generator.

So, NO, it doesn't work. Don't feel bad, people who don't understand basic physics (and even some people who do) ask this question all the time. In fact, if you drive an EV, sooner or later someone will ask you this or a similar question.

The best you can do is to convert excess mechanical energy into electricity. Like when you need to slow down or are going down hill. Normally you would use your brakes and convert the mechanical energy into heat. Instead you can use something called regenerative, or "regen", braking; this uses your drive motor as a generator and converts some of the mechanical energy back into electricity (and slows you down).

The problem is that if you are using series wound DC motors (like most conversions do) regen is complicated and expensive, and you gain very little benefit from it except saving your brake shoes.

Plug-in HEV Notes continued from page 7

8. Sequoia's average emissions are approximately 50% less than the SULEV standard, assuming nightly charging and combined driving based on NPTS statistics.

9. The Greenhouse Gas Impact (GHGI) represents the CO2 equivalent of tailpipe and upstream CO2, CH4 and N2O emissions.

10. The FutureTruck method assumes that all trips are 250 miles in length. For Sequoia, such a trip construction assumes that approximately 25% of all driving miles utilize EV mode while 75% of miles are driven in HEV mode. This calculation does not correlate with NPTS statistics.

11. Adjusted for Sequoia's correct battery efficiency.

12. Assumes trip length statistics from the National Personal Transportation Study and nightly charging. Uses greenhouse gas emissions of national-average electricity generation in 2010, assuming incremental use of power plants during off-peak hours (source: "Comparing the Benefits and Impacts of Hybrid Electric Vehicle Options," Electric Power Research Institute). The greenhouse gas emissions of current California average electricity generation are slightly less than this forecast of 2010 national-average emissions.

13. Uses greenhouse gas emissions based on a Department of Energy/Energy Information Administration 2015 forecast of the average electricity generation mix in California.

14. Sequoia's electric drive system was not fully functional during this test. The ¼-mile time will be faster with full system operation.

HEV Update

P.S. For those of you who don't follow plug-in HEVs, there has been a recent ground swell of interest.

In North America, the HEV Working Group is releasing their Phase 1 comparison of mid-size HEVs (with and without a plug) in early August. This two-year, $2 million effort led by EPRI involved automakers, utilities, research institutions, and federal/state/local government and looked at performance, energy use, environmental benefits, technological issues, costs, existing incentives, and consumer interest. The results are exciting and will soon be posted at www.epri.com.

In addition, there are over 20 plug-in HEV buses in Italy (by Autodromo) and Toyota's subsidiary Hino has a shuttle, a full-size transit bus, a full-size touring bus, and a delivery van. Additional HEVs around the world are the commercial plug-in HEV forklifts in Europe (by Linde and others) and plug-in HEVs in Japan by Toyota. And Renault is releasing the world's first commercial light duty plug-in HEV — a "microvan" called the Kangoo in four European countries in early 2002.

Finally, EVAA is working on a plug-in HEV amendment to the tax credit provisions of the CLEAR ACT (by Senators Hatch, Rockefeller, Jeffords) so that the larger environmental benefits of plug-in HEVs (compared to no-plug HEVs) will be rewarded with a larger tax credit.

(For more information on the tax credit amendment, go to "www.evaa.org" then go to government activities and then to legislative action center and enter your ZIP code.)

by Will Beckett, EAA Bylaws Chairman

The bylaws for the Electric Auto Association were recently included in a copy of the Current Events (Issue 33, Vol. 3-4, March/ April 2001). These bylaws had some minor changes, which reflected modifications in the California Non-Profit Corporation Law (effective 2/2001), which allowed for new technology notifications for special Board meetings.

We indicated there would be a committee formed to review the bylaws for possible changes to the Purpose of the organization. Changes have now been made which were just reviewed and approved by the board for inclusion in this Current Event for membership approval. These changes have been made to more clearly define the focus of the organization in a generic way so that future changes in electric vehicle technology will not necessitate another change in the bylaws. Also, a new provision in California Non-Profit Corporation Law was added which defines board member meeting attendance through telecommunications. By California law, this section is included by default until January 1, 2003, then it would need to be included in the bylaws in a way that would be determined by the organization. We decided to include this section now.

Legal sections are numbered and not subject to the discretion of the membership. However, we have also included the new text defining the organization purpose and ask that the membership review the section labeled Corporation Purpose.

If there are any concerns for suggestions for improvement, we ask that you notify us, in writing, of your specific concerns and/or changes by October 15, 2001. At this time the board will review this information, make modifications as determined by the board and then formally vote on the new bylaws. Send your comments and/or concerns to our membership address, either eaamembership@email.com or 4189 Baker Ave., Palo Alto, CA 94306-3908.

Revised Bylaws (7/21~~5~~/2001)~~(10/8/2000)~~
Draft
Electric Auto Association
(A California Nonprofit Public Benefit Corporation With Members)

I - CORPORATION PURPOSES:

A. To act as a source of information for the membership, other organizations and the public, on developments in the current state of electric vehicle automobile technology worldwide.

B. To encourage experimentation in the building of electric vehicles, particularly in the area of reducing weight by the use of lightweight body construction with quality and saftety in mind. to improve energy and resource efficiency of the use of energy, reduce emissions and improve vehicle safety.

C. To promote and organize public exhibits of electric automobiles vehicles built by members and others for the purpose of informing the public on the progress of electric automobile vehicle technology and conducting public opinion polls.

D. To use all media, such as to publish newsletters, build web sites, information packages, and other paper and electronic media materials designed to inform the public and, there by, promote the cause of electric vehicles.

