Electric Auto Association

# CURRENT EVENTS

May-Jun 2003 | Promoting the use of electric vehicles since 1967 | Vol. 35 No. 5 & 6

# BAR STOOL RACING? ARE YOU FOR REAL?

*By Bob Oldham, EVA/DC member*

One of the more esoteric branches of the electric vehicle scene is the racing of electric bar stools and other strange electrically propelled "vehicles". Bar stool racing seems to have originated with ICE-powered stools in the early '80s, when one Ken Lowe built what is currently the oldest documented powered bar stool. But he was closely followed by a group of enthusiasts who thought, "Hey, I could do that electrically!" and did.


*A typical Bar Stool racer - Bar Fool Racer*

History aside, the motorsports scene hasn't been the same since. Powered shopping cart racing, electric love seats, and electrically driven sculptures have made their appearances and been copied and improved upon. (Otmar Ebenhoech's electric love seat was a big hit at the Burning Man festival a number of years ago, as have been several electrically driven mobile sculptures.)

*Otmar's electric loveseat, at an EV event.*

But it's the electric bar stools that have really taken off. Many have been built and raced, both for land speed record tries and as a special category within the NEDRA competitions, as well as for just plain fun.

There are bar stools and then there are *bar stools*, though. Some have been simply motorized, steered by dragging feet or other low-tech means. Others, such as the streamliner sponsored by Rod Wilde's EV Parts, are sleek versions, with fender skirts, "oversized" wheels, and handlebar steering.

*Bonneville streamlined version of a Bar Stool*

John Norton (www.thunderstool.com) has been producing, racing, and selling electric bar stools since the mid-'80s. Using a single 12-volt battery and an automotive starter, these wacky vehicles have been bought by folks from as far away as Malaysia, according to John.

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## COMMENTARY: OVERCHARGED AND UNDERSERVED

*By Dave Goldstein, EVA/DC President*

The New Year has begun with a double whammy against EVs, and suddenly, we have all becoming members of "The Loyal Underground." It is not like we didn't see it coming.

First, the California Air Resources Board (CARB), bending to heavy lobbying and a lawsuit from the automotive industry, issued another retreat on the ZEV Mandate, further eroding the Zero Emission Vehicle requirement to less than one percent, effectively killing it.

Shortly thereafter, Toyota Motor Corporation, the last original equipment manufacturer (OEM) to offer a battery EV in the US — the RAVEV — having sold out all of its remaining EVs through a network of 25 California dealers, notified the public that it would no long produce an all-electric model.

Late last year, Ford announced that it "could not afford to sustain" its fledgling EV business, and did an about-face on its much ballyhooed "TH!NK" EV, despite more than a thousand advance orders from anxious customers. Meanwhile, GM sent out letters to its EV1 lessees, advising that it would no longer extend leases on its fabulous "electric Corvette" and returned sizeable deposits from dedicated EV1 owners who lobbied in vain to continue driving what is arguably the most advanced limited production car ever built in the US.

And yet, untold thousands of potential EV1 customers were reportedly *turned away* by California Saturn dealers or placed on unfilled waiting lists for more than *two years* while GM spent millions to lobby against EVs, sued CARB, and pretended that there was "no EV market."

DaimlerChrysler is still promoting it's golf-cart-like "Low Speed Vehicle ("LSV") — the "GEM" — although you would have been hard-pressed to find anyone at the recent Detroit, LA or DC auto shows to actually talk about it. Its more powerful highway capable "Epic" electric van was never offered to the public.

But it was Honda, which once bragged that it was the first car company to fulfill its ZEV commitment in California (just 300 EVs, as promised in a legal compromise with CARB) which set the pattern for others to follow, by asserting afterwards that since it had "only"sold 300 EVs, that there was "no EV market." It was a dirty little game, compounded by Honda's gasoline hybrid ad campaign that trumpeted the alleged benefits of "never having to plug it in!" But aside from Honda and their automotive allies, was anybody really worried about that?! And just what *is* it that Honda — indeed the entire automotive industry — is so deeply afraid of?

The answer, I think, is the potential loss of billions of dollars in revenues from automotive parts and service that EVs will never need — no oil changes, filters, tune ups, transmission repairs, exhaust systems, hoses or belts that consumers have been conditioned to replace or repair again and again after the initial sale. *Why, oh why* would Detroit ever want to turn off such a lucrative money machine? So WHAT if the world is running down its oil supply, our cities are choked with smog and our sea levels are rising? Is that of any concern in Detroit, Tokyo or Berlin?

Surprisingly, the answer may be a qualified "Yes!" — PROVIDED that it doesn't cut into corporate earnings. And that is the crux of the matter. That is why the Autos have poured hundreds of millions into defeating CARB and its potential fines for noncompliance, as well as the uncertainties of battery economics that offered only limited returns on investment in exchange for a frightening amount of potential losses, both before and after the sale. It was partly fear, and partly a matter of staid corporate economics — i.e., — "business as usual."

And something else. Over the past decade or so, the world's major auto companies have been buying up pieces of one another to the point that the auto business has evolved into a huge inter-locked global network, not unlike the "bully trusts" in the U.S. of the 1920's. The bigger you are, the less likely you are to take risks. Instead, you try to "manage change."

A corporation is, after all, a "corporation" — dedicated to making a return on its investments and avoiding risks to its shareholders. Over time, the most successful corporations tend to grow and devour other corporations. That is the nature of the beast.

But if you think that I have somehow joined PETA or invested my retirement money in the automotive industry, you'd be wrong on both counts! ;-) And this is where the sympathy for GM-Ford-Honda-Toyota-DaimlerChrysler ends.

Because behind all of the arguments and negative EV propaganda, beyond the fear factor and the economic uncertainties, the automotive industry has just shot itself in the foot.

It has forgotten, like the railroads of an earlier era, or the airlines of today, that it is in a *transportation* business — not a "car" or "truck" or "SUV" business, and that it must be ready to satisfy the changing tastes of its customers and to adjust to *change* itself, rather than to try to "manage" change for the good of the corporation.

G-F-H-T-DC — the Beast — has lost its vision, as evidenced by declining world-wide sales (except in China) and a return to the tired solutions of the past. Ten cylinder motorcycles, 16 cylinder Cadillacs and 10 mile per gallon Hummer H2's — all shown at the recent Detroit and LA auto shows — are visceral but outmoded responses to the kind of world we live in TODAY — in which the U.S. consumes about *one-fourth* of the world's oil supply, importing more and more petroleum from nations that hate us, even as we prepare for the possibility of oil-related wars on two different continents, and weapons of mass destruction are getting closer and closer to the hands of some *very* dangerous people.

In case the Auto's have forgotten, radiation and bio terrorism are VERY bad for business! ;-)

And even if we survive these threats and the world oil supply holds out for another 20 or 30 years, there is still the matter of *consumer choice*. Many thousands of people have now

been exposed to EVs, and *liked* them — despite every conceivable effort that the auto industry has made to dissuade them — and the genie is out of the bottle. But the public has not been granted its wish. People — consumers — WILL remember that, and eventually *some* manufacturers with courage, vision and appropriate financial backing will figure that out. Likely, this will occur at the worst possible time for the traditional automotive industry — when a major oil or economic crisis hits, throwing hundreds of thousands of people in the car business out of work, including some key executives who should have seen it coming.

Used car lots will bulge with outmoded trucks and SUVs that no one wants — a replay of the 1980's, when Detroit's bloated gas guzzlers became the pariahs of a new generation.

Will Fuel Cell Vehicles be ready in time? Doubtlessly NOT. Without the push for EVs, the impetus for FCVs will soon be lost. Faced with daunting economics for FC's and a potential multibillion dollar Hydrogen infrastructure, the Autos, which now sup at the government Fuel Cell trough — thereby limiting their own risk — will, barring a fundamental technological breakthough, "pull the plug" again when their own costs begin to rise, no doubt blaming "the environmentalists and government regulators." The public, once again, will be left to fend for itself.

The question now is: What do we, "the Loyal Underground," DO? How should we respond to this? One opportunity — a long shot, perhaps, but far more technically and economically feasible than Fuel Cells or 16 cylinder Cadillacs — is the GRID RECHARGEABLE HYBRID, currently being studied and promoted at EPRI, UC Davis, and as part of a growing U.S. consortium. Part battery EV, part ICEV and capable of being recharged by "plugging it in!" the GRH could bridge the gap toward a future *oil-free* transportation mix that makes far more sense for our country and the world in the intervening decades before the "Hydrogen Economy" can become firmly established.

*By Elaine Lissner, presented to CARB*

## Big problems with the current staff proposal (sorry, guys!):

- CARB would be requiring that the auto industry spend a certain amount *towards* cleaner air, rather than requiring clean air— in effect, regulating spending, not air quality.

- CARB would be playing God. I know Chairman Lloyd and several other board members like fuel cells. But you know what the problem with playing God is? People expect you to be omniscient, and then they sue you when you aren't! (Either that, or if you're lucky, they just publicly humiliate you.)

## I submit for your consideration:

1. To clean up the air, CARB needs to stop getting sued.

2. To stop getting sued, CARB needs to:
   - simplify, simplify, simplify
   - stop making references to fuel efficiency (as Chrysler so kindly pointed out)
   - *not start* mandating specific technologies, either fuel cells or BEVs or anything else
   - stick like glue to its original mandate, regulating *emissions levels*
   - not take away anything that has already been given, or the automakers will sue so fast… Besides, it's not fair.

## Core principles:

- **CARB must regulate emissions, not cost.** CARB's mandate requires it to be realistic about cost. But it must regulate based on desired outcome (emissions), not tell people how much to spend to get there. In effect, the current staff proposal requires automakers to spend a certain amount of money to achieve clean air, rather than just telling them to clean the air a certain amount.

- **CARB must give credits based on function, not technology.** If a car gets you down the road without polluting, it gets you down the road without polluting. The question is "How far will it get me down the road before refueling or recharging?" And "How fast will it get me down the road? Will it just get me around town? Or can I get on the freeway?" And "If I can get on the freeway, will I feel comfortable there when everybody else is doing 75?" If the car is green, CARB shouldn't care what's under the hood (or, per above principle, how much the auto manufacturer spent to get it that way). Credits mustn't be used to play favorites, placing bets on the sexiest technology or the "technology of the future." They must only reflect how well, how far, and how fast a car gets you down the road.

- **One car, maximum one credit!** Less function (e.g. a city car), less credit. The mandate will never be credible if "two percent of the cars sold" doesn't add up to at least two percent of the cars sold.

- **No back-door dilution.** Extra credits are not just playing favorites, they are also hidden dilution. To be respected, you must do any diluting right up front, in the percentages you require, and not sneak dilution in the back door by giving 8 credits here, 40 credits there. If you sneak dilution in the back door, every complicated formula you use for credits will become a point you'll have to negotiate with (and defend against) the automakers. It bears repeating: one car, one credit. Less function than a car? (Somebody jokingly called my Th!nk City "half a car.") Less than a credit. One credit must equal at least one vehicle driving down the road! Unrealistic for the automakers to make that many cars? Then face facts and lower the percentage, to 1%, or 0.5%, or 0.1%, or whatever it takes. Choose one thing to defend—a percentage—and then defend it mightily. Don't let the automakers pick apart every little formula until you have nothing left.

## Realities:

- CARB has already stated it cannot meet its goals without some zero-

emissions vehicles.
- The credit glut threatens to put off zero-emission technology for so many years that CARB will not be able to meet its goals.
- If 20,000 ZEVs are required several years from now with no ramp-up, the automakers will squawk and/or sue. Plus, the market needs buildup.
- The 2001 rules can't start before model-year 2005 or CARB will get sued.

## Conclusion from the above:

The only way for CARB to reach its goals without getting sued is to offer a *technology-neutral, emissions-based* alternate compliance path that would ramp up ZEV production smoothly.

### Nuts and Bolts

## Alternative Compliance Path:

- No old banked credits allowed. (This means that Toyota and Ford will probably not take this path, preferring to use the banked credits they have built up. I believe Ford is covered through 2009 or so. So when calculating numbers of cars, one could reduce it by 30% or so, but I won't.)
- No new banked credits. Credits expire each model year.

