Electric Auto Association

CURRENT EVENTS

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MOW THAT LAWN — WITH GREEN POWER FROM THE SUN

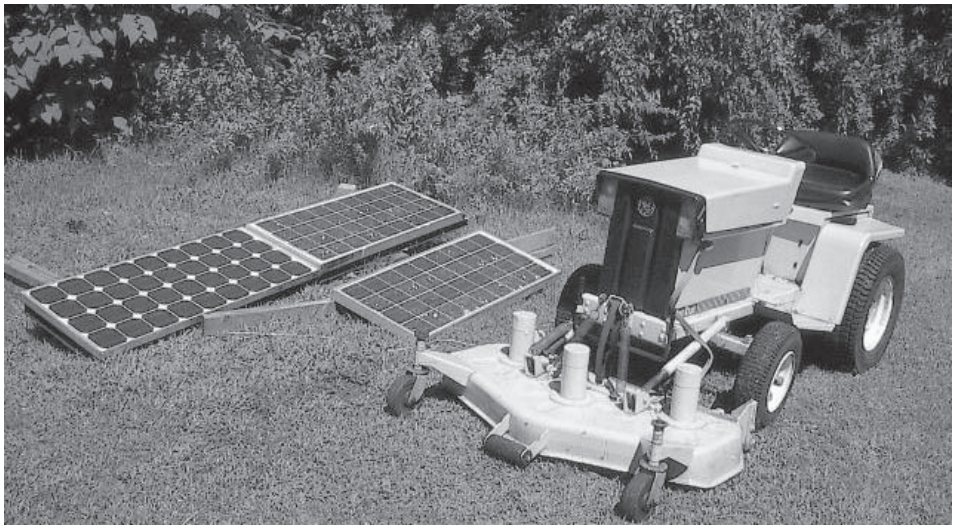
By Dave Robie, NEEAA Member

Through reading little bits and pieces of CE, the Net, and *Connections* (our New England chapter newsletter), plus attending chapter meetings over the past several years, it seems that a number of us "EV people" have discovered the joys of the 'Etractor.'

Most of them seem to be various models of the GE 'Electrak' that were produced and marketed through groundskeeping equipment dealers from 1970 to 1974. GE then sold out its lawn tractor division to Wheel Horse, who continued production for a couple more years under their own name. They sold their product through the existing Wheel Horse garden tractor dealer network. All production ceased by the late 70's. Electraks were expensive and too far ahead of their time. They were also too misunderstood by their users to be a marketing success. But now, with us EV people, their time HAS come and the price is right.

These 'lawn EV's' are a great vehicle for the EV beginner to start with. However, the downside is that many are quite badly rusted—especially the battery boxes—and need a good bit of auto body type work. Fortunately the work is cosmetic, not structural. As to the electric; lawn deck motor rebuilding plus the standard electrical and function related repairs should be expected for an item that may have been rusting outdoors for 20 years or more.

Offsetting this fact, the tools, parts, and skills needed to restore one of these tractors to health and even beauty are much fewer than to restore any other defunct EV, except for an Ebike. The restoration takes comparatively little time. Many parts are standard 'lawn tractor' or electrical items, and some 'OEM' parts can even be had from long established Wheel Horse dealers. Also, once restored with all age related problems solved, they are ghostly quiet and efficient, requiring almost no maintenance and always start — unlike their gas guzzling cousins. A great green pleasure to mow, tow or move snow with.



Solar Etractor

Here in the New England chapter, we have many Etracs. This writer presently owns eight of them, mostly GE's, with complete service manuals for all. Our Vice President Bob Rice, although a 'road EV' builder/owner/driver for many years just acquired his first, a GE built Wheel Horse. It's like a GE late model 15 bigframe painted red with a front mower deck. This tractor needs a good going over, as they all do when first acquired, but we are confident that Bob will be mowing courtesy of Reddy Kilowatt by late Summer.