II - OFFICES:

A. The principal office and any other office(s) shall be located at such place(s) as the Board of Directors shall authorize. [5160]*

III - MEETINGS AND VOTING RIGHTS:

A. **REGULAR MEETINGS:** The annual meeting of the members of the corporation shall be held each year at a place, date and time arranged by the Board of Directors. Notice of the meeting shall be sent to each member of record, as of the date of notice, by mail not less than 20, nor more than 90 days prior to the meeting date. At each annual meeting directors shall be elected and any other business may be transacted which may properly come before the meeting. [5510 (a), (c)]

B. **CHAPTER MEETINGS:** For the convenience of participation, groups of members may form EM (?) chapters in geographic regions. Meetings of EM chapters shall be held at times and places determined by the chapter officers and its members. [5510(a)].

C. **SPECIAL PURPOSE MEETINGS** of members may be called by the Board of Directors, the Chairman, the President or by 5% or more of the members. Special purpose meetings shall be held not less than 35 nor more than 90 days after receipt of a valid request. [5510(e), 5512]

D. **NOTICE OF SPECIAL PURPOSE MEETINGS** of members shall be sent by EAA to all members of record, by mail, not less than 20, nor more than 90 days prior to the meeting date. Meeting notices shall state the business to be transacted and nominees for positions, if an election is to be held, as well as the time and place of the meeting and date by which proxies must be received. Business at special purpose meetings shall be limited to that stated in the meeting notice. A proxy form shall be furnished to each member with the meeting notice with which the member may vote absentia on the business or the candidate. [5511]

E. **QUORUM FOR THE TRANSACTION OF BUSINESS:** At any meeting of the members those present plus those represented by proxy shall constitute a quorum, if 5% or more of the members are represented. The affirmative vote of a majority of those voting in person and by proxy shall be the act of the members. [5510(d), 5512]

F. **ACTION BY WRITTEN BALLOT WITHOUT A MEETING:** Any action, including election of directors, which may be taken at a meeting of members maybe taken without a meeting by mailing to each member of record a ballot describing the proposed action with an opportunity for the member to specify approval or disapproval of the proposal(s). A reasonable time limit for the return of the ballots shall be stated. Approval on a majority of the ballots received by the stated time shall be the act of the members if 5% or more of the members

voted. If directors are to be elected by mailed ballot, without a meeting, the number to be elected shall be stated and that number of candidates receiving the highest numbers of votes on ballots received by the stated time shall be considered elected. Written ballots are irrevocable. [5513(d)]

G. **VOTING:** Each member shall be entitled to one vote on proposals and for candidates at general meetings of members in person or by proxy or by mailed ballot if a meeting is not held.. [5610]

H. **PROXIES:** Each member entitled to vote, may do so by sen ding a proxy to the Secretary of the corporation, which must be received by the date set in the meeting notice. A proxy shall be valid only for the specific meeting and proposal(s) stated in the meeting notice. Proxies must be delivered in a sealed envelope and are to be opened only by a teller committee appointed by the Board of Directors.[5613]

IV - BOARD OF DIRECTORS:

A. **POWERS OF THE BOARD:** The activities and affairs of the corporation shall be conducted by or under the direction of the Board of Directors subject to any limitations in the Articles of incorporation or these bylaws. [5210, 5150 (a)]

B. **NUMBER OF DIRECTORS:** The authorized number of directors of the corporation shall be an odd number not less than three(s) nor more than eleven (11). The exact number of directors shall be set within these limits from time to time by affirmative vote of a majority of the directors or by affirmative vote of a majority of members voting at a duty held meeting and by proxy or by mail received by the time limit stated in the notice. The maximum an/or minimum number of directors may be only changed by approval of the members. [5151]

C. **DIRECTORS NOMINATION, ELECTION AND TERM:** Nominations of candidates for director may be made to the Board of Directors by any member at any time to fill vacancies or to replace members whose term has expired. Nominations shall close 60 days prior to the date of the meeting at which the election is to occur or the date by which written ballots must be received. The Board shall provide nominee a reasonable opportunity to accept or reject nomination, communicate to members their qualifications and reasons for candidacy and to solicit votes. Directors shall be elected at each annual meeting of members and shall hold office until the expiration of the term for which elected and until their respective successors are elected and qualified or until death, resignation, or removal. Directors shall be elected for terms not exceeding three (3) years. Terms shall be arranged so that no more than one half will expire in a single year any bylaw amendment increasing the terms of directors or extending any director's term, must be approved by the members. [5220]

D. **RESIGNATIONS:** Any director may resign effective upon giving written notice to the Chairman of the Board or to the Secretary of the Board. However, no director may resign if such resignation would leave the corporation without a duly elected director in charge of its affairs. [5224, 5226]

E. **REMOVAL:** The Board of Directors may declare vacant the office of a director, elected subsequent to the adoption of this bylaw, who fails to attend or otherwise actively participate in three consecutive board meetings. If not in attendance, active participation may be by written input to the upcoming meeting. The entire Board of Directors, or any individual member of the board, may be removed from office by affirmative vote of the majority of members voting by written ballot or in person and by proxy at a duly held meeting for which such removal was stated in the meeting notice as a proposal to be decided at the meeting. If the members act to remove the entire board they must immediately elect a replacement board. [5221, 5222]

F. **VACANCIES:** A vacancy(s) on the Board of Directors shall be deemed to exist whenever there are fewer directors than the authorized number Such vacancies may be filled by a majority of the remaining directors or by a sole remaining director. The members may elect a director at any time to fill any vacancy not filled by the Board of Directors. [5075, 5224(b)]

G. **REGULAR MEETINGS:** The board shall meet at least quarterly. One board meeting shall be held immediately after each regular meeting of members for the purpose of organization, appointment of officers and transaction of other business. [5211]

H. **SPECIAL MEETINGS OF THE BOARD OF DIRECTORS** may be called by the Chairman or the President or any Vice President or the Secretary of the corporation or by any two (2) directors or by five (5) percent or more of the members. [5211(a)(1)]