- **Gold category (ZEV):**
  - These numbers start from what is absolutely possible now, so they can't simply pulled out of a hat. For example, in calendar year 2002 (about 2/3 of a model-year), Toyota placed 300-some cars; Ford brought 200-some city cars to California, did no advertising, and ran out in six months. William Korthof tells me that fleets need about another 600 cars per year just to *sustain* their programs. (Fleets generally have long lead-times and were not able to participate in Toyota's brief 2002 offering.) So 1500 vehicles in two model years should be no sweat and would actually be less per year than what the public plus fleets demanded in 2002.
  - 0.15% (about 1500 cars based on about 1 million per year) any type of ZERO emission vehicle (no tailpipe!) in model year 2004 or 2005
  - 0.3% ( about 3,000 cars) in model year 2006
  - 0.6% (about 6,000 cars) in model year 2007
  - 1.2% (about 12,000 cars) in model year 2008
  - back to the full 2% in each model year 2009-2011
  - 3% in each model year 2012-2014
  - 4% in each model year 2015 and subsequent

- **Silver category:**
  - Again, must be emissions-defined, not mandate any specific technology, to avoid getting sued (or betting on the wrong technology).
  - Emissions level stronger than SULEV but accomplishable by CNG, some plug-in hybrids, and the cleaner current hybrids.
  - 2% in each model year 2005-2008 (about 20,000 cars)
  - 3% in each model year 2009-2014
  - 4% in each model year 2015 and subsequent

- **Bronze category (PAV):**
  - Same concept as silver, except the emissions cutoff should be accomplishable by what are currently called PZEVs. Hybrids would also fall in this category until/ unless they're clean enough to meet silver requirements. This category would be known as "Partial Allowance Vehicles" (PAV). The terms "PZEV" and "AT-PZEV" would be abolished, since calling anything "partial-zero" is an oxymoron and strains the mandate's credibility.
  - 6% each model year 2005 through 2018 and subsequent

- **Credit Calculation:**
  - Credit calculation is based on functionality/versatility, which is a proxy for how many vehicle miles a zero-emissions vehicle would be expected to replace relative to a standard vehicle.
  - credit for 25mph-capable, 25 mile range
  - 0.75 credit for 55mph-capable, 50 mile range (new car, or MOA car newly offered for sale and sold)
  - Additional credits available to freeway-legal vehicles, but at no time shall the total credit for a vehicle exceed 1:
    - 0.05 credit for 65 mph-capable
    - credit for each mile of range over 50
    - credit for each mile of range refuelable/rechargeable within 10 minutes

## Assumptions:

- Numbers required across the auto industry, such as 250 or 500 cars, are going to be a giant pain in the rear to administer fairly. It's better to stick with the original idea, percentages per automaker.

- Because of the success of the lawsuits, and because the CARB and staff then re-opened everything rather than just fixing the legal issues, CARB is now seen as vulnerable to pressure. Therefore, when given a multi-year timeframe in which to do something, most domestic automakers will wait until the last year and then cry "It's not realistic!" or sue.

- CARB will erode its credibility if it plays fast and loose with terminology. I'm sorry, there is no such thing as a "partial zero emissions" technology! Either it's zero or it's not zero. If it's not zero, it's low, or ultra-low, or whatever you want to call it, but not partial-zero or the insidious "near-zero." Similarly, if you put anything with a tailpipe in the gold ("zero emissions") category, the public is going to laugh. Can you imagine the headline? "CARB CHAIRMAN CHALLENGED TO BREATHE FROM TAILPIPE OF "ZERO-EMISSIONS" VEHICLE."

- Continuing the previous thought, it would

be against your mandate (clean up the air), and patently unfair, to highly reward a plug-in hybrid with "gold" membership if it's dirtier than Honda's CNG technology ("silver"). Honda would be justifiably upset, maybe enough to drop their unfailingly polite manner.

- In the alternative compliance path, CARB must get rid of all the gaming of credits. Just like categories (gold, silver, bronze) are to be based on emissions, not cost or technology to get there, credits must be based on function (highway-capable or not, quick-refueling, etc.), not cost or technology to get there. It should be as close to "one credit, one car" as possible. If you credit for spending money rather than accomplishing a goal, you reward automakers for pursuing cost-inefficient strategies. An example: you wouldn't give a teenager $200 and say "you must spend this money to buy yourself jeans and a shirt." The child could do it, by going to Neiman Marcus. But the more economically-efficient thing to say is "Here's $200 to spend on jeans and a shirt, and whatever you don't spend you can keep." Then the child goes to Old Navy, spends $60, and puts the remaining $140 to more productive uses (like CDs, burgers, and concert tickets!).

- In a way, the alternative compliance path is not really alternative— it must be absolutely realistic and lawsuit-proof on its own. This is because the 2001 rules are vulnerable to attack, so this alternative compliance path must offer an alternative that is beyond reproach.

- CARB members must eliminate the word "goal" from their vocabulary. This is about requirements, not goals. Board members, don't let the automakers think you're weak—that they can do anything less than what is demanded of them. Californians have waited long enough! This new proposal is all based on proven technology. Make clear that the only way this may get revised in the future is to make it *more* stringent!

## Details, in case you're still reading:

You've heard the expression "The devil's in the details." Well, I think in this case, the key is really the core principles (about emissions vs. cost and function vs. technology). But here are some details that if not attended to, could still derail things or have unintended consequences. (Remember the NEV fiasco?)

- SUV loophole must be closed in both compliance options. If not, probably nobody will choose the alternative compliance path.
- Need to make sure, for fairness, that credits can be used in lower categories too.
- Leased vehicles must have a purchase option (open lease) or they don't count.
- Action item for staff: Figure out whether my NEV multiplier is realistic. Will it keep the market alive while not providing a loophole? What's the incremental cost on a NEV, and how does it compare to the incremental cost on a city car or full-function car?
- Not get into the hydrogen infrastructure business. Talk about opening a can of worms! Talk about playing god and placing bets on a particular technology!
- Not get into the demonstration transit corridor business. See above about the can of worms. It's a great idea, Supervisor DeSaulnier, but it's too complicated for CARB. CARB's role should be to do one thing: force the automakers to build the vehicles that your transit corridor will use.
- As Commissioner McKinnon states, firm numbers for the future are key.
- No expert review panel. It sends a message of weakness. If you follow the above suggestions, every one of the three categories contains *proven* technology options at rapidly dropping prices. Besides, we're only talking about 10% of total cars sold. Remember catalytic converters, which added perhaps $1,000 (I'm guessing here) in today's terms to the price of *every* car on the road? At a certain point, some of the costs of driving need to be reflected in the price of the autos rather than in the state's hospital budget. And guess what, automakers: as long as it's fair across automakers, that's just a part of doing business in our state.
- Penalties *must* be substantial, and reflect that a weasely manufacturer avoids big bucks in R&D and line setup. I suggest (just guessing here) $50,000 per car. Penalties can go into a fund to give consumers tax breaks on their purchases.
- Help Ford get around DOT crushing of Th!nk City cars, if Ford wants.

## Economic impact on automakers—$$ and cents analysis (putting this in context):

Of course, CARB's primary focus should be on the economic impact of air pollution on California's public health and economy. But CARB is also required to *consider* the impact on automakers, and to be realistic. Plus, it's easier to defend a proposal when you have some sense of its impact. Here are some calculations to put things in context.

For simplicity, we'll assume the automakers subsidize the incremental cost of clean-air vehicles and add the cost to the other 90% of cars sold. We'll use incremental cost numbers from the staff report. We'll say automakers choose the cheapest way to meet the requirements (if they want to build fuel cells instead of BEVs, that's their problem). This is going to be a rough estimate, but here goes:

For 2005:

- 0.15% ZEVs (about 1,500) divided by 0.75 credits for a city car = 2000 city cars, at $8,000 incremental cost per city car totals $16 million (about the cost of two super-mansions in Silicon Valley)
- 2% silver (20,000) at incremental cost of $1700 = $34 million (four mansions)
- 6% PAVs (60,000) at incremental cost of $100 = $6 million (one mansion)
- Total comes to $56 million, spread over the other 90% of cars equals **$62** per car.

Let's do 2009, with a nice modest 20% reduction in incremental "gold" and "silver" costs:

- 2% ZEVs (about 20,000) divided by 0.75 credits for a city car = about 26,670 city cars, at $6,400 incremental cost per city car totals $128 million (about the cost of 16 super-mansions in Silicon Valley)

- 3% silver (30,000) at incremental cost of $1360 = $40.8 million (five mansions)
- 6% PAVs (60,000) at incremental cost of $100 = $6 million (one mansion)
- Total comes to $175 million, spread over the other 89% of cars equals **$197** per car, still well below a catalytic converter, I believe.

If one uses the staff report's numbers for later years in the silver category, the costs are significantly lower. If one uses EPRI's numbers for volume production of batteries in later years and accounts for consumer fuel savings, the cost of a ZEV approach is significantly lower. If the French "compressed air" approach amounts to anything, the costs would be significantly lower. These are conservative numbers, designed to be on the high side.

## Objections and Responses:

**Objection:** "But we don't believe in electric cars! Been there, done that! We believe in hydrogen!"
**Response:** Well, too bad, because this is about clean air, not about what you believe in. If you really can't stand the idea of having your company associated with electric cars, if you really think they have cooties and are eight-track cassettes, then buy some credits from somebody who is willing to put pollution-free cars on the road, and chalk it up as a cost of doing business. And if you want to spend a million dollars per car to accomplish the same thing, we're happy for you, but do it on your own dime.

**Objection:** "You're forcing us to build something we don't believe in!"
**Response:** No, we're not. This is a free market. Buy some credits from somebody else and quit complaining.

**Objection:** "This will distract us and dilute our efforts to build fuel cells."
**Response:** Oh, please. Does your effort to build the new Civic distract from your effort to build the new Passport? Does building the Thunderbird distract from building the Expedition? It seems awfully modest to claim you can't pursue two complementary technologies at once.

**Objection:** "It's too expensive to both do fuel cell research and make electric cars."
**Response:** If it's really more than you can handle, you're free to pick one path. And if you're (hello, Ford) really near bankruptcy anyway, you probably shouldn't be spending millions of dollars on a technology like fuel cells that you admit is more than a decade from widespread use. Maybe you should be putting your Th!nk City cars back on the road and leaving the glamorous stuff to companies that aren't about to go bankrupt.

**Objection:** "This will harm poor Californians and Californians of color by making cars more unaffordable."
**Response:** Oh, please. You're telling me poor Californians would rather have asthma than pay a couple dollars more a month on their car payments? The poorest Californians can't afford cars anyway. Go home, and don't come back until you come back with a better argument. Oh, by the way, please don't insult my intelligence again by implying poor Californians are synonymous with Californians of color.

Good news you can tell the automakers:

**To Ford:** Look, we didn't make you build any extra fuel cell cars! In fact, you're not going to have to do *anything* in the gold category for a long time if you choose not to take the alternate compliance path, what with all your banked credits from the Ford Ranger (plus Th!nk City and Th!nk Neighbor). And since gold credits can of course be used in lower categories, you may not have to do anything at all for a while.

**To Honda:** Finally, you'll get some respect for making super-clean CNG vehicles! Guess what: you're going to have the market cornered on what's going to be the cheapest way of satisfying the silver requirements. Other automakers will be lining up to buy your credits. And you're well positioned with the Civic and Insight to meet bronze requirements. You can buy some gold credits from Ford, make exactly the number of fuel cell vehicles YOU want, and laugh all the way to the bank.

**To GM:** If you act quickly, you can avoid any immediate burden in the gold category by putting the EV1-s back on the road. We'd like to be able to give you more good news, but we have to be fair to car companies that actually made a good-faith effort. Maybe you shouldn't sue us next time.

**To Toyota:** Looks like you're sitting pretty. With all your credits from the RAV4 EV, you may choose not to even take the alternate compliance path. But if you do, all you have to do is fire back up the RAV4 assembly line. Based on your 2002 sales, you'll easily be able to sell enough of them to meet your gold requirements, and probably fill in some of your silver requirement too. (Heck, you won't even have to spend money on new ads, since RAV4s still feature prominently in your advertising!) Or you may find it more cost-effective to buy some silver credits from Honda. You're well positioned to meet bronze requirements with the Prius. And you can make as few or as many fuel cell cars as you want to—you got through this process without being forced to make any extra at $1 million apiece. Nice guys really do finish first.

**To Daimler Chrysler:** Ever heard the term "corporate citizenship?" Toyota and Honda have, and even Ford thinks it sounds vaguely familiar. Get with it. By the way, see you in court.