However, there are four members of this Worcester, MA based chapter who have gone a giant step farther than the normal 'green power revolutionary' activities of restoring and using a battery operated lawn tractor. These members are running their tractors on 100% solar power. All have independently found out that to be a solar electric vehicle and have all solar advantages, the photovoltaic panels for charging need not be on the vehicle.

Member Bill Glickman is a case in point. With a full complement of PV's on his roof already running other household items, Bill set aside and wired one section of three 12V panels to provide the necessary power to charge his 36V GE smallframe model 8. This worked excellent for the lawn duties, but Bill found that the 8 doesn't have the traction or low ground speeds necessary to run the GE 42" snowblower attachment he found separately. This will be solved soon. A bigframe model 15 awaits his touch at restoration to make this solar operation a twelve month proposition. Bill also has a yard cart used for other groundskeeping purposes.

This writer's is not quite as complex. Three 50 watt 12V PV panels were obtained as used surplus items. These were laid flat on the sunny back porch, connected in series with a simple 0-5A swing pointer meter and a 5A backflow blocking diode and go to a pair of charger clips. The tractor (usually a

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COVER STORY

Photos provided by Dave Robie

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Gold Award
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If you thought the Segway Human Transporter was extreme, there's now a prototype of the next evolution of minimal transport. Like the Segway, Bombardier's Embrio concept — a prototype that may or may not make production — uses gyroscope technology to balance riders. In addition, this concept uses one less wheel than the Segway and will attract, Bombardier hopes, a younger demographic. The vehicle is designed as a guess at what transportation in the year 2025 might look like.

It is a fascinating idea because it combines the simplicity and alternative-fuel technology of forward-thinking commuting vehicles with the excitement of "recreational" products like ATVs. Indeed, the Embrio could attract people who drive a more fun sort of vehicle, what with its motorcycle-derived styling cues and, like an ATV, the fact that you have to lean in order to turn.

The Embrio is powered by a hydrogen fuel cell, a technology that creates power by mixing hydrogen and oxygen, ideally resulting in water as the only exhaust. Carmakers are also developing this technology for automobiles, and General Motors stands by its plan to sell hydrogen cars by 2010.

The Embrio also borrows several other advanced technologies from cars, like infrared night vision and an active suspension, which can vary its damping rates based on road conditions. Its riding position resembles that of a motorcycle, and it balances one or more passengers with a network of sensors and gyroscopes. To move the Embrio, you use an accelerator trigger on the left handlebar and a brake trigger on the right.

The vehicle is made of lightweight materials, like Polypropylene, Santoprene, nylon (injection moulding), aluminum (stamping, die casting and robotic assembly), and magnesium (casting). It weighs only 360 pounds.

Although Bombardier says the gyroscopes are enough to balance the Embrio, the vehicle is also kept longitudinally stable by a smaller wheel that operates like an airplane's landing gear. It touches the ground when the vehicle is stopped or just starting. Once the Embrio is in motion, the landing gear will retract when the vehicle reaches about 12 mph (20 km/h). During braking, the gear redeploys when the vehicle slows to 12 mph (20 km/h). Even without the landing gear, the EMBRIO would be stable when motionless because of the gyroscope.

The Bombardier EMBRIO concept is one of several concepts that were proposed by different internal design teams of Bombardier Recreational Products which had to respect the design philosophy "to create highly innovative, functional and exciting products to exceed people's recreational needs", and answer the following challenge: what would be the "next thing" in recreational vehicles?

Dimensions and weight:
48.75" x 27.5" x 47.5"
124 cm x 70 cm x 120 cm
360 lb 164 kg

For information:
Bombardier Recreational Products
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www.recreation.bombardier.com

Photos courtesy Bombardier Recreational Products

SATURDAY NIGHT PORTLAND STREET DRAGS... STUNNED RICE BOYS—SHOCKED'MERICAN V8 HEADS

By John Wayland, OEVA & NEDRA member

I was beginning to think I was never going to make it to the track to test out the post Woodburn, 216V higher current version of White Zombie, powered by 18 of Exide's Orbital Blue Top marine deep cycle batteries. At every turn, there seemed to be an obstacle. Last Friday, we worked on the car until nearly midnight, and the following Saturday, it still wasn't completed until late in the afternoon. Fast forward to this past week...