I. **NOTICE OF MEETINGS:** Notice of the time, date and place of all meetings of the Board of Directors shall be delivered to the directors at least one week in advance by first class mail or 48 hours notice, before a special urgent meeting, by personal delivery or telephone, including a voice messaging system or other system or technology designed to record and communicate messages, telegraph, facsimile, electronic mail, or other electronic means. [5211(a)(2)]

J. **ACTION WITHOUT A MEETING:** Any action which may be taken by the Board of Directors, may be taken without a meeting if all directors consent in writing to such action. Such consent shall be filed with the minutes of proceedings of the Board of Directors. [5211(b)]

~~K.~~A. **QUORUM AND TRANSACTION OF BUSINESS:** A majority of the authorized number of directors present in person or participating by phone shall constitute a quorum for the transaction of business. Every act done or decision made by a majority of Directors present at a meeting duly held at which a quorum is present shall be the act of the Board of Directors. [5211 (7),(8)]

K. **QUORUM AND TRANSACTION OF BUSINESS:** A majority of the authorized number of directors present in person or participating by phone shall constitute a quorum for the transaction of business. Every act done or decision made by a majority of Directors present at a meeting duly held at which a quorum is present shall be the act of the Board of Directors. Any board meeting may be held by conference telephone, video screen communication, or other communications equipment.Participation in a

meeting under this Section shall constitute presence in person at the meeting if all of the following apply:

1. Each member participating in the meeting can communicate concurrently with all other members.

2. Each member is provided the means of participating in all matters before the board, including the capacity to propose, or to interpose an objection to, a specific action to be taken by the corporation.

3. The board has adopted and implemented a means of verifying both of the following:

a) A person participating in the meeting is a director of other person entitled to participate in the board meeting.

b) All actions of or votes by the board are taken or cast only by the directors and not by persons who are not directors. [] . [5211(a)(6)(7),(8)]

L. **MEETINGS:** The Chairman of the Board shall preside at every meeting of the board, if present. If no chairman is present a chairman chosen by a majority of directors present shall act as chairman. The Secretary of the corporation or in the absence of the Secretary, any person appointed by the Chairman shall act as secretary of the meeting.

M. **COMPENSATION:** Directors and members of any committees shall serve without compensation except for reimbursement of expense incurred on behalf of the corporation and subject to prior approval by the Board of Directors. [5235]

N. **COMMITTEES:** The Board of Directors may create one or more committees each consisting of two or more directors and may include other members of the association. The board shall define the responsibilities and authority of each committee. [5212]

V - ORGANIZATION

A. **OFFICERS:** The corporation, shall have a Chairman of the Board, or a President or both, a Secretary, a Treasurer and such other officers with such titles and duties as the Board of Directors shall determine. All officers shall be chosen and appointed by the Board of Directors and serve at the pleasure of the Board. [5212, 5213]

B. **THE CHAIRMAN OF THE BOARD** shall exercise such powers and perform such duties as may be assigned by the Board of Directors. The Chairman may sign and execute, in the name of the corporation, any instrument authorized by the Board of Directors. The Chairman shall have all the general powers and duties of management usually vested in the President or Chief executive Officer of a corporation.

C. **THE SECRETARY** shall keep, or cause to be kept, in a place and form readily available to any director:

1.Minutes of all meetings of the corporation members, Board of Directors and committees of the Board of Directors.

2.Names and addresses of all members.

3.The original or copy of the Articles of Incorporation.

4.*These bylaws including any revisions.*

D. **THE TREASURER** shall be responsible for maintaining accurate and correct books and records of moneys of the corporation received and disbursed and for depositing same in the name to the credit of the corporation and shall provide a statement of financial condition of the corporation to the Board of Directors when called upon to do so.

E. **CHAPTERS:** Members may form Chapters. Each Chapter has its own meetings, procedures and activities, Chapters must establish and maintain a relationship as affiliates of the EAA and agree to abide by the bylaws and Code of Ethics of the Electric Auto Association.

VI - CONTRACTS AND LOANS:

A. **CONTRACTS:** The Board of Directors may authorize any director, committee of directors or officer of the corporation to enter into any contract or execute and deliver any instrument in the name of and on behalf of the corporation. Without such expressed and recorded authorization no director, committee, officer or other person shall have the power or authority to bind the corporation or to render it liable for any purpose or in any amount. [5141,5210]

B. **LOANS:** No loans shall be contracted on behalf of the corporation unless authorized by the Board of Directors.

VII. MEMBERSHIPS:

A. **ADMISSION OF MEMBERS:** The corporation, shall admit as a member anyone who pays the annual membership fee and shall consider each such person a member for one year following receipt by the corporation of each membership fee. Certain institutions, organizations and individuals may be granted complimentary memberships at the discretion of the Board of Directors. Any member may resign at any time by written notice to the Board of Directors. [5310]

B. **CLASS OF MEMBERS:** The corporation, shall have one class of members and each member shall have one vote on matters to be voted on by the members. [5330]

C. **DUES:** The Board of Directors may levy upon members such dues, assessments and fees as it may deem appropriate. [5351]

VIII - INSPECTION OF CORPORATE RECORDS:

A. Every director shall have the right to inspect and copy all books, records and documents of the corporation and to inspect the physical properties of the corporation at any reasonable time. Each member shall have the same right of inspection for purposes reasonably related to the business of the association and in the interests of the membership, upon written request stating the purpose, to the Board of Directors. No director or member shall use any record, such as members' names and addresses, for any purpose not in the best interests of the corporation or any member.

IX - MISCELLANEOUS:

A. **FISCAL YEAR:** The fiscal year of the corporation shall end on the last day of December of each calendar year.

B. **ANNUAL REPORT:** The Board of Directors shall cause an annual report to be prepared and sent to members, within 120 days after the close of each fiscal year. The report shall include, in appropriate detail: summaries of the corporation, chapter and member activities and corporation income and expenses.