## Issues / concerns not addressed:

- How do electric motorcycles, and one-seater vehicles such as the Sparrow, fit into all of this? Not at all, I suppose.

- I don't know much about where the 10% figure originally came from. But I just wonder whether it's still the most logical approach. Not that I'd like this, but has anyone considered saying that 50% or 80% or 90% of all cars must meet certain minimum emissions standards, SULEV for example? How does the SUV loophole affect all of this? Will CARB's closure of the SUV loophole prevent a situation in which five years from now there will be about two cars left on the road and all the rest will be SUVs?

*Elaine use to drive a Sparrow until it had too many problems and was never repaired by Corbin Motors. Currently she leases a Ford Th!nk City, until Ford removes them from the road.*

# CONVERSION WORKSHOP, STEP 16 BATTERY PACK LAYOUT

*By Michael P. Brown, © 2003*

In the last issue of Current Events, I promised that this time we would we would begin to talk about the big stuff:: high voltage/high current cables and connectors. Since the batteries are the source of that high voltage/ high current, we are going to look at how to arrange the batteries and connect them to each other in order to get the battery pack voltage wanted to where it is needed.

### Terms of Engagement

The place to start is defining the terms "series" and "parallel" as they apply to battery hookup. In a series hookup, the positive post of one battery is connected to the negative post of the next battery, and so on until all the batteries are hooked up. The positive and negative terminals that are at each end of the string are called the most positive and most negative terminals of the string.

The total voltage of a series string is equal to the voltage of an individual battery times the number of batteries in the string. A typical EV battery string uses sixteen 6 volt batteries, so the total string voltage is 96. The amperage capacity of the string is equal to the capacity of one of the batteries of the string.

In a parallel hookup, all the positive terminals in the string of batteries are hooked together and all the negative terminals are hooked together. The total voltage of a parallel string is equal to the voltage of one of the batteries of the string. The amperage capacity of the string is equal to the amperage capacity of the individual battery times the number of batteries in the string. In a normal electric car conversion, we need to use a series string of batteries to achieve high enough voltage for highway speeds.

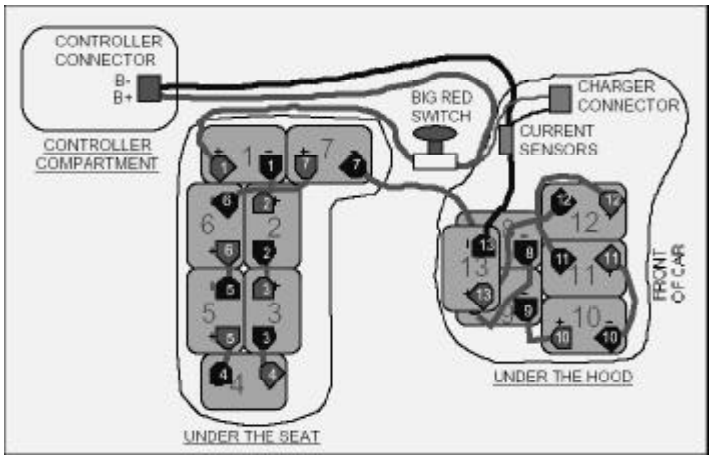
### The Plus & Minus of Things

The batteries we use are composed of individual two-volt (nominal) cells arranged in groups of three in a 6 volt battery, groups of four in an 8 volt battery, or groups of six in a 12 volt battery. The number of cells determines the placement of the battery's terminals. The 6 volt battery with its odd number of cells (three), has its terminals on the diagonal corners of the battery. The 8 volt battery and the 12 volt battery have even numbers of cells (four and six respectively), so they have their terminals on the opposite ends of the same side of the battery.

### Building the String

As we discussed in the previous articles, the physical layout of the batteries is pretty much determined by the space available in the car or truck we are converting. Now we have to orient the batteries in the battery box so that their terminals are in the best position to be connected in series.

The first thing to determine is which side and which end of the battery box the most positive and most negative battery cables have to exit. The location of the holes in the box for these cables should be in places that are closest to the next battery box or component that the cables are going to. It is important to avoid long cable runs, due in small part to the internal resistance of the cable, and in larger part to the cost of the cable. Make sure that you have room between the battery box and the body of the car for the cables to exit without sharp bends.




*pack layout from sparrow-ev, Davide Andrea*

### Planning on Paper

Once the locations of the cable holes have been determined, you can start to arrange the batteries in the series string for that box. Since this is often a trial and error process, and batteries are heavy and hard to move, this task should be done on paper.

To make this paper pack building easier, I have scale drawings of the batteries we use. There are enough batteries on a sheet to lay out a 144 volt pack of that type of battery. All the terminals and filler holes are shown in their proper location and orientation. If you would like some of these sheets, write or email me. Be sure to tell me which battery you want-6, 8, or 12 volt.

Cut out the individual batteries. Get a piece of paper big enough to hold all the batteries you are going to use, and a stick of removable glue. Now you're ready to start building your string.

Draw an outline of the battery boxes that will hold the paper batteries. Starting with the rear battery box, place the first battery in position with the positive terminal against the spot that you have chosen for the cables to exit. This positive terminal is the most positive terminal of this battery pack. Use a little glue from the glue stick to hold the paper battery in position.

Place the next battery in the string, with its positive terminal positioned to allow it to be connected to the first battery's negative terminal. It is important that the interconnect— the cable or strap that connects the two battery terminals— doesn't run over the tops of the battery filler caps, interfere with other terminals, or cross over other interconnects. Continue placing the paper batteries in this manner until you have filled the box. The negative terminal of the last battery is the most negative terminal of this battery pack.

### Cable Entry and Exit Points

Just as the number of cells in a battery determines where the terminals are on the lid, the number of rows of batteries in a battery pack has an effect on where the most positive and most negative terminals are

located in the pack. A single row of batteries hooked up in series will have these terminals at the ends of the row. A long cable running along the top of the batteries or outside the box will be necessary to bring the most negative end of the string out of the pack on the same side or end of the box as the positive end.

Two rows of batteries can be interconnected at the opposite end of the pack. Continue the series hookup back so that the most negative terminal is located on the same side of the box as the most positive. The amount of space required for a three or four row box makes them rare, but hooking the rows in series can be done with a little thought and cable.

Work with your paper batteries until you get a layout that suits you. Repeat this process with the remaining boxes. This is the time to pay attention to the placement of the cable holes in the boxes for the most efficient cable run to the next box or component.

## Connecting the Boxes

At this point, you have two or three separate battery packs hooked together in a series circuit, with a most positive and most negative terminal for the total combined pack. You will also find that one of these terminals is at the end of the rear pack and the other is at the end of the front pack. I prefer to have the most negative end of the series in the front of the car. This makes a short connection between it and the controller, which is located at that end to be close to the motor.

The side of the front pack the most negative connection exits from will depend on the exact location of the controller. A little work with the paper batteries should bring these two connections as close to each other as possible. The most positive side of the circuit can then be brought to the front of the car (and to the area of the circuit breaker, main contactor, and controller) by means of a long cable from the rear.

We now have a battery pack laid out on paper. We were careful to position the batteries so that the interconnects between them didn't interfere with other parts of the batteries or each other. We positioned the most positive and most negative terminals of the separate battery packs to minimize the length of cable runs. We brought the most negative battery pack terminal close to the controller.

All of the above work has been done on paper. The actual connection of the batteries has to be done with the batteries in the car. Since this requires some heavy lifting I am going to stop here. Next issue we will look at the various ways to interconnect the batteries. I feel that this is a topic that should be thoroughly covered because battery terminal failure is one of the most common and potentially dangerous EV problems.

Talk to you then.

*Mike Brown, Electro Automotive, PO Box 1113-HP, Felton, CA 95018-1113 * 831-429-1989 * Fax: 831-429-1907 * mike.brown@homepower.com * www.electroauto.com*

| Go-Kart Specifications | |
|---|---|
| Motor | 2HP, 120VDC Permanent magnet |
| Batteries | Four 12 volt 20 amp/hr SLA in series |
| Controller | Homebrew 3kW FET output, PIC-controlled |
| Speed | Safety limited to 10MPH |
| Run time | 60+ minutes |

*By Frank Giannandrea, DEVA member*

Frank has always been interested in the advancement of electric vehicle technology. A DEVC member for 5 years, his skills in electronics and passion for EVs recently cumulated in the form of an electric go-kart for his kids. After living in CO for 8 years, Frank moved to NJ where he now works as a web developer for an electronics firm. He continues to support the DEVC as a sponsoring member because, "I believe that electric vehicles will eventually be the most reliable and environmentally clean option for personal transportation."

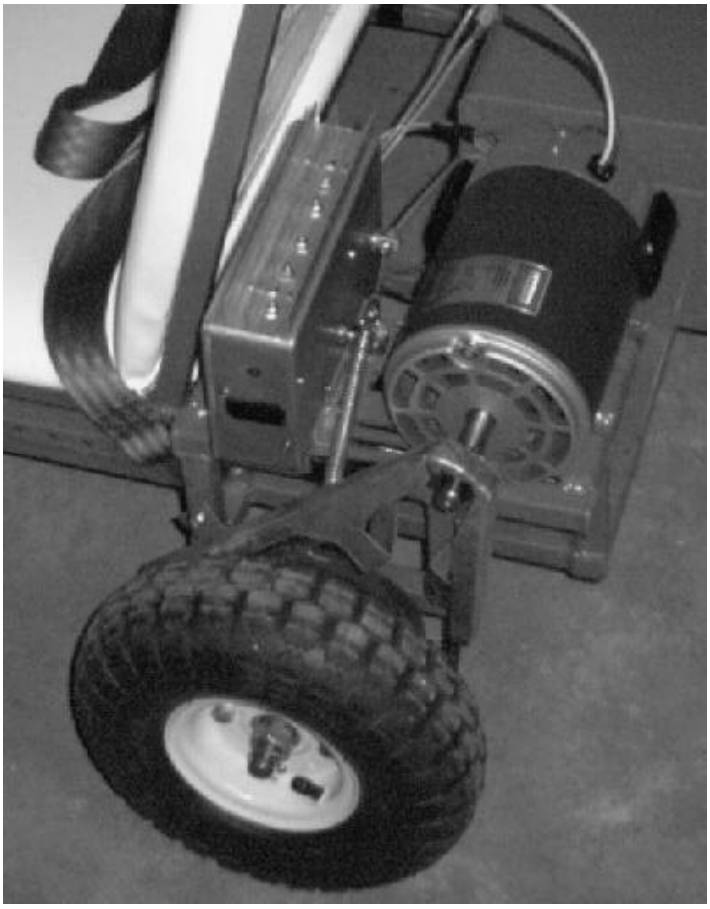
The Kart story: I don't have an EV for myself, but I have always wanted to build my own, however it never seemed that I would get the opportunity. One day I was watching my kids ride on a neighbor's store bought kiddie car and thought hey, I could make a electric go-kart. I figured it would be a fun project for me, help me keep my skills fresh and something the kids will enjoy it too. With this idea in mind and the fact I seem to love to build things from scratch, I started working. I was shooting for a vehicle that was a wide two-seater with a rigid frame, high enough off the ground to ride easily in the backyard or in mild off road conditions. With no plans to kill my kids any time soon, I would be happy with high end speeds of 7 to 12 MPH and with at least 30 to 40 minutes running time on a charge.

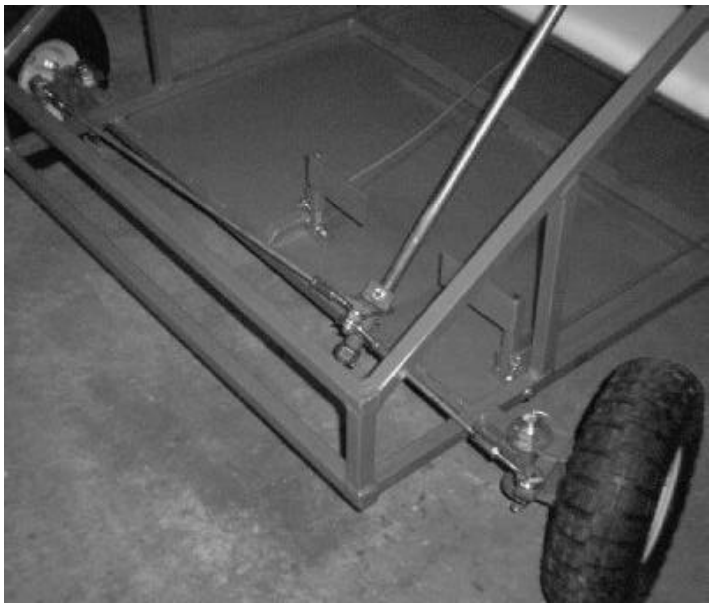
Since I wanted to make most of the project from scratch, I weighed my options as to the choice of material. Choosing steel over aluminum was a matter of convenience, it was easy to get and having no access to an aluminum welder, the choice was made very easily. As it was, I need to brush up on my MIG welding anyway; I wasn't going to try to attempt aluminum at this point. Almost all of the steel metal stock came from local hardware store, most of it was several 4 foot sections of 3/4" square box, 3/4" round, 5/8" solid round, and a large flat sheet.