Friday came, the car was ready, but the weather had changed with rain accompanied by chilly temps for most of the day. Towards the early evening, however, the weather started to improve and it looked like I might indeed, be racing later in the night. Then, 'work happened', and instead of an easy day with a quit time of around 3:30 or so, I found myself buried with all kinds of service calls, and the day kept stretching out. I was doing in depth charger repairs on a Yale walkie stacker lift truck at 7:30 pm, instead of being at the track for the 'gates open at 8:00' Friday night drags...damn!!

Saturday, things finally worked out...the clouds parted, the rain dried up, the sun came out, the temperature climbed, and gods of drag racing smiled upon Portland. My long time EV sidekick, Marko Mongillo, was even free to go play with me later in the evening, so that lined up nicely, too. The van and trailer were ready, and with the entire 24 hours slated as a race day, I even had the time to take a few short drives in the car to further break in the pack. That was a good thing, because about 5 miles from my house, the car started to jerk and stutter when some small push-on type connectors on a contactor microswitch came loose. I was able to jam the connectors back on and return to my EV shop, where I dissed them and soldered a new pigtail connector affair in their place...problem solved.

Marko arrived right on time in his way-cool 'Fiamp', his super clean dumpster green '59 Fiat 600 sedan (it makes my small Datsun 1200 look big) powered at 120V courtesy of the newest Optima group 31 YTs. He had come from his home in Oregon City, some 18 miles south of Portland, and had run it hard as he had some sort of 'freeway speed demonstration' with a guy in a vintage American car. Evidently, as he followed behind, the guy had seen the stack of yellow batteries in clear view through the slotted green engine lid at the rear of the Italian bathtub on wheels, had seen the custom plate 'FIAMP', didn't hear the typical rattle-clatterer-throb of a tiny 600cc motor about to puke its guts out at freeway speeds, and with an absence of the typical tailpipe smoke of all old Fiats still on the road, he had figured out it wasn't running on dino juice anymore! He had pulled along side Marko and had given him a huge 'thumb's up'! Marko muttered something about 90+ mph... let me tell ya, that's hump'n in a Fiat 600!

The race car tow van, my ugly but oh so dependable '89 Ford Aerostar van, was ready to assume its burden of a belly full of Orbitals (new new dump charge pack), all the various racing paraphernalia, and the trailer loaded down with the race car (now at a heftier weight) and the 300+ lb. 10 kW genset (powered by the 2 cylinder Subaru from hell). Marko said, "You know, it would be much more impressive if you just 'drove' the Zombie to the track!"

With 18 Orbitals, the 15+ mile trek to Portland International Speedway 'was' a piece of cake....hmmm... the battery pack really 'did' need to be broken in a bit more…hmmm…the batteries really would perform better once they were heated up…hmmm...we could dump charge once we got to the track to put all the juice back in…hmmm… and with that, the decision was made. Into the back of the van went the heavy genset, and considering nighttime driving conditions, a second small 12V AGM battery was placed under the Zombie's hood (the race car currently lacks a DC-DC) and put in parallel with the other one to insure the lights would stay lit and the contactors pulled in. Ready for another Marko and Plasma Boy adventure, we were off!

I decided that instead of all freeway driving, we'd turn east from my house to 122nd, then north downhill towards the Columbia River, then west for 10 miles or so on Marine Drive to the track at Delta Park. This route had the benefit of taking us right past a Wendy's and a service station for two fill-ups...one for the van (it was nearly empty), and one for me, as I had not yet had any dinner and I was in the mood for a gut bomb. While I was ordering up some food for us, Marko was across the street filling the van with gas. Being used to electric city driving and the every month-to-month and a half fill up of the Insight's 10 gallon tank, and usually not allowing the van's tank to go much below half, I choked on my quarter pound double stack when Marko told me it cost $39 to do the deed...arghhh! Back on the road with the Zombie's passenger seat serving as my dinner table, I was partially comforted by the thought of clean hydroelectrically generated electrons in this machine's tank. The gas thing would be a recurring theme on this night…