C. **BYLAWS:** It is the intent of these bylaws to comply with mandatory requirements of the California Nonprofit Corporation Law. The Board of Directors will correct any noncompliance brought to its attention. These bylaws may be adopted, amended, revised or repealed by the Board of Directors or by the members unless the action would materially and adversely affect the rights of the members. [5150]

D. **CODE OF ETHICS:** The Association will adopt and abide by a Code of Ethics published to the membership as a separate document.

E. **AWARDS:** The association may grant awards for meritorious service, technical achievement, or other purposes as determined by the Board of Directors.

* Numbers in brackets refer to California Nonprofit Corporation Law. If this law should change, the intent of these sections in this document is to follow the law as modified.

Appointment of Jerry Asher

The EAA Board of Directors is pleased to announce the appointment of Jerry Asher, to fill the seat vacated by Edward Holsinger. Jerry's energy and enthusiasm is greatly appreciated as we strive to upgrade the organization and encourage involvement across the Chapters.

At the July Board Meeting, Jerry presented his focus/mission, which we've reprinted here.

Aside from immersion into the EAA Culture awareness of the West Coast, I have a tri-theme in mind in taking on being an EAA Board member — Recruitment, Training, and Recognition (RTR).

In Recruitment, I mean building membership within EAA, taking the 1,000 members now and seeing the number becoming 10,000 and more. I also mean increasing Chapters by incorporating an independent club like the Pennsylvania-New Jersey-based Eastern Electric Auto Club (EEVC) into the EAA fold. I include as well establishing new Chapters, such as the Central Shenandoah Valley Regional Governor School in Virginia. Recruitment also includes getting EAA to the point where it has a paid Executive Coordinator and staff to administer the affairs of EAA. Then those members who presently do volunteer work as Board of Directors can focus on the matters of policymaking for the organization, not its every day survival.

In terms of Training, what it entails encompasses high school EVents on the proactive side for EAA. It also means possibly delving into "e-learning" about EVs and retrofitting via the Multimedia of today with the Internet, the computer, TV, the CD and more. Who knows, we could possibly have EAA's own Virtual University doing e-training with synchronous EV technical sessions right at the community colleges on a national level ... in their automotive shops.

For Recognition, it's establishing standards so that one day, an EVent may be called "EAA Sanctioned." It means organizations such as the Electric Vehicle Association of the Americas and power utilities recognize EAA as a viable entity. It means EAA Chapter Presidents are listened to as recognized leaders within their communities in bringing forth the transformation of American transportation into one that's truly greener and cleaner.

In wrap up, I'd like to think that, on the EVigilance side, my serving on the EAA Board would add balance and momentum for EVs for this truly national non-profit organization of ours. This is achievable by seeing the East Coast represented and publicized as a "center of gravity" along with the West Coast. Such is illustrated by the premier High School EVent in the Nation, the EV Challenge in North Carolina, the international Tour del Sol from the Northeast Sustainable Energy Association, and the only HS-sponsored EVent in the country—the Northampton East County High School EV Autocross and Road Rally.

These are the EVnotions that I declare that I am about in serving on the Electric Auto Association Board of Directors.

Jerry Asher
Washington, DC

Call for Elections:

Requirement: Must be a current paid EAA member to run for Board of Directors. Each serves a 3-year term and may be re-elected. Currently 3 Board positions open – to be filled by Incumbents or new Candidates. All Candidates must submit an Application. The three existing Board Members up for renewal are:

- Stan Skokan, current Treasurer
- Anna Cornell
- Kurt Bohan

For new candidates, we are looking for enthusiastic supporters of the EV cause to get plugged in and represent EAA Member interests. The Board meetings are held every two months and can be attended by teleconference, so it is not mandatory to physically live in the San Francisco area of California to be on the Board.

Application for Candidate (written):

- Description of qualifications (no long biographies) – for reprint on ballot.
- List of goals, personal focus for EAA – for reprint on ballot.
- Description of availability (phone, fax, email, mail) for Board use only.

Email to: EAA-contact@excite.com
mail to: 2 Smith Ct., Alameda, CA 94502.

Schedule:
Application Deadline – **Nov 7, 2001**
Voting Deadline – **Dec 31, 2001**

CANADA

VANCOUVER ELECTRIC VEHICLE ASSOCIATION
Web Site: http://www.veva.bc.ca/
Contact: Haakon MacCullum, 1-604-878-9500, hmaccallum@hotmail.com
Mailings: P.O. Box 3456, 349 W. Georgia St., Vancouver, BC V6B3Y4, Canada
Meetings: 3rd Wednesday/month 7:30 pm
Location: Varies, see Web Site for details.