After sizing my kids up and figuring out some growing room, I laid out a simple frame design, welded it up over a period of 4 months or so. I made all of the steering parts as well, settling on a simple adjustable front-end layout. In the rear end, there is a solid shaft used as a back axle. It is not a "live axle" however, as the kart is only a single wheel drive system. The solid shaft was used to hold the wheels and has a metal tube over the center of the shaft. This metal tube has two perpendicularly welded structures that are connected to the two rear band/drum brakes so it applies equal force on the brakes. One rear wheel has a 66-tooth sprocket collected via #35 chain to a 12-tooth sprocket driven by the motor.

Most of the framework is over kill on strength and so the weight could be much less, but this was my first try at this sort of thing. I found an inexpensive surplus electric permanent magnet motor used for treadmills this was rated at 120 VDC at 14 amps continuous or about 2 HP. With rated speed of the motor the gearing and the size of the 10" tires the maximum speed was just over 20 MPH.

Since my intent was to run the motor at a lower voltage the speed would drop in to my target range, a 48 VDC system is what I settled on. Now I went about building a pulse width modulated motor controller. Yes, I know I could have bought one there are many good controllers on the market, but as I said before I like building things from scratch, so some would say I enjoy pain as well. All I can say is that nothing built from scratch is easy, but you sure will learn a lot in the process! At this power lever everything is the system must be considered.





Did you ever notice how hard it is to find a inexpensive 60 VDC switch at 40 amps? I heard a story with a person who used a standard AC light switch, with 24 VDC powered motor, only to have it fuse closed when he wanted to turn off the motor. This was on a go-kart, I'm sure it made for a very exciting ride!

Building a speed controller and finding cut off switches for safety were not a easy. I read a lot on the specifics of speed controllers, there is a lot of information available on the Internet. Like anything in this world, it was also filled with personal views on what was the best way to achieve the end goal. I also found a lot of this information contradict other information. So after thinking about what would work I started experimenting, in the end, the controller I designed and built was based on PIC16C71 microprocessor, TC4427 FET drivers, and IRFP260N FETs. Field Effect Transistors are very common to speed controllers, as they have very low resistance when on and very high resistance when off. They are different from most other bipolar transistors because the input current required to drive the transistor on, is very small, especially at when the transistor is controlling high currents. This is not true for bipolar transistors, typically the more current the transistor is switching, and the more current the transistor needs to turn on. FETs are fairly robust devices, but to make a controller work reliably there are many things to consider. I can easily say that after smoking a few FETs in the process.

What I ended up with a design that can easily handle 55 VDC and up to 60 amps. I found that current sensing in the controller was one of the best options for protecting the circuit and the FETs. You can easily draw 150 amps or more from the batteries over the short period of time. The FETs can survive that current but only for very short periods usually measured in the milliseconds.

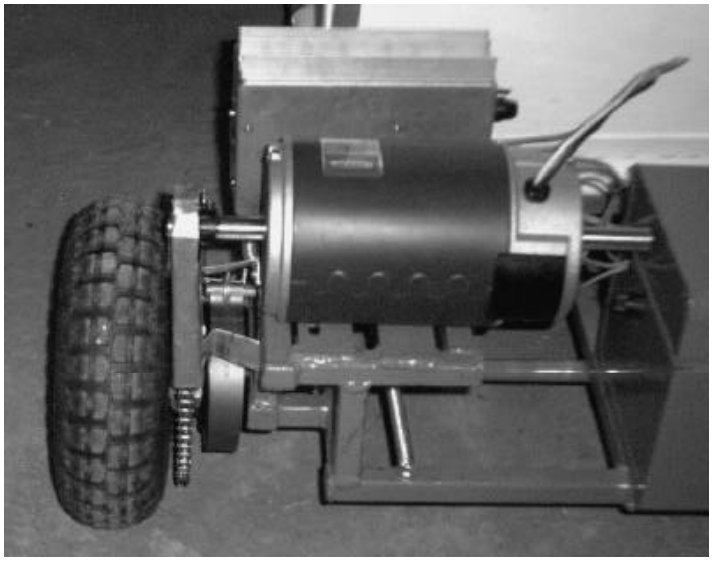
Since this controller was intended to control the speed of the motor and not the direction, a "free wheeling" diode was used across the motor terminals. The original diode I used was my main design fault, eventually shorting out under high motor loads, and then smoking the FETs later with excessive current. The controller also need to handle large spikes of voltage returned from the motor so transient protection was needed.

Another requirement of the controller was ability to ramp up and down the power to the motor so the shock to the power components were minimized. Battery power is supplied to the controller by four 12 volt 20 amps Panasonic sealed lead acid batteries fused and linked in series. A driver accessible 40 amp 80 VDC breaker/ switch is also in the power circuit, to allow all power to the motor to shut down in case of a problem. This particular item was about $5 and took a long time to find, luckily, found a source from a company that sells supplies for solar power equipment.

The go-kart runs very quickly in my back yard, with the two kids on it and the maximum output current set to 30 amps. So far I have estimated that it can get up to 10 MPH in the longest stretch of my back yard and battery life seems a little over a hour of running time. The batteries are charged with another project of mine, a microprocessor controlled a dual 12V battery charger. With the fuses pulled between the batteries I can charge two batteries at a time.

I had a great experience building this kart, there is a lot of technical knowledge I gained with building it. A couple of minor things I would have changed, the biggest would be in the placement of the batteries. The current placement makes the kart rear end heavy, better placement would have been under the seat, or farther forward on the sides to better balance the weight to the tires.

The other thing I would have changed was to build a 48 VDC charger instead of the dual 12V. It would be nice make one connection and charge the whole battery pack at once. But I wanted to get this finished for the kids, so that will be a later project. Which brings me to what is next; I am starting work on a new controller, one that is a H-bridge and thus add reverse. My plans for the controller include a rs-232 interface to make it more programmable and higher voltage, higher current so I can use the design for larger projects as well. Of course there is my daughter who is bugging me for her own go-kart, a single-seater similar to this one, but pink!"



## EAA NICAD BATTERY TEST RESULTS

*By Jim Stack, PEAA President*
*Dec 2002 test results*

In the search for a great EV battery we looked at old and new batteries. Sometimes you have to look back just to be sure you didn't miss something. We wanted batteries with long life, good AH capacity per pound, fast recharging and still affordable. We looked at flooded lead acid, sealed lead acid, NiCad, NiMH and Li-Ion. Bill Mulgrew is a long time car builder and EV driver. He has rebuilt many cars from a 1930 Model A Ford to a GTO, Roadrunners, classic Olds and many others.

After looking at every affordable battery we decided on some government surplus NiCad batteries. They were listed as having a voltage of 1.2 v per cell, weight of 1.5 lbs, and a few other details. It turned out they weighed 3.3 lbs each. These are smaller cells. Ten together equal a 12-volt battery. They had a C1 rating of 30 Ah. More research showed these batteries can be discharged down to 0 volts with no damage and they are good for 30 years. They also can be charged fast and aren't affected by cold or heat. This seemed too good to be true and would be perfect for an EV.

We also were told they were refurbished but we found they were new and had been stored for 10 or more years. With this type of battery age doesn't matter unless they were connected and put in service. When we got them there was a lot of work to open and inspect each one as well as re-tap the terminal screw holes and cleaning the terminals.

This type of battery has to be charged differently from lead acid batteries, and they have other unique characteristics. Keeping them away from lead acid batteries with their lead terminals is also very important.

Bill found many differences between these and any other battery he has worked with. Just connecting these together can be a big job. He checked on getting the connecting bars used by the military but the cost was about four times what he could make them for. He got some copper bars and had them cut and drilled. He knows how batteries corrode metal so he plated them with Zinc. This was a lot more work but worth it for a good connection that can carry high current. He also saw the cases expanded when charging the batteries. This required placing them side by side with support all around like the military case that held them. He did this by carefully placing them side-by-side in rows with the battery case supporting them at the sides and end. Each connecting bar had to be square and make solid contact to the next battery. The bolts had to be tightened to 35-50 lbs with a belville washer to retain the tight connection.

I e-mailed a few helpful EV drivers and racers and found they had heard of and tried some of these batteries. They were proven to be good on speed, giving up their power fast, but maybe gave less range. It's very hard to compare with 6V, 12V and the many different C1, C3, C5, C10 and C20 ratings batteries are listed with. Each case can be a little different.

Some literature and online information showed that SAFT NiCads should be very similar. Their 600-type batteries look just like the military batteries we have. We don't have prices or experience with them but they show more range and longer life than other batteries. I would expect similar results. They also have some in packs, like a 12v battery that would be very handy.

To test and compare these against other batteries we compared them to Hawker Genesis batteries that were in the G20 van to begin with. The van was originally made with one string of 6V Sodium batteries, when Bill got it there were 3 dead strings of Hawkers. There were also notes from users showing they never got over 30 miles to a charge.

http://www.hepi.com/genperf.htm (Hawker Web site battery info)

Some comparisons were very similar. A Hawker 12V weighs about 33 lbs, 10 of the NiCads we had totaled 30 lbs plus connectors so it's very close. The C1 number for the NiCads was 30 and the Hawkers were listed at 42 AH for C10 (this would be close to a C1 of 30). The recommended depth of discharge for the Hawkers is 80% which is what our controller is set for and would treat any battery the same way.

We ran a string of 18 Hawkers that had been charged and checked in the van for a few months that summer. After weeks of driving the same route he would get 8 miles before the controller would slow done with low battery power. He drove the same route and as close to the same start and stops as possible. He also watched the temperature. It usually took 3 to 4 hours to recharge.

On December 28th (with Terry Wilson, EAA Historian, who just happened to be visiting) we took a test run with only 1 of the 3 strings of NiCad connected. All were in the van's battery box so the weight would be the same. We went about 20 miles on one charge. It took about 2 hours to recharge. This was better than I had ever dreamed. With 3 strings we should be able to go 60 miles, maybe more. This is farther than we have seen or heard anyone going in a big G20 Van. With the faster charging, it would be no problem going too low on a charge. The idea that these could last 20 to 30 years is great.

We still have to try all 3 strings. Terry said he might be able to find the best charge methods, which also may improve range. If we could reprogram the controller to keep pulling from these new batteries it could go even farther.

Proving they last for 20 to 30 years will take time, but we have seen 20-year-old military batteries that tested as well as the batteries we have.

| Hawker Genesis 42AH | NiCad |
|---|---|
| 12v | 12v (10 cells) |
| 33 lbs | 33 lbs (incl connectors) |
| C1 30 | C1 30 |
| 600 charge cycles | 20,0000 charge cycles |
| DOD 80 % | DOD 100% |
| 4 HRS to charge | 2 HRS to charge |
| G20 range | G20 range |
| 10miles | 20 miles |
| 3 string | 3 string |
| range 30-40 | range 60-70 |
| each $121 | $50 ($5 each approx) |
| Life years 3-6 | Life years 20-30 |

Picture of test vehicle at Phoenix auto show, see page 20 of this issue.


*By Lee Hart, EAA member*

I thought I might mention how my 6th grade class is coming on their "Segway." I'm an engineering mentor in a program called BEST (Bridging Engineers, Science, and Teaching — see http://www.bestoutreach .org). We go into classrooms and help the kids design and build their own electric vehicles, which they race against each other at the end of the school year.

Like many states, Minnesota passed a special law allowing a "2-wheeled non-tandem self-balancing" vehicle to be ridden without license, registration, insurance, helmet, or age limit anywhere that pedestrians are allowed. Obviously, it was only meant to apply to the Segway. But the kids decided to build their own vehicle to meet these rules. They REALLY loved the idea of a vehicle that they can ride even where bikes, skates, scooters, and skateboards are not allowed!