The drive to the track was really fun for me, and with the gas hog van following behind, I cruised along scenic Marine Drive following the massive Columbia River, in my electric car powered by marine batteries! It was 7:30-ish, and the decaying sunset ahead was still stunning, reflecting in the water as the twin electric motors whirred away propelling me along at a steady state 45 mph...Emeter reporting 224V under the easy load, and never dipping lower than 204V even on uphill grades. It was getting dark fast though, and when I took the turn from Marine drive to get to East Delta Park, I slowed to a crawl as I pondered which nondescript side road I needed to take for the 'secret back-door way' to the race track. It was then that the first gasoholic dude encounter happened.

As I was coasting to walking speeds in the darkened tree lined park area, I heard the varoom-varoom of a Chevy V8, as some guy in a red Camaro pulled along side me, and with his girlfriend riding shotgun, he looked over and nailed it briefly, laying a smart patch of rubber in a taunting teenage fashion (he was probably 35). I so much wanted to return the favor and show him a bit of electrically generated tire smoke, but I showed some composure and simply gave them a nod of 'yeah, that's cool'. He instantly smiled back and asked, "That's electric, isn't it? I bet you could smoke this old girl (his car, not the real girl)...I know

all about electric cars, I've seen 'em run at Woodburn! Say (assuming I was on my way to the track), what time do the gates open?" I answered back, "Eight o'clock...how do I get there from here?" He quickly snapped back with, "Follow us!"

I had made some new friends in the night, and with Marko in line, we caravanned towards the track, snaking our way through park and ending up near the track entrance, with a small detour to a service station...guess the 'old girl' needed a bit of fuel. As the young station attendant filled up the Camaro (we don't have self serve in Oregon), Todd and Debbie were all over my car..."Geesh, it's got a Ford none inch back here!" "He's got rubber stuck all over the rear fenders, Todd." Marko added the fill-in comments, bringing them up to speed on all things electric.

Todd was an absolute hoot, turning to the gas station attendant while motioning towards my car and saying, "I've got his gas bill, too." Taking him seriously, the young kid walked to the Zombie and asked me:

"You want me to fill it up?"

Me: "Fill it up with what?"

Station kid: "You know, with gas."

Me: "Oh yeah, sure, if you can find a place to put it in, have at it."

Station kid: "Well…uh...how 'bout right here? (looking at the car's former locking fuel filler door)"

Me: "Oh yeah right, let me unlock it for you."

I opened the door as the parallel charger contactors automatically clunked resoundingly, and revealed the blue 175 amp Anderson charge connector…

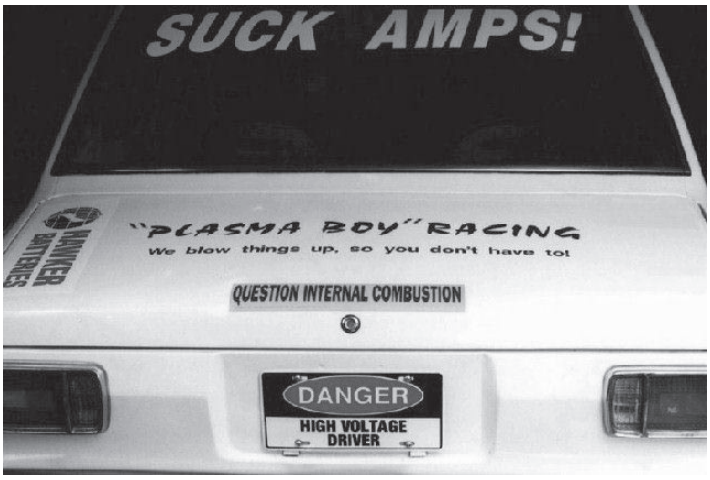
Station kid: "What the heck?"