UNITED STATES

ARIZONA

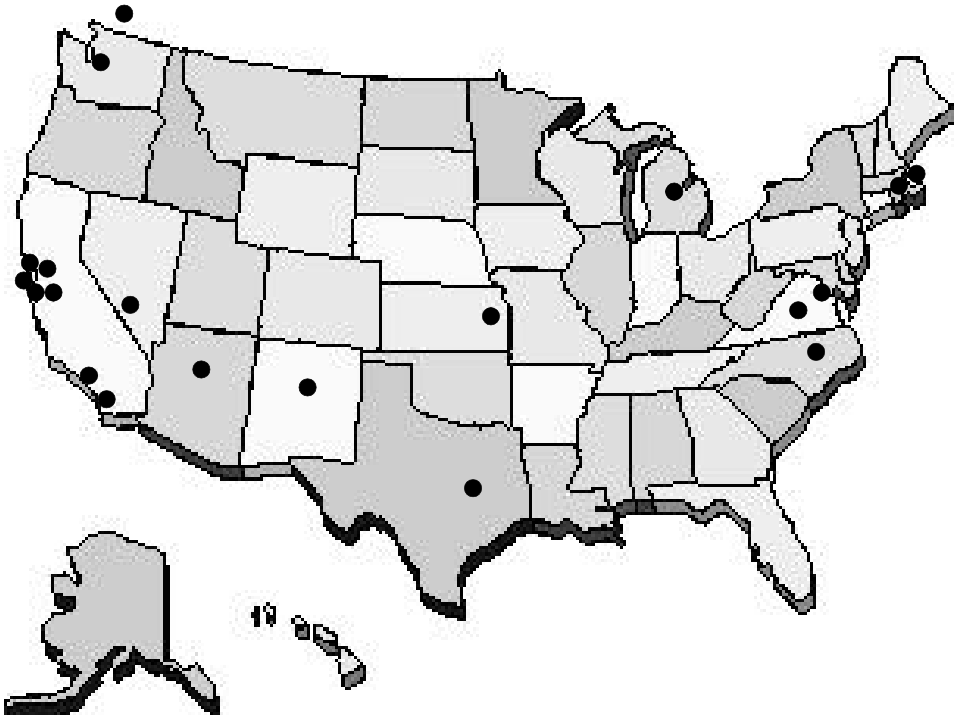
PHOENIX EAA
Web Site: http://geocities.com/phoenix_eaa/
Contact: Roy Thompson, Chapter Pres., 1-480-991-5075, dv8bug@aol.com
Contact: Sam DiMarco, 1-480-948-0719, voltek_2000@yahoo.com
Mailing: EAA Phoenix Chapter, PO Box 6465, Scottsdale, AZ 85258, USA
Meetings: 4th Saturday/month, 9:00 am
Location: Varies, see Web Site for details.

CALIFORNIA

EAST (SF) BAY EAA
Web Site: http://www.geocities.com/MotorCity/1756/
Contact: Ed Thorpe, Chapter Pres., 1-510-864-0662, EAA-contact@excite.com
Mailing: 2 Smith Ct., Alameda, CA 94502-7786, USA
Meetings: 4th Saturday/month, 10:00 am.
Location: Alameda First Baptist Church, 1515 Santa Clara Ave, Alameda, CA

LOS ANGELES EAA
Contact: Irv Weiss, Chapter Pres., 1-818-841-5994
Mailing: 2034 North Brighton, Burbank, CA 91504, USA
Meetings: 1st Saturday, 10:00 am
Location: CA Tech, Winnet Lounge, Pasadena, CA

NORTH BAY EAA
Web Site: http://www.geocities.com/MotorCity/1757/
Contact: Don McGrath, Chapter Sec., 1-707-968-9667, vintner@pobox.com
Meetings: Call for meeting details.
Location: Call for meeting details.



SAN FRANCISCO PENINSULA EAA
Web Site: http://www.geocities.com/MotorCity/1759/
Contact: Tony Kabage, Chapter Pres., 1-650-992-1834
Mailing: 356 East Moore Ave., Daly City, CA 94015-2039, USA
Meetings: 1st Saturday/month, 10 am
Location: San Bruno Public Library (downstairs), 701 West Angus St., San Bruno, CA

SAN DIEGO ELECTRIC VEHICLE ASSOCIATION
Web Site: http://home.ATT.net/~NCSDCA/EVAoSD/
Contact: Barry Schaefer, Chapter VP, bear1_ca@hotmail.com
Mailing: 2031 Ladera Court, Carlsbad, CA 92009-8521, USA
Meetings: 4th Tuesday/month, 7:00 pm
Location: San Diego Automotive Museum, Balboa Park, San Diego, CA

SAN JOSE EAA
Web Site: http://geocities.com/sjeaa/
Contact: Mike Thompson, Chapter Pres., m.t.thompson@ieee.org
Contact: Roy Paulson, 1-408-269-7937
Mailing: 1592 Jacob Ave. San Jose, CA 95118, USA
Meetings: 2nd Saturday/month, 10:00 am
Location: Reid-Hillview Airport, 2350 Cunningham Ave., San Jose, CA

SILICON VALLEY EAA
Web Site: http://eaasv.org/
Contact: Will Beckett, Chapter Pres., 1-650-494-6922, Will_Beckett@email.com
Mailing: 4189 Baker Ave., Palo Alto, CA 94306, USA
Meetings: 3rd Saturday/month, 10:00 am
Location: Hewlett-Packard Co, Corp. World HQ, Lobby A Auditorium, 3000 Hanover St., Palo Alto, CA

KANSAS / MISSOURI

MID AMERICA EAA
Web Site: http://maeaa.org
Contact: Mike Chancey, 1-816-822-8079, evtinker@hotmail.com
Contact: Don Buckshot, Chapter Pres.
Mailing: 1700 E. 80th St., Kansas City, MO 64131, USA
Meetings: Call 1-877-377-0833 for current meeting info.

MASSACHUSETTS

NEW ENGLAND EAA
Web Site: http:/neeaa.org/
Contact: Tony Ascrizzi, Chapter Pres., 1-508-799-5977, tonyascrizzi@juno.com
Mailing: 34 Paine Street, Worcester, MA 01605, USA
Meetings: 2nd Saturday/month, 2 pm
Location: Call/email for meeting location.

PIONEER VALLEY EAA
Web Site: http://www.geocities.com/pveaa/
Contact: Karen Jones, Chapter Pres., k-jones@juno.com
Contact: Emlen Jones, Chapter Vice Pres., 1-413-549-6522
Mailing: P.O. Box 153, Amherst, MA 01004 USA
Meetings: 3rd Saturday/month, 2 pm
Location: Call/email for meeting location.

MICHIGAN
DETROIT EAA
Web Site: http://geocities.com/detroit_eaa/
Contact: Lawrence Rose, larryrose11@yahoo.com
Mailing: 4301 King Fischer, Detroit, MI 77035, USA
Meetings: Email for meeting details.
Location: in Ferndale, MI.