They built several small models, using several different schemes to meet the rules. The one they settled on is a "car" with only a right-front and left-rear wheel. The wheels are wide SUV tires, so wide that they act like rollers and stand up by themselves. The seat and battery are located very low, to keep the center of gravity below the axles; this makes it self -balancing.

They have a pair of EV Warrior motors, and plan to use one on each side, driving the wheels with a v-belt. A 2" pulley goes on the motor, and the v-belt actually fits in the tread grooves in the tire.

They plan to steer it with skid steering; turn on one or the other motors and/or pull independent brake levers for each side. (I have my doubts, but the way BEST works is by letting them conduct the experiments themselves, and learn by doing).

Anyway, I am very proud of them for trying such an ambitious project. Just imagine; a team of 6th graders is building a "Segway" for perhaps $100, when Dean Kaman needed $100 million!

*More pictures in upcoming issues.*

## CLEAN AIR AWARD - ED HUESTIS AND "VOLTAGEVILLE"

*American Lung Association, May 16, 2001*

Ed Huestis is a busy man today. He's being honored by the American Lung Association in San Francisco and he's receiving WestStart's 5th annual Blue Sky Award in La Canada-Flintridge. Huestis chose to attend WestStart's luncheon this afternoon to receive his award. This coveted honor recognizes companies, organizations or individuals who are selected for making an outstanding contribution to clean air, energy efficiency and to the advanced transportation industry. Past recipients include Ford, General Motors and Toyota.

In addition to this honor, Huestis won the Clean Air Award for outstanding transportation, an award presented by the American Lung Association. Because both ceremonies occur at the same time, Vacaville Mayor David Fleming will accept this award on Huestis' behalf. "The efforts are finally beginning to pay off. There's been a lot of late nights, but it's all starting to happen," said Huestis of his prestigious awards. Though he wishes he could attend both ceremonies, he's pleased to have the mayor accept the award for him. Plus, the mayor will apparently take an environment-friendly mode of transportation. "I'm pretty sure he'll be taking the ferry," quipped Huestis.

As Vacaville's transportation systems manager, Huestis began attending and holding ride and drive events to promote the use of electrical vehicles in 1998. Since then, he has purchased charging devices and a fleet of electric cars for the city. Right now Vacaville owns four Toyota RAV4s and three Nissan Hyperminis for city officials to use. Huestis is also waiting for two Ford Ranger EVs for the water department. In addition to spreading more awareness about electric vehicles, the major contribution of Ed Huestis has been his ability to offer residents financial incentives to help pay for electric vehicles. EV's are not available for purchase and typically a monthly lease can be as high as $499.

To reduce the cost of leasing, Huestis applied for and secured a grant that could provide a $6,000 incentive to any Vacan who buys an EV from an automobile manufacturer. In total, he has secured nearly $1 million in federal grants to further help Vacaville residents pay for these cars. Now, owners of EVs through Huestis' program can pay as low as $310 per month. His efforts currently allow this city to boast the most electric vehicles per capita in Northern California, an accolade that has earned Vacaville the name "Voltageville" among EV enthusiasts and environmentalists alike. The publication, evWorld, calls Vacaville "America's EV home town." Electric car proliferation is heaviest in California, and to say that Huestis is the leading residential EV proponent nationwide may even be an understatement.


*Ed Huestis (right) raffled off a Voltageville "Only Way to Fly" t-shirt to winner Jim Van Scyoc at a resent NBEAA meeting.*

Huestis' progress in promoting EV usage seems to be keeping up to speed with his prized vehicle's technology. The 1997 General Motors EV1 model that he began driving three years ago required frequent stops to recharge its battery. A trip down to Los Angeles meant pulling over 10 times to fill his battery at stops along Route 101, the only route in the state that is adequately equipped with these charging devices. His new 1999 EV1 model requires only four stops. In addition to more efficient batteries and more charging stations, electric car travel on highways is assisted by being allowed to drive in the carpool lane.

As the technology gains momentum, and cost continues to plummet, demand will undoubtedly increase. It already has in Vacaville. Right now more than 100 people remain on a waiting list for Huestis' incentive program. Though he wishes that manufacturers would produce the vehicles at a greater pace, he knows that the overall goal of his program is working. "One of the biggest ways that we can make a difference is by driving more of these. We need to raise awareness, and not have people think that they are a slave to the fuel vehicle. There is a cleaner way to go," he preached.

Vacaville is only a few cars away from having the most electric vehicles per capita in the entire state. But Huestis would be lying if he didn't admit to actually enjoying the EV experience on top of the financial and environmental benefits. His vehicle's quick acceleration and stealthy whir illicit what Huestis calls the "the EV1 smile." Sitting behind the wheel of his sleek red vehicle whose body looks like something out of the "Jetsons," he praises the fuel and cash efficiency of his vehicle. A round trip to Los Angeles costs him less than $10. Aside from the fuel efficiency, Huestis feels that it's hard to beat his car's comfort and technology. "Once you drive an EV1, you'll never go back," he added.

*Although this award was given 2 years ago, Ed Huestis has continued to promote EV usage in the city of Vacaville. Some updated information on the Vacaville EV Program (from the EV1/RAV4-EV group):*

Ed Huestis reported that since the last EV1 meeting, five RAVs were delivered before New Year's Eve, then six more on that day. That brings the number of EV's placed in Vacaville to 95 total. Seven more RAVs are to be delivered once they hit the docks in Long Beach. Ed is considering making a video with the Vacaville participants about how many EV miles have been driven and correspondingly how much energy and pollution has been saved by the program.

## INDUSTRIAL NEWS - CORRECTION

*By Rick Woodbury*
*President, Commuter Cars Corporation*
http://www.commutercars.com

In response to a news release (Industry New) in the last issue of Current EVents, where Commuter Cars was described as receiving a $300k loan, the record needs correcting.

Commuter Cars does not resort to loans for raising capital. The approximately $300k in capital contributed by the investor was for purchase of stock in the company. This funding commenced in the summer of 2000, not in 2003, as the article misinformed.

Following are brief outlines on the product and company plans. Please remember that Commu ter Cars is an early stage company so reality may prove different from these plans. *This material is for information only and should not be construed as a solicitation of funds.*

### Design Objectives:

To provide a safe and efficient, powerful, high quality, zero pollution vehicle that can dramatically reduce commute time and provide parking freedom.

The key to this is the Tango's unique size and stability. At just 39" wide and 8' 5" long, the Tango can be parked perpendicular like a motorcycle. And, also like a motorcycle, the Tango can snake through slow moving or stationary traffic. The unique size advantage will assist in reducing journey times and parking hassles. Commuter Cars has a patent on this unique design, and the Tango is classified as an Ultra-Narrow Vehicle.

The stability comes from the ballast provided by the 25 12-volt lead acid batteries at the base of the car. The power available from the battery pack is capable of accelerating the Tango to 60 MPH in 4 seconds and to a top speed of over 130 MPH. The useful range at freeway speeds will be 60 miles. The Tango can be recharged from any standard 110-volt or 220-volt outlet as well as conductive EV charging stations.

The Tango, unique in its ability to outperform the quickest production cars on the market, will have a build quality and finish that you would expect in any high performance vehicle. Plus, as an Electric Vehicle, it qualifies for certain city, state, and federal tax incentives.

### Funding Objectives:

From a company perspective, we are now in initial fundraising mode. The objective is to close an initial round as soon as possible to secure $2.5M to bring the Tango into limited production of 10 kits per month. Once funding is secured, we will be accepting deposits to be held in neutral escrow. The first few units will be available by year's end, selling for $80,000.

The next phase will be to engineer and introduce a lower cost variant selling for $42,000 by Q4 2004. At this point the company becomes profitable and will have demonstrated the demand for Ultra-Narrow Vehicles. Then we will commence with plans to enter volume production. This will incur substantial engineering and tooling costs but will lower the retail price to under $20,000. First year production will be in excess of 10,000 vehicles. As demand grows, production can be ramped up and we envisage a market of hundreds of thousands of units per year within 5-7 years. Sales of this order will provide Commuter Cars with multi-billion dollar revenue and a substantial valuation.

### The Market:

The US has approximately 90 million single-occupant car commuters who travel an average of 20 miles on their own each day. The global commuter market measured in passenger kilometers will double between 1990 and 2020 and will double again by 2050 to over 100 trillion passenger kilometers. US Vehicle sales for 2003 will be over 16.5 million units.

Commuter Cars will be the leader in this second car commuter market. As global traffic congestion continues to grow and the costs of gas and city parking increase, these macro-economic changes will further amplify the demand for ultra-narrow, zero-emission vehicles. With a strong patent and first player advantage, Commuter Cars will be the leader in the market that can best relieve global traffic stagnation. We have already received positive recognition from federal, state and city governments who see the Tango and the introduction of special ultra-narrow lanes as an important way to address city congestion and help restore downtown sanity.

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The cost for a 1997 EV1 lease assumption is $175/month, with a $595 one-time fee for the lease assumption. EV1s turned in early go first to Vacaville people, but Ed has discretion to place them with others if there are no takers in Vacaville. Preference goes to someone who at least drives through Vacaville periodically!

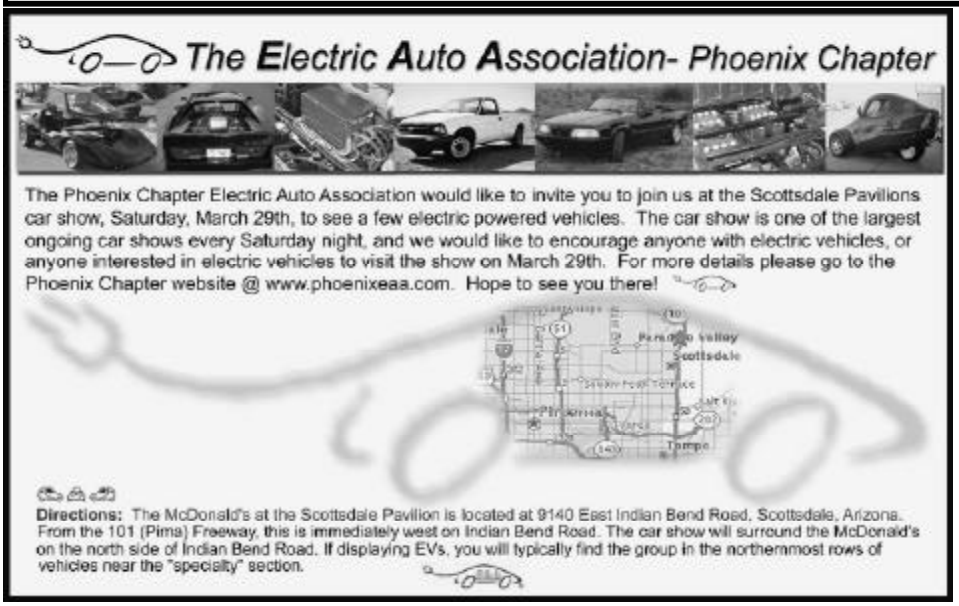
Work is also proceeding on charger installations in Vacaville. At the Stars bowling center, the contractor has the go-ahead to install two small-paddle inductives (SPI) and two AVCON conductives. Electrical work is done for two TAL SPIs to be added at the Vacaville Regional Transportation Center park & ride lot on Davis Street. There will also be another park & ride lot put in on other side of the freeway at Davis Street with four SPIs and two AVCONs plus a PV system to help power them. That will mean lots of charging within walking distance of the Brendan theatres. Chargers for the downtown parking lot #9 are also ready to go, and work is proceeding for the 39kW PV system at City Hall.

Ed asked for suggestions on how to do special striping for the EV charging spaces at Costco in Vacaville. The group's recommendation was a wide white line across entry end of all the spaces, with "EV PARKING ONLY" written in green on top of the stripe.

The program will provide eight Nissan Altras for Vacaville and two for Dixon, and will be installing the GM Gen2+ SPI chargers that go with them. The Dixon charging station will be a good spot to split the distance between Vacaville and Davis with several eateries nearby.

Ed also hopes to swap out Benicia, Fairfield and Vallejo large-paddle chargers for SPI under another program. The earliest timeframe for funding that program is May.