NEVADA
LAS VEGAS EVA
Web Site: http://www.geocities.com/lveva/
Contact: William Kuehl, Chapter Pres., 1-702-645-2132, bill2k2000@yahoo.com
Mailing: 4504 W. Alexander Rd., N. Las Vegas, NV 89030, USA
Meetings: Call 1-702-642-4000 for time and location.

NEW MEXICO
ALBUQUERQUE EAA
Web Site: http://abqev.org/
Email: info@abqev.org
Contact: Neil Wicai, Chapter Pres., 1-505-899-7660, neilwicai@home.com
Mailing: 19 Santa Maria, Corrales, NM 87048, USA
Meetings: 1st Tuesday/month, 7:00 pm
Location: Shoney's Restaurant, 6810 Menaul NE, Albuquerque, NM

NORTH CAROLINA
TRIANGLE EAA
Web Site: http://www.rtpnet.org/~teaa/
Contact: Ken Dulaney, Chapter Pres., 1-919-461-1241, teaa@rtpnet.org
Mailing: 202 Whitehall Way, Cary, NC 27511, USA
Meetings: 3rd Tuesday/month, 5:30 pm
Location: Varies, call for details.

TEXAS
HOUSTON EAA
Web Site: http://www.dataline.net/hceaa/
Contact: Dale Brooks, Chapter Pres., 1-713-218-6785,brooksdale@usa.net
Mailing: 8541 Hatton St, Houston, TX 77025, USA
Meetings: 3rd Thursday/month, 6:30 pm
Location: The Citizen Environmental Center, 2nd flr, rm 280, 3015 Richmond Houston, Texas

VIRGINIA
VIRGINIA ELECTRIC VEHICLE ASSOCIATION
Contact: Ernest Moore, Chapter Pres., 1-804-271-6411
Contact: Bob Oldham, 1-804-864-1455, bobtheham@igc.org
Mailing: 12276 Welling Hall Rd, Doswell, VA 23047, USA
Meetings: 3rd Wednesday/month, Call for details.
Location: Richmond Technical Center, Westwood Ave., Richmond, VA

WASHINGTON
SEATTLE ELECTRIC VEHICLE ASSOCIATION
Web Site: http://www.halcyon.com/slough/seva.html
Contact: Steven Lough, 1-206-524-1351, slough@halcyon.com
Mailing: 6021 32nd Ave. NE, Seattle, WA. 98115-7230, USA
Meetings: Call for details.

WASHINGTON D.C.
ELECTRIC VEHICLE ASSOCIATION OF WASHINGTON DC
Web Site: http://www.evadc.org
Contact: David Goldstein, Chapter Pres., goldie.ev1@juno.com
Meetings: 2nd or 3rd Tuesday/month, 7 pm
Location: National Institute of Health (NIH), Building 31-C, 6th Floor, Bethesda, MD.
Note: Please call Charlie Garlow 1-202-564-1088 to confirm attendence.

Listing updated, verified and current as of 8/20/01.

For information on how to become affiliated with the EAA, checkout http://www.eaaev.org

Board of Directors 2001

Chairman
Ron Freund
rfreund@cup.hp.com

Vice-Chairman
EAA Membership
Will Beckett
willbeckett@email.com
1-650-494-6922

Secretary
EAA Publications
Ed Thorpe
EAA-contact@excite.com
1-510-864-0662

Treasurer
EAA Awards
Stan Skokan
1-650-366-0643
1020 Parkwood Wy
Redwood City, CA 94061-3691

EAA Historian
Terry Wilson
eaa.historian@n2.com
1-408-446-9357

Web, EAA Technology
Bruce Parmenter
brucedp@n2mail.com

EAA Chapter Relations - West Coast
Anna Cornell
ebeaa@juno.com
1-925-685-7580

EAA Chapter Relations - East Coast
Jerry Asher
EVJerry@usa.net

Kurt Bohan
eaanews@aol.com

EAA Board contact:
e-mail: EAA-contact@excite.com
phone: 1-510-864-0662

EAA Membership contact:
e-mail: EAAmembership@email.com
phone: 1-650-494-6922

September 9 - 14

HYPOTHESIS IV, Stralsund, Germany
Conference on theoretical and engineering solutions on hydrogen power.
Contact: Fachhochschule Stralsund Univ.
Phone: +49-3831-456-811/456-703
Fax: +49-3831-456-687
E-mail: hypothesis@fh-stralsund.de
Web Site: http://www.hypothesis.de

September 15

SVEAA CHAPTER RALLY, Stanford, California, USA
Annual Silicon Valley EAA Rally, from 10 am to 4 pm, at the Stanford University Campus.
E-mail: Will_Beckett@email.com
Web Site: http://home.pacbell.net/beckettw/rallyinfo.htm

September 18 - 20

WORLD FUELS CONFERENCE, Washington, D.C., USA
Forum bringing together automotive and fuels industry executives to discuss the fuels marketplace.
Contact: Chemical Week Conference
Phone: 1-212-621-4978
Fax: 1-212-621-4829
E-mail: reg@chemweek.com
Web Site: http://www.chemweek.com

September 30 - October 2

NATURAL GAS VEHICLE COALITION CONFERENCE, San Francisco, CA, USA
Annual meeting discussing recent issues and topics related to the natural gas vehicle industry.
Contact: NGVC
Phone: 1-703-527-3022
Fax: 1-703-527-3025
Web Site: http://www.ngvc.org

September 29

SACRAMENTO RACES, Sacramento Raceway, Sacramento, California, USA
Web Site: http://www.nedra.com/

October 1 - 4

SAE AUTOMOTIVE AND TRANSPORTATION TECHNOLOGY CONGRESS AND EXPO (formerly ISATA), Barcelona, Spain
Conference to explore issues, products and ideas vital to the automotive and transportation technology industry.
Contact: ATT staff
Phone: +44-1372-720620
Fax: +44-1372-720101
E-mail: enquiries@attce.com
Web Site: http://www.attce.com

October 5 - 6

NORTHAMPTON ELECTRIC VEHICLE RALLY, Roanoke Rapids, North Carolina, USA
6th Annual Event sponsored by the Northampton County East High School, only HS-sponsored EVent in the Nation. Autocross on Friday, Road Rally on Saturday.
Contact: Todd Clark
Phone: 1-252-585-0627
E-mail: neat_team@hotmail.com
Web Site: http://www.evchallenge.org or http://www.geocities.com/dgtina_01/contact.html

October 20 - 24

EVS-18, Berlin, Germany
Eighteenth annual EVS International Electric Vehicle Symposium , hosted by EVAA.
Contact: EVAA
Phone: 1-415-249-2690
Fax: 1-415-249-2699
E-mail: ev@evaa.org
Web Site: http://evs18.tu-berlin.de/

November 5 - 8

SAMPE, Seattle, Washington, USA
33rd International Society for the Advancement of Material and Process Engineering, Technical Conference
Web Site: http://www.sampe.org/eventsi.html

November 5 - 6

ALTENERGY 2001, Edmonton, Alberta, Canada
First alternative fuel energy conference sponsored by Canada to focus on the latest science and business applications and solutions of the alternative fuel industry
Contact: AltEnergy 2001
Fax: 1-403-258-0745
Web Site: http://www.altenergy2001.org

November 5 - 6

CLEAN AIR TECHNOLOGIES 2001, Anaheim, California
SCAQMD sponsored international conference on urban air pollution technologies and solutions.
Contact: Anita Saunders
Phone: 1-323-466-3445
Fax: 1-323-466-8653
E-mail: info@aqmdconferences.org
Web Site: www.aqmdconferences.org

November 2nd or 3rd weekend

MID-ATLANTIC EV CHALLENGE, Richmond, Virginia, USA
Sponsored by Richmond Technical Center.
Contact: William Baul
Phone: 1-804-780-6237
E-mail: BasketBaul@aol.com
Web Site: http://www.evchallenge.org

November 26 - 28

CAATS ANNUAL MEETING, San Francisco, California, USA
Annual meeting of the California Alliance for Advanced Transportation Systems.
Contact: Randi Dixon
Phone: 1-916-325-0473
E-mail: Randi_Dixon@caats.org
Web Site: http://www.caats.org

December 8 - 10

EVAoSD WISH RALLY, San Diego, California, USA
First event by the San Diego EAA, to raise money for the Let's Celebrate Foundation. Chris Jones will drive he's Sparrow EV as far as he can in 3 days, from San Diego to Hollister (the Corbin Motors Sparrow factory) and back.
Web Site: http://www.wishrally.com

December 11 - 14

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A Smart Electric in Georgia?

by Bob Oldham

A Georgia man whose companies build some very fast race cars has begun a venture to bring small electric cars to Georgia in a big way. Donald Panoz of Braselton, Georgia is working to reach agreement with DaimlerChrysler to convert the German-American car-maker's smart® cars to all-electric drive for use as "station cars" linking public transit to destinations in the traffic-clogged Atlanta metropolitan area.

Panoz has established a new company, eMotion Mobility, to import and convert as many as 5000 smart gliders a year, installing the electric drive train in them in a plant to be located somewhere in south Georgia or north Florida. At the projected production volume, eMotion Mobility would be the largest electric vehicle producer ever in the United States. The smart is a tiny 2-seater 5 feet shorter than the new VW Beetle and is becoming popular in the crowded cities of Europe.

One hundred years after the first production electric cars came on the market, there are still only about 28,000 electric or hybrid vehicles in the United States. In contrast, Ford sells more of its popular Explorer SUVs than that every month. The prospect for an increase in the EV numbers is generating excitement in the EV community.

"I think that this is one of the brightest, most promising EVentures that I have seen in some time," says Dave Goldstein, president of EVA/DC and a consultant to EV manufacturers. "In many ways it reminds me of the groundbreaking Tropica venture which showed the potential for a small manufacturer to assemble an affordable, high-value, sporty two-seater EV." Goldstein continues, "But, whereas Tropica was perpetually undercapitalized, and failed because of it, this project has been far better organized with some brilliant embellishments, including the support of one of the world's leading auto manufacturers and the use of a glider vehicle that has already proven itself in Europe. And that could make all the difference this time around."

Used as "station cars", the electric smarts would be parked at transit stops, shopping malls, campuses, and employment centers, and would be available for use by multiple drivers on a rotating basis by subscription. (Subscription costs have not yet been determined.) They would be reserved online, and drivers would use a computer "smart card" to gain access for operation. Usage and location would be tracked by GPS.

The range of 60 to 70 miles and the top speed of 70mph that are projected for the electric smarts, plus air-conditioning for the Georgia climate, would make these economical and clean vehicles an attractive alternative to Atlanta's presently jammed and smoggy roads. Two similar "shared electric vehicle" projects, at Emory University and the Georgia Power offices, together using about 24 vehicles, were recently announced.

John Wilson, president of eMotion, predicts that the first smart electrics will be on the streets by the end of 2002.

Panoz Motor Sports began experimenting with hybrid race cars in 1998, and Panoz contacted the Southern Coalition for Advanced Transportation last year and asked the Coalition to develop a plan to use EVs in Atlanta city traffic. If the scheme is successful in Atlanta Panoz hopes to take the e-car system to other Southern cities that have transportation and urban pollution problems, and beyond that to the rest of the country.