*Let's continue to encourage the progressive work of Ed Huestis and others, and boldly champion the EV cause.*




*By Ed Thorpe, EBEAA member*

Mike Pengelly of the Phoenix EAA organized about 17 EV members from the local chapter to participate in a local Pavillon Mall Auto Show in Scottsdale on Saturday, 29 March. This was a great method of drawing EVers together and exposing the public to the presence and benifits of EVs. What a sight to see electrics and hybrids mingling with turbine-driven motorcycles, Model T hotrods, decked-out Hummers and other show cars.

Every chapter should consider participating in any and all local car shows. Great idea for gathering EVs together and exposing the public. And most of the organizing is provided by the show rather than all on the chapter.

*Couple of Segways to show state-of-the-art mobility*

*Phiefer Dietrich's Bicycle creation*

*Rick Smith's Corbin Sparrow, updated for the Phoenix hot temp*


*Mario DiMarco's Pheonix 500 racer*

*Bill Mulgrew's G-Van, test bed for the NiCad batteries (article)*

*Jean Tasmano's Pickup has logged over 100,000 miles*

*James Wolfe's Dodge TEVan*

*Glen Rector's Pickup with lift/tilt bed to get to the batteries*

*Sam DiMarco's Chevy S-10 Electric Pickup*

*Dennis Berube's KIllowatt Dragster, just in from the drag*

*continued from page 1*

They can be raced on closed-circuit courses indoors, as well as outdoors on drag tracks, go-kart circuits, or the Bonneville Salt Flats (one of John Norton's barstools was clocked at 37 mph!).

*A Thunderstool model, ready to race.*

The National Organization for Barstool Racing in America (NO BRA) has established rules for the design of competition barstools: They must use a real barstool as the basis with a minimum height from ground to seat top of 30 inches, may use no more than 12 volts for power, have a maximum overall width of 23 inches and a maximum 21 inch wheelbase. Steering and brakes in some form are also required. Most are powered by an automotive starting battery or a deep-cycle battery such as the Optima Yellow top, and use an automotive starter motor for the drive. Most are belt-driven to the rear wheels separately, through a moveable jackshaft for reduction and clutch control. Brakes range from simple friction plates rubbing on the tires to drum or even disc brakes. Wheels and tires can run the gamut too.

Assuming a bar stool can be obtained reasonably, it's hard to imagine a less expensive or more entertaining way to get a drivable EV. And the attention they draw can be a benefit or a problem – one builder of a really hot racing ICE barstool quit taking it to the automotive races because the crowds that gathered were a distraction from "business."

Electric vehicles should be fun as well as functional. With examples like these, the availability of inexpensive parts, and the knowledge sharing and camaraderie of the EV community, playfulness can become more of a routine part of our efforts to educate the general public to the benefits of EVs.

**Bar Stool Racing Specs:**
http://www.thunderstool.com/rules/barstoolracersclubrulesflyer.jpg

**Other Links:**
http://www.thunderstool.com/

http://www.saltflats.com/barstool.html

gttp://www.barstoolracing.net/Jim's_page.htm

http://www.geocities.com/RainForest/Vines/5565/barstool.html

*Up on 2 wheels, lots of fun.*

http://www.azroom.com/barstool/page100/page100.htm

Definately a worthwile adventure on a fairly low budget for an EV.

*Bar Stool Polo practice..*

*By Charlie Garlow, EVA/DC member*

Dennis Weaver, movie actor and environmentalist, is sponsoring a cross-country motorcade of hydrogen and electric drive vehicles. See www.ecolonomics.org for details as they emerge on this May 1-14, Los Angeles to San Francisco to Salt Lake City to Denver to Detroit to Cleveland to Pittsburgh to Washington D.C. demonstration of clean car technology.

Hey, if you live along this route, why not help out? Join the motorcade with your EV for part of the distance. Circulate the petitions that are on the web site and present them to Dennis, to your mayor, or someone.

How about some advance publicity to "hubba-hubba" your local newspapers, radio, etc. Any coverage you can get for our electric drive movement is good. Here is a hard news hook, also known as a good excuse to call up the radio talk show folks: suggest a live call-in radio show with Dennis from the cockpit of his clean car.

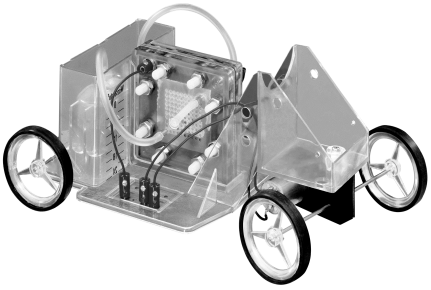
How about having a Junior Solar Sprint race, like we are doing here in D.C., and have Dennis hand out the trophies? Or arrange to have the clean cars visit a local school science class? They have to stop at night and sleep, so why not sponsor a welcoming luau for the caravan? Party down! Use this as an excuse to build your membership or form a chapter where there wasn't one. Use your imagination.

Call me with your ideas.
Charlie.Garlow@juno.com
ph 202-564-1088 fax 202-564-0068

*Note that this drive/event is focused on promoting the "Hydrogen economy". Other alternative energy advocates are piggybacking on this effort, but they do not seem to directly support the battery EVs (Editor's opinion, from attending one of their stops). Many still don't realize that Hydrogen Fuel Cell vehicles are electric.*

# From Germany: New educational package

Build and operate a **hydrogen powered fuel cell** zero emissions vehicle. Step by step learning of all parameters in physics, chemistry, electrical, and math. 30+ experiments and digital VOM meter included along with **96-page lab manual.** This is not a cheaply built toy, but a complete educational package with manual and hardware worthy of the finest technical schools in the world.



* Uses water to make Hydrogen and oxygen – stored aboard vehicle which then are recombined within the fuel cell to make electric power which runs the vehicle for 15 minutes. Included solar panel eliminates batteries; car can be run as a hybrid in sun and shade for increased range. Clearly demonstrates all advantages of this new 'green' technology.

Designed for age ranges 12 to 112 yrs, all educational levels. Great gift for the inquisitive talented youngster – or to bring out a talent. After completing the manual, this youngster will understand ***your*** EV and motivations, and the necessity of making the proper 'green energy' choices regarding his/her own vehicle when the time comes to choose.

Fun to build. Fun to run.
Fun to learn what makes it run.

- Included only by this dealer – 25-page addition to the manual picking up where lab manual leaves off with a flowchart of all presently driven low or no emission vehicles, additional info sources, political issues and 'of interest' websites. This addition actively promotes the EAA.
- EAA members get the 'in quantity' school discount even if ordering one kit. Why? Because your dealer is a believer and EAA member, PEV owner/driver (several vehicles) since 1996.
- Price, (Hobby shop) $150**. EAA member price $125 plus $10 p/h.** Or SASE for further information. Make out check or PMO to David Robie, PO Box 414, South Weymouth, MA 02190. 781-335-5322 days, mycroftxx@juno.com. Purchase orders accepted from accredited institutions.

*By Bob Oldham, EVA/DC member*

In addition to conventional electric vehicles (EVs), Neighborhood Electric Vehicles (NEVs) have the potential to both reduce traffic congestion on city streets, because of their smaller size, and reduce air pollution, due to their all-electric propulsion systems, in the cities where their use becomes prominent. Therefore their use should be encouraged, especially since their range and speed capabilities are an excellent fit with the transportation needs of a large percentage of in-town commuters.

Incentives will be necessary to encourage the adoption of the use of NEVs. One such incentive could be the access to priority lanes for their use, similar to the high-occupancy-vehicle (HOV) lanes on Interstate highways. Given the relatively small size of neighborhood electric vehicles it should be possible to engineer street lane layouts to provide lanes designated for NEV and conventional EV use. In these lanes NEVs and EVs would have priority or exclusive use. For improved commuter access, only arterial streets would need designated NEV lanes, although major feeder streets should also have designated NEV lanes.

NEV lanes should be engineered so as to provide the optimum security of travel, with access priority for certain features of the street system such as left-turn lanes. For the most efficient incentive, the lanes should provide desirable travel conditions such that drivers will want to have access to their special priority through adoption of the use of an NEV themselves. This sort of incentive would yield the benefit to the city of both reduced congestion and reduced air pollution, with the added benefit of greater public safety due to the inherently lower speeds of NEVs. On the streets where the NEV lanes have been established, the posted speed limit should be the top speed of the most common NEVs in use in that community. Enforcement will be needed to ensure that excessive and hazardous speeds common on most major streets no longer are possible.

It should be possible to get the cooperation and support of local NEV dealers and manufacturers, as well as NEV and EV owners, for the campaign for approval by the city's administration of designated NEV lanes. Drive-and-Ride events, demonstrations and exhibition of vehicles at popular gatherings such as street fairs, parades, and sports events, and other methods of increasing the visibility and effectiveness of the message will be helpful. In a few locales NEV manufacturers may have already donated, or can persuaded to donate, a quantity of vehicles to local, state, or Federal government agencies, potentially increasing the receptivity to the idea of designated NEV lanes.

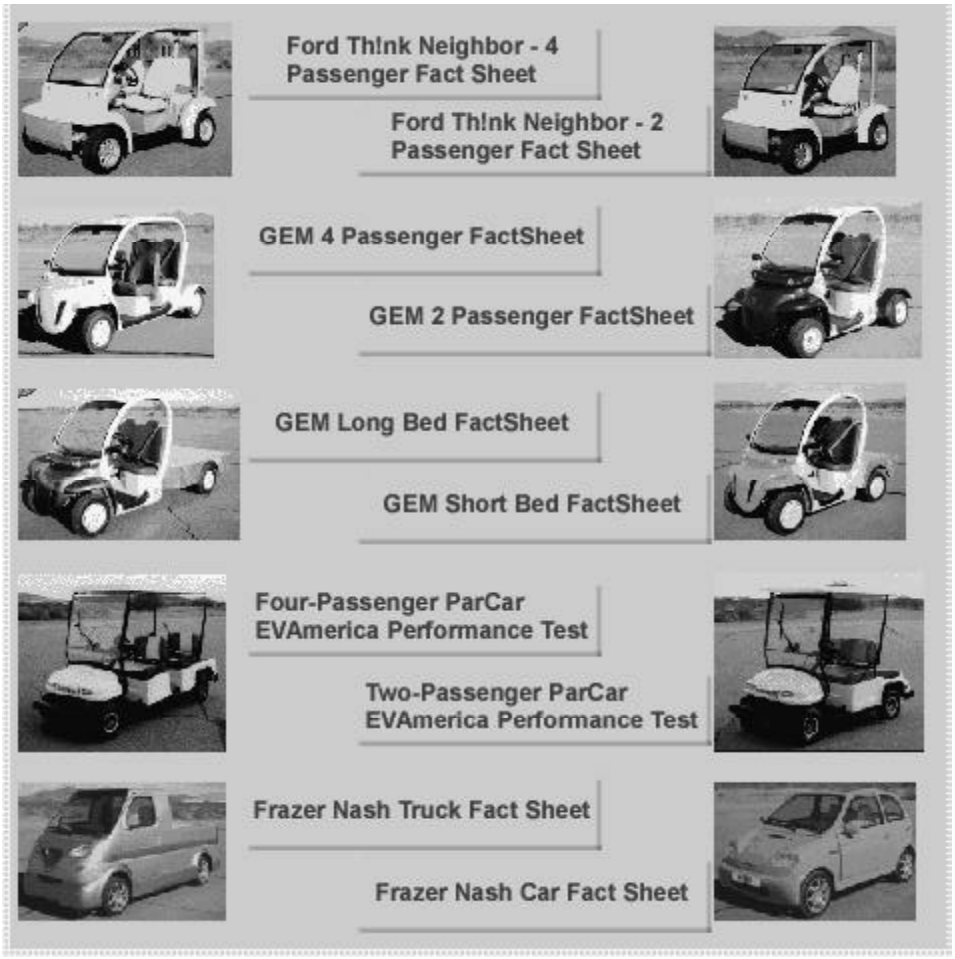
When a few such designated lanes have been established by one or more cities, the sharing of the information about the conduct of the campaign as well as success stories regarding the use of the lanes, will greatly assist in the campaigns for adoption of NEV lanes in other cities and towns. As the momentum builds and more users get experience both with the vehicles and with the specially designated lanes, many users will have overcome the resistance to conventional EVs and will become part of a market for them. This in turn will increase the demand for both conventional EVs and NEVs, propelling manufacturers into the market as well as enhancing the ability of existing small, specialized firms to succeed.