Sources for Existing EVs for Sale:

Silicon Valley Chapter EAA
http://home.pacbell.net/beckettw/forsale.htm#owned

Innevations
http://www.innevations.com/used-evs.html

Eco-Motion Electric Cars
http://www.halcyon.com/slough/contributions.html

Arcata Electric Car
http://www.tidepool.com/~ecar/list.html

EV Tradin' Post
http://members.nbci.com/evalbum/geobook.html

EVA/DC
http://www.evadc.org/forsale.html

Triangle EAA
http://www.rtpnet.org/~teaa/forsale.html

Electric Auto Association (EAA) Membership Application Form

Copy and fill out this form, attach a check or money order or use PayPal in US funds only for $39 ($42 Canada) ($45 International) payable to '**Electric Auto Association**'. You can fold this form as indicated and mail it with your payment enclosed. Do not use staples, instead use tape to seal the form before you mail it. Or send an e-version of this form, pay through PayPal using http://home.pac

New Member: ❑ Renewal: ❑ Country (if non-USA):_____ Date: _____

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Mailing Street Address: _____ Home phone#: _____

Mailing City, State & ZIP: _____ *Work phone #: _____

*Do you ❑ own or ❑ lease an Electric Vehicle? ❑ Production ❑ Conversion ❑ Bicycle ❑ Other:_____ ❑ No

I support the _____ EAA Chapter, or please select an EAA Chapter closest to me. ❑

(*optional) All information in this application is for the exclusive use of the EAA and not be sold or given to any other organization.

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Please Identify your primary areas of interest relating to the EAA (check as many as you wish):

❑ Hobby/Builder ❑ Professional (income) ❑ Competition (Rallies, Races, Records) ❑ Owner/Driver
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❑ Promotion & Public Awareness of EVs ❑ Student or General Interest ❑ Electrathon/Bicycle/other

The Electric Auto Association www.eaaev.org

'Providing free Electric Vehicle information to the public since 1967'

The Electric Auto Association (EAA) is a non-profit organization (eaaev.org 501c3) for the promotion of Electric Vehicle use in and by the public. Your membership is Tax Deductible and you will receive the informative EAA publication, "**Current EVents**". All information and statistics in this application are for the exclusive use of the EAA and is not sold or given to any other organization or company. From your membership dues, a percentage goes to the EAA Chapter you support for public Electric Vehicle promotion activities like EVents, Rallies, Shows, and EV rides.

(fold the bottom half under. This will now be the front of the letter. Be sure to seal it with tape)

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EAA Merchandise

The **Electric Auto Association** (EAA) is a nonprofit organization for the promotion of public awareness of Electric Vehicle use as a viable transportation option. All minor sales proceeds are used to cover the costs of our nonprofit efforts in this cause. Please show your support with your purchases for better, cleaner, quieter, and lower maintenance transportation.

Product	Description	Comments	Item#	Price
Licence Plate Holder	Black plastic frame, white lettering on visible green.	Allow 6 weeks.	LICPH1	$ 10.00
Licence Plate Holder	For motorcycles. Black or chrome metal.	Allow 6 weeks.	LICPH2	$ 14.00
Embroidered Patch	White, Sew-On.	Allow 3 weeks.	PATCH1	$ 6.50
Embroidered Patch	Green, Sew-On.		PATCH2	$ 6.50
Embrodered Hat	Adjustable fit.		CAP002	$ 15.00
"Electric Vehicle Parking Only" Sign	Metal sign, reflective white background with dark green lettering. Wall or pole mounting.	Like public no-parking sign quality.	PARK01	$ 25.00
EAA Key **Chain**	With LED light and "30 years 1967-1997".		KEY01	$ 2.50
Coffee Mug	Ceramic.		MUG03	$ 5.50
Insulated Car Coffee Mug	Plastic.		MUG02	$ 6.50
Embroidered Polo Shirt	Size: S,M,L,XL,XXL. Color: Forest, Teal, or Navy.	Allow 10 weeks.	SHIRT01	$ 40.00
EAA Jacket	Size: S,M,L,XL,XXL. Color: Blue or Black.	Allow 10 weeks.	JACKE1	$ 59.00
EAA Wind Breaker	Size: S,M,L,XL,XXL. Color: Blue or Black.	Allow 10 weeks.	WBREK1	$ 49.00
EAA Sweat Shirt	Size: S,M,L,XL,XXL. Color: Blue or Black.	Allow 10 weeks.	SWEAT1	$ 39.00
EAA ball-point pen	EAA ball-point pen with EAA.	Sold individually.	PEN01	$ 1.00
Car Window Shade	EAA Car Window Shade.		SS001	$ 8.00
Bumper Sticker #1	EAA Bumper Sticker.	Size: 10.5" x 3.75"	BS800	$ 2.00
Bumper Sticker #2	EAA Bumper Sticker "The Switch is on".	Size: 15" x 3.75"	BS002	$ 2.00
Decal	EAA Decal (The Switch is on).		DECAL	$ 1.00
	— EV Buyers Guides —			
2000	Electrifying Times Preview 2002.		BG2000	$ 5.95
1999	Electrifying Times	Not available.	BG1999	NA
1998	Electrifying Times Preview 2000.		BG1998	$ 5.95
1997	1997 EV Buyers Guide.		BG1997	$ 5.95
1996	1996 EV Buyers Guide.		BG1996	$ 5.95
1995	1995 EV Buyers Guide.		BG1995	$ 5.95
	— Literature —			
Convert-It	EV conversion Book		CONV01	$ 24.95
KTA Catalog	Electric Vehicle Kits & Component Parts		CATAL1	$ 5.00
Window Literature Holder	Light plastic.		WL002	$ 15.00
	— Special —			
AVCON to 14-50 Electrical Adapter Kit	Sheet metal box, 14-50 outlet (2 hots and a ground, no neutral), for 220 VAC chargers only.	Allow 6+ weeks delivery after payment deposited. Some assembly required.	ADAPT1	$200.00
EAA Membership	Fill out Membership for on opposite page	Include form w/ order.	EAAM01	$ 39.00
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			Handling	$ 2.00
			TOTAL	$_____

To order, include your name, phone number, mailing/shipping address and payment by check or money order. Please specify quantity for each item and size/color for clothing.

Send orders to:

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

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