This approach has the potential to convert a substantial proportion of the driving public to the use of EVs and NEVs for daily commuting within cities. While this does not address the problem of longer-distance commuting directly, the development of longer-range EV technology, given the existence of a market for EVs, should make available EVs capable of even the longest daily automobile commutes in most cities. Such vehicles have already been demonstrated as, for example, in the Solectria Sunrise. The use of such vehicles would increase the positive impact on both air pollution and fuel demand of which EVs are capable.

Since giant steps seem not to be possible, small steps, such as are proposed here, may cumulatively succeed in making more widespread the use of electric vehicles. Our cities and our country would be the beneficiaries.

*Editor note: NEVs make good first cars for teenagers - provides "wheels", room for friends, but limits maximum speed and range to reduce frequency of accidents. Also would be great for driver training, except for the 25mph max limitation.*

*Additional info: http://avt.inel.gov/nev.html*




Columbia *ParCar's* two-passenger neighborhood electric vehicle (NEV) led the pack in distance running under tests of 10 low-speed electrics sponsored by the U.S. Department of Energy. The micro-car ran 52.9 miles before needing a recharge for its six lead acid batteries. However, it came in last in accelerations, taking 22.9 seconds to get from zero to 20 mph, according to results released last Fall by DOE's Field Operations Program. Other NEVs tested were Ford's Th!nk *Neighbor*, DaimlerChryslter's *GEM*, and two Frazer-Nash models.

The testing program, managed by the Idaho National Engineering and Environmental Laboratory, in past years has given comparable trails to full-size EVs such as GM's *EV1* coupe, Ford's *Ranger EV* pickup, Toyota's RAV-4 EV and the Honda EV+. But the only battery cars now in volume production in the U.S. are NEVs. Sometimes described as golf carts modified for street use, NEVs are allowed in 35 American states on roads with speed limits up to 35 mph. The vehicles themselves cannot be programmed to operate at speeds greater than 25 mph.

The DOE trials were conducted in Phoenix, AZ, testing site over a six month period starting in November 2001. Columbia supplied a 2-passenger and a 4-passenger ParCar and For a 2-passenger and a 4-passenger Neighbor, DaimlerChrysler provided four GEMs (Global Electric Motorcars) - 2-passenger, 4-passenger, a short be utility and a long be utility. Frazer-Nash offered a CityCar enclosed passenger car and a "Sensible Utility," a small pickup.

Only two of the manufacturers - GEM and Columbia - are major producers now in the NEV market, with production in the thousands of units per year. Ford is shutting down its Neighbor plant as of the end of December. Frazer-Nash, a British firm, is a small volume specialty builder.

Columbia's NEVs outdistanced the others in the DOE test by a substantial margin, with nearly 53 miles for the 2-seater and 47.1 miles for the 4-seater in a test involving range at maximum attainable speed until it dropped below 18 mph. Runner-up was the short bed *GEM* with 41.2 miles. Range of the others was in the 30's.

While all the NEVs ran on lead acid batteries, a Columbia official suggested that the *ParCar* had a superior pack because its eight modules were flooded, not "maintenance free" gel cells, and because the unit had 6-volt nominal voltage allowing more power. The *ParCar* pack provided 146 ampere hours for a 48-volt system. By comparison, the *Neighbor* 2-passenger gel lead acid pack of six 12-volt modules had a rating of only 73 ampere-hours, only half as much, for its 72-volt system, and the *GEM* 2-seater pack with six 12-volt flooded batteries was only slightly higher than the *Neighbor*'s with a 79 Ah rating. Also aiding the *ParCar*'s distance run may have been the fact that its top speed was only 21.6 mph; therefore, the 2-seater presumably was drawing less current at the start of its distance trail than if it had begun nearer to 25 mph as did the others.

The Frazer-Nash utility truck did best in acceleration with 5.3 seconds for 0-20 mph. The acceleration performance goal for all NEVs was 6 seconds. The Columbia official could not say why the 2-passengter *ParCar*, which did so well in other categories, was so far behind in pickup. He said those who conducted the test offered no explanation.

GEM's short bed utility was the clear leader in terms of electrical efficiency while on the road. It consumed 97.1 watt-hours per mile. Runner-up was the GEM 2-seater with 111.2 watt-hours per mile.

| Vehicle | 0-20mph secs | Max mph | Range miles |
|---|---|---|---|
| Neighbor (2) | 6.3 | 24.2 | 33.1 |
| Neighbor (4) | 5.6 | 24.1 | 38.6 |
| GEM (2) | 7.3 | 23.7 | 33.4 |
| GEM (4) | 5.5 | 23.7 | 31.4 |
| GEM (short) | 7.8 | 21.3 | 41.2 |
| GEM (long) | 5.9 | 23.9 | 36.2 |
| ParCar (2) | 22.9 | 21.6 | 52.9 |
| ParCar (4) | 16.7 | 23.3 | 47.1 |
| Frazer-Nash (car) | 5.8 | 24.6 | 30.9 |
| Frazer-Nash (pu) | 5.3 | 24.7 | 32.7 |

### May 5 - 7, 2003

**FuSys2: Fuel Cell Systems Conference**, Las Vegas, Nevada, USA
*Phone:* +1-561-367-0193
*Fax:* +1-561-367-8429
*Email:* powersourcesnet@aol.com

### May 6 - 9, 2003

**Advanced Automotive Battery Conference**, Nice, FRANCE
Conference will discuss batteries for advanced vehicles, power generation and distribution on board vehicles, technical and financial challenges for ultracapacitors and fuel cells.
*Phone:* +1-530-692-0140
*Fax:* +1-530-692-0142
*Web Site:* http://www.advancedautobat.com

### May 10 - 13, 2003 P

**2ND EAA ALL-CHAPTERS CONFERENCE**, Washington, DC, USA
Planned to be held in conjunction with the Tour de Sol. All Chapters invited.
*E-mail:* evjerry@usa.net
*Web Site:* http://www.eaaev.org

### May 10 - 14, 2003

**2003 Tour de Sol: The Great American Green Transportation Festival**,Washington, DC, USA
From Burlington County NJ., through Trenton, NJ and Philadelphia, PA. Sponsered by NorthEastern Sustainable Environment Assoc.
*Phone:* +1-413-774-6051
*E-mail:* nesea@nesea.org
*Web Site:* http://www.TourdeSol.org

### June 3 - July 4, 2003

**Fuel Cell 2003**, Lucerne, SWITZERLAND
The Fuel Cell World & 2nd European PEFC
*Phone:* +41-56-496-7292
*E-mail:* info@efcf.com
*Web Site:* http://www.efcf.com

### June 7, 2003

**VEVA REV!2003**, Vancouver, British Columbia, CANADA
'EV Rides' in a show and ride event near Science World at First and Ontario.
*Web Site:* http://www.veva.bc.ca

### June 8 - 11, 2003

**Hydrogen and Fuel Cells 2003 Conference and Trade Show**, Vancouver Canada
The Canadian Hydrogen Association
*Phone:* +1-604-688-9655
*E-mail:* hfc2003@advance-group.com

### June 10-13, 2003

**Advanced Automotive Battery Conference**, Nice, FRANCE
Sponsered by the Advanced Automotive Batteries
*Phone:* +1-530-692 0140
*E-mail:* info@advancedautobat.com
*Web Site:* http://advancedautobat.com/aabc_current.html

### June 11 - 12, 2003

**Advancements in Battery Charging, Conditioning & Testing symposium**, Denver, Colorado, USA
Conference focused on applications and technologies in battery charging, conditioning, monitoring and testing of VRLA, NiCD, NiMH, and LI batteries.
*E-mail:* marshah@infowebcom.com
*Web Site:* www.batterypoweronline.com

### June 23 - 25, 2003

**Automotive Fuel Cell Systems Seminar**, Costa Mesa, California, USA
*Phone:* +1-877-606-7323
*E-mail:* CustomerService@sae.org
*Web Site:* http://www.sae.org

### June 29, 2003

**NEDRA Power of DC**, Mason Dixon Dragway, Hagerstown, Maryland, USA
Third annual Power of DC electric vehicle drag race.
*Phone:* +1-301-490-0657
*Web Site:* whttp://ww.powerofdc.com & http://www.nedra.com

### June 30 - July 4, 2003

**Fuel Cell 2003**, Lucerne, SWITZERLAND
*Phone:* +41 56 496 7292
*E-mail:* info@efcf.com
*Web Site:* http://www.efcf.com

### August 17 - 20, 2003

**Energy 2003: Real World, Real Solutions**, Orlando , Florida, USA
Sponsered by FSEC
*Phone:* +1-321-638-1014
*E-mail:* joann@fsec.ucf.edu
*Web Site:* http://www.energy2003.ee.doe.gov

### August 23, 2003 (tentitive)

**EBEAA EV Distance Rally - part II**, Hayward, California, USA
Second half of the Annual East Bay Chapter display and distance event.
*Web Site:* http://geocities.com/ebeaa

### August 23 - 25, 2003

**2003 Challenge Bibendum**, San Francisco, California, USA
Challenge Bibendum was conceived by Groupe Michelin to bring together and test the best available technologies for environmentally positive vehicles. Open to all energy sources. It features vehicles from virtually major vehicle manufacturer and brings together vehicle manufacturers, designers, energy suppliers, technical and industrial partners.
*Phone:* +1-864-458-4698
*E-mail:* lynn.mann@us.michelin.com
*Web Site:* http://www.challengebibendum.com

### August 31, 2003

**NEDRA 2003 Nationals**, Woodburn Drag Strip, Woodburn, Oregon, USA
Annual national electric drag races.
*Web Site:* http://www.nedra.com

### September 13 - 14, 2003 (tent.)

**GASLESS AT THE CROSSROADS**, Seattle, Washington, USA
Alt.Fuel Vehicle / and Electric Vehicle show, sponsored by the Seattle EVA, will be located at Bellevue's Crossroads Shopping Mall.
*Web Site:* http://slough1.home.mindspring.com/seva.html

### September 20, 2003

**SVEAA ANNUAL ELECTRIC CAR RALLY**, Palo Alto, California, USA
31th annual Premere West-coast EV rally. This year the event will be held at Palo Alto High School, at El Camino Real and Embarcadro Road.
*Web Site:* http://eaasv.org/

## September 24 - 26, 2003 ✈

**8th Grove Fuel Cells Symposium 2003**, Oxford, UK
Building Fuel Cell Industries conference and exhibition
*Phone:* +44-1322-663-006
*E-mail:* pamchattin@aol.com
*Web Site:* http://www.grovefuelcell.com

## October 3 - 4, 2003 (tent.) 🚌

**NORTHAMPTON ELECTRIC VEHICLE RALLY**, Northampton, North Carolina, USA
Eighth Annual road rally and autocross, the kickoff event for the 2003-4 EV Challenge.
*Telephone:* +1-252-534-1258
*Email:* johnsond.east@ncs.schoollink.net
*Web Site:* http://www.evchallenge.org

## November 15 - 19, 2003 ✈

**EVS-20 The International Electric Vehicle Symposium and Exposition**, Long Beach, California, USA
Powering Sustainable Transportation, the theme of EVS-20, highlights the important opportunity that electric drive technologies represent for addressing societal and economic issues shared across the globe.
*Phone:* +1-408-741-5870
*E-mail:* EVS20Symposium@aol.com
*Web Site:* http://www.evs20.org

## November 2003 *(Date TBD)* 🚌

**RICHMOND EV RALLY**, Richmond, Virginia, USA
Seventh Annual rally at Richmond Technical Center
*Phone:* +1-804-780-6237
*Email:* basketbaul@aol.com
*Web Site:* http://www.evchallenge.org

## December 9 - 11, 2003 ✈

**POWER-GEN International 2003**, Las Vegas , Nevada
Sponsered by the PennWell Corporation.
*Phone:* +44-1992-656600
*E-mail:* powergen@pennwell.com
*Web Site:* http://www.pennwell.com


*USA / Canada chapter distribution*


*USA / Canada membership distribution*

Email information to <cenews@eaaev.org>.

EAA **Chapter** Event = 🏳

EV related **Event** = 🚌

EV related **Conference** = ✈

## USA EV Organizations:

**Electrathon America**
*Web Site:* http://electrathonamerica.org/
*Focus:* Light-weight EV racing

**EV Challenge**
*Web Site:* http://www.evchallenge.org/
*Focus:* Educating Middle & High School children

**National Electric Drag-Racing Association - NEDRA**
*Web Site:* http://www.nedra.com/
*Focus:* EV racing

**National Station Car Project**
*Web Site:* http://www.stncar.com/
*Focus:* EVs to public Transportation

**Electric Vehicle Association of the Americas - EVAA**
*Web Site:* http://www.evaa.org/
*Focus:* EV industry organization

**Northeast Sustainable Energy Association, - NESEA**
*Web Site:* http://www.nesea.org/
*Focus:* Sponsers of the annual Tour de Sol

**EV List Photo Album**
*Web site:* http://www.evalbum.com/
*Focus:* Listing almost 400 electric vehicles from around the world - EVDL List owners

**Union of Concerned Scientists**
*Web Site:* http://www.ucsusa.org/
*Focus:* Citizens and Scientists for Environmental Solutions

## Non-USA EV Groups:

**EV Council Of Ottawa**
*Web Site:* http://econogics.com/ev/evco.htm
*Location:* Ottawa, Canada
*Focus:* Canadian EV organization and resource

**Australian Electric Vehicle Association**
*Web Site:* http://aeva.asn.au/
*Focus:* Australia national group

**Japan Electric Vehicle Club**
*Web Site:* http://www.asahi-net.or.jp/~MR5T-OKB/index.html
*Focus:* Japan national group
(Choose the english pages)

## Sources - Used EVs-4-Sale:

**EAA Main Links Page**
http://www.eaaev.org/eaaevsforsale.html

**Silicon Valley Chapter EAA**
http://www.sveaa.org/

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

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

**Phoenix Chapter EAA**
http://phoenixeaa.com/

**EVFinder**
http://www.evfinder.com

**EV Tradin' Post**
http://www.austinev.org/evalbum/geobook.html

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

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

Check out these websites and the various EAA Chapter websites for new and used EV vehicles, production and conversions, and EV parts.

## Fast Charge Anyone?

Need a quick recharge of your electric vehicle? This 50kW inductive charger is built to recharge an EV up to 80% state-of-charge (SOC) in just 15 minutes. The charger has a built-in credit card reader like a modern gas pump, except this one dispenses electricity safely and without the smell and toxic fumes of petroleum.

Also on display at NAEVI '98 were several conductive fast chargers that are also capable of recharging a vehicle in less than 20 minutes depending on the vehicle's SOC.

Interestingly, the most promising new market for these Level III chargers is in the off-road EV market of industrial forklifts and airport ground service equipment. Fast charging can eliminate the need for extra sets of batteries and the cumbersome process of swapping heavy batteries at shift changes. Paradoxically, fast charging also seems to increase the service life of lead acid batteries.

## EV Charging Maps & Info:

**Tom Dowling's EV Charger list**
Covers Arizona, California and Georgia.
*Web Site:* http://evchargernews.home.attbi.com/

**EV1-club inductive Charging**
*Web Site:* http://ev1-club.power.net/chglist.htm

**AVCON Charging**
*Web Site:* http://www.hondaev.org/chg.html

**Arizona EV Public Charging Sites**
*Web Site:* http://www.1opossum.com/chargers/

**Ottawa Canada Charging Locations**
*Web Site:* http://www.econogics.com/ev/chargloc.htm

**Additional Canada Charging Locations**
**Web Site:** http://www.ve-montreal2000.com/site/en/vebornes/Cartebornes.htm

**How to Install Electric Vehicle Charging**
*Web Site:* http://www.eaaev.org/eaaevcharging.html
*Web Site:* http://www.geocities.com/evcharging/

## — General Items —

| | | | | |
|---|---|---|---|---|
|   | *License Plate Holder, black plastic frame, white lettering on visible green.* | LICPH1 | $10.00 | |
| License Plate | *Motorcycle size, only in metal & black or chrome. (Special order, need additional 6 weeks.)* | Black: LICPH2-B Chrome: LICPH2-C | $14.00 | |
|   | *Embroidered Sew-On Patch, white. (Special order, allow an additional 3 weeks.)* | PATCH1 | $ 9.00 | |
|   | *Embroidered Sew-On Patch, green. (Special order, allow an additional 3 weeks.)* | PATCH2 | $ 9.00 | |
|  | *Embroidered Hat, adjustable fit.* | CAP002 | $15.00 | |
|  | *Embroidered Bucket Hat, comes in: small/medium & large/xlarge.* | S/M: DCP01-SM L/XL: DCP01-LXL | $25.00 | |
|  | *Ceramic Coffee Mug.* | MUG003 | $ 5.50 | |
|  | *Insulated Car Coffee Mug.* | MUG02 | $ 6.50 | |
|  | *Embroidered Polo Shirt (Forest or navy S,M,L,XL,XXL), 10 weeks for all colors other than Forest.* | SHIRT01-F-S SHIRT01-F-M SHIRT01-F-L SHIRT01-F-XL SHIRT01-F-XXL Same for SHIRT01-N-... | $40.00 | |
|  | *EAA Car Window Shade.* | SS001 | $ 8.00 | |
|   | *EAA Bumper Sticker #1 (10.5"x3.75").* | BS800 | $ 2.00 | |
|  | *EAA Bumper Sticker #2 "The Switch is on" (15"x3.75")* | BS002 | $ 2.00 | |

## — EV Buyers Guides —

| | | | |
|---|---|---|---|
|   | **Electrifying Times Preview 2004 *Electrifying Times Preview 2000 *1997 EV Buyers Guide *1996 EV Buyers Guide *1995 EV Buyers Guide* | ET2002 ET1999 BG1997 BG1996 BG1995 | $ 5.95 |

## — Literature —

| | | | | |
|---|---|---|---|---|
|   | *Convert-It EV conversion Book* | CONV01 | $24.95 | |
|   | *KTA Electric Vehicle Kits & Component Parts Catalog* | CATAL1 | $5.00 | |
| | *Window Literature Holder (light plastic)* | WL002 | $15.00 | |
| Indicate Month/Year and/or Vol #, back 20 yrs. | *Back issues of CE (Current EVents) magazine* | CE001 | $ 3.00 | |

## — Special —

| | | | | |
|---|---|---|---|---|
|  | *AVCON to 14-50 adapter kit - sheet metal box, 14-50 outlet (2 hots and a ground, no neutral), for 220 VAC chargers, no 120 VAC (6weeks)* | ADAPT1 | $255.00 | |
| (fill out complete membership form on flip side of page) | ***Electric Auto Association Membership ($10 rebates to local chapter.)*** | ***6/year of Current EVents, member voting rights*** | $39.00 | |

Shipping: USA 10%, Canada 15%, All Others 20% of subtotal
Handling $2.00 Send check (USA dollars) to:
**EAA Merchandise, 582 Herma St, San Jose, CA 95123 USA**

# 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. Use tape to seal the form before you mail it. Or send information in this form and pay through PayPal using http://eaaev.org/membership.htm.

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

Name: _____ *email: _____

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.

(fold back ward, this will protect your personal information, placing it on the inside)

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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
❑ Environmental/Gov. Regs. ❑ Social (Rallies, Shows, Dinners) ❑ New Technology & Research
❑ 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 is a non-profit, 501(c)(3) for the promotion of electric vehicles. Membership includes the informative complementary EAA publication, "**Current EVents**". Donations are tax deductible. 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 EVents like 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)

---

**Return address**

_____
_____
_____

**membership@eaaev.org**

**1st Class Postage Here**

Electric Auto Association
Membership Renewals
4189 Baker Ave.
Palo Alto, CA 94306-3908 USA

**VANCOUVER EVA, BC, CANADA**
*Web Site:* http://www.veva.bc.ca/
*Meetings:* 3rd Wed./mon., 7:30 pm, Vancouver

**PHOENIX EAA, AZ**
*Web Site:* http://www.phoenixeaa.com
*Meetings:* 4th Sat./mon., 9:00 am, Phoenix

**CHICO EAA, CA**
*Web Site:* http://geocities.com/chicoeaa/
*Meetings:* 2nd Sat./mon., 11:00 am, Chico

**EAST (SF) BAY EAA, CA**
*Web Site:* http://geocities.com/ebeaa/
*Meetings:* 4th Sat./mon., 10:00 am, Alameda

**LOS ANGELES EAA, CA**
*Meetings:* 1st Sat./mon., 10:00 am, Pasadena

**NORTH BAY EAA, CA**
*Web Site:* http://geocities.com/nbeaa/
*Meetings:* 2nd Sat./mon., 10:00 am

**SAN DIEGO EVA, CA**
*Web Site:* http://home.att.net/~NCSDCA/EVAoSD/
*Meetings:* 4th Tues./mon., 7:00 pm, San Diego

**SAN FRANCISCO PENINSULA EAA, CA**
*Web Site:* http://geocities.com/sfpeaa/
*Meetings:* 1st Sat./mon., 10:00 am, San Bruno

**SAN JOSE EAA, CA**
*Web Site:* http://geocities.com/sjeaa/
*Meetings:* 2nd Sat./mon., 10:00 am, San Jose

**SILICON VALLEY EAA, CA**
*Web Site:* http://eaasv.org/
*Meetings:* 3nd Sat./mon., 10:00 am, Palo Alto

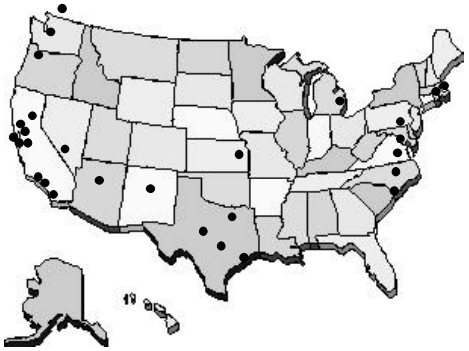
**VENTURA COUNTY EAA, CA**
*Web Site:* http://geocities.com/vceaa/
*Meetings:* 4th Sat./mon., 10:00 am, Ventura

**FOX VALLEY EAA, IL**
*Web Site:* http://www.fveaa.org/
*Meetings:* 3rd Fri./mon, 7:30 pm, River Forest

**MID AMERICA EAA, KA/MO**
*Web Site:* http://maeaa.org/
*Meetings:* 2nd Sat./mon., 1:30 pm, Kansas City

**NEW ENGLAND EAA, MA**
*Web Site:* http:/neeaa.org/
*Meetings:* 2nd Sat./mon., 2:00 pm, Worcester

**PIONEER VALLEY EAA, MA**
*Web Site:* http://geocities.com/pveaa/
*Meetings:* 3rd Sat./mon., 2:00 pm, Amhurst



**DMC-EAA DETROIT MOTORCITY CHAPTER, MI**
*Web Site:* http://geocities.com/detroit_eaa/
*Meetings:* Detroit

**LAS VEGAS EVA, NV**
*Web Site:* http://www.lveva.org/
*Meetings:* 2nd Sat./mon., 10:00 am, Las Vegas

**ALBUQUERQUE EAA, NM**
*Web Site:* http://abqev.org/
*Meetings:* 1st Tues./mon., 7:00 pm, Albuquerque

**TRIANGLE EAA, NC**
*Web Site:* http://www.rtpnet.org/teaa/
*Meetings:* 3rd Tues./mon., 5:30 pm, Raleigh

**OREGON EVA, OR**
*Web Site:* http://www.oeva.org/
*Meetings:* 2nd Thur./mon., 7:30 pm, Portland

**EASTERN EV CLUB, PA**
*Web Site:* http://members.aol.com/easternev/
*Meetings:* 2nd Wed./mon., 7:00 pm, Plymouth

**AUSTIN AREA EAA, TX**
*Web Site:* http://www.austinev.org/
*Meetings:* Austin

**HOUSTON EAA, TX**
*Web Site:* http://www.hea.org/
*Meetings:* 3rd Thurs./mon., 6:30 pm, Houston

**NORTH TEXAS EAA, TX**
*Web Site:* http://www.geocities.com/nteaa/
*Location:* Richardson

**CENTRAL VIRGINIA EAA, VA**
*Meetings:* 3rd Wed./mon., Richmond

**SEATTLE EVA, WA**
*Web Site:* http://slough1.home.mindspring.com/seva.html
*Meetings:* 2nd Tues./mon., 7:00 pm, Seattle

**EVA OF WASHINGTON DC, DC**
*Web Site:* http://www.evadc.org/
*Meetings:* 2nd Tues./mon., 7:00 pm, Bethesda

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