Me: "I think you can put gas in here (now moving to open the trunk lid, showing the blue ocean of batteries nestled down in the custom Marko-created sunken well). The kid was taken back, but Todd jumped in to quickly educate him. After the fun at the servicestation, we drove on over to get into the track. When I rolled up to the pay booth, the girl asked:

"Racing or watching?"

"Racing", I answered.

Pay booth girl, "That's sure a quiet race car."



I won't go through all that was said, but let it suffice to say that the girl and the security guard kept me at the booth for a while with lots of comments and questions backed with considerable enthusiasm about electric cars...cool! This first encounter at the race track would set the tone for the entire evening, one that was definitely a positive experience.

Marko and maneuvered our vehicles and eventually rolled into the left-most tech inspection line, among the Cudas, Mustangs, Road Runners, Hondas, WRX Subes, etc., etc. The tech area was well lit with high power lighting, the night was at a comfortable 60 degrees or so, and there were people everywhere. There was quite a mixture of fast cars, everything from vintage muscle to modern turbo and nitrous rice burners. I was told it was a heavier than usual turnout. My heart was pounding and it was good being back in my element.

Our presence was immediately both controversial and crowd generating, as we presented quite the unusual scene. Picture this…here we were, this be-stickered old Datsun, with a fat umbilical cord coming from its gas filler area and running over to this funky Aerostar van going backwards and along side, rear gate opened, and the side slider door opened to reveal a bunch of batteries all over the place. Inside the strange little Datsun, the Emeter glowed red and green displaying triple figures as 235 amps flowed into the car's hungry batteries. We had decided to use the time waiting in line as an opportunity to replenish what 15 miles of driving had used..man, that dump charging sure works well!

Our turn to be inspected came up, and the tech guy already had the NHRA rulebook opened to the electric car section. He was really excited about teching his first EV, and asked me to be patient with him as he went through the list of rules governing my car. He stumbled at the driveline loop issue, but I politely explained to him how and why my car was required to have it, then offered to show it to him. This is how it went on each issue...I'd offer up a little help, and we'd move on. He finally said, "Geez, you seem to have this all memorized...that's when I told him I had been the residing NEDRA president when the rules were being pounded out at NEDRA round table discussions.

I took the opportunity to educate him and the large group surrounding us, about the really quick Evs that had set impressive records...Dube's bike, Rod's Mazda, Dennis' rail…when they all heard tales of low 11's, 9's, and even 8's, a lot of mouths dropped open! I was asked what my car could do, and Marko jumped in and told them it had turned 13.1 - something at a tick shy of 100 mph, and that again, made them all looked a bit, well, shocked.

I let them all know that we were trying out a different setup on this night, one with a heavier battery pack at a substantially lower voltage, and that though we were hoping to break into the high 12's, that it might in fact, turn out to be slower and only run in the 14's. One guy said, "Listen to this, he's got an electric car that might 'only' run in the fourteens...there's quite a few of us here that would be very happy with a 14 tonight!" Everyone seemed impressed, that the electric car about to go out and bang heads with he gas cars, had been driven to the track. Many

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Saturday Night: *continued from page 5* were amazed at the beefy red 4/0 power cables interconnecting the batteries...one asked, "Why is it that thick?" My short answer, "1400 amps!" This raised more than a few eyebrows, and caused the tech guy to blurt out, "you got that outside disconnect thing?" I showed him the rear bumper mounted toggle switch, then showed him the 3000 amp interrupt rated Bubba contactor...again, the assembled swarm of ICE racers kind of gasped at such lofty currents.

The tech guy turned out to be the brother of 'Big Jim', the guy that stages the multiple lanes of racers before they are allowed to get onto the track. He wanted to introduce me to the big guy, so that after charging in the special 'electric car recharge pit area' area he had set up for us, we could simply take a short cut over to the fastest lane of racers, and Big Jim would stop all of them to let the electric car get in line...cool! The tech guy allowed us to set up camp right off the paved return lane, so that after picking up the time slip, I could turn right off the road and into the well-lighted space where they had cones set up to keep other cars away, right next to the van with the genset and dump charge pack. The dump charging regime would turn out to be quite the attraction most of the night.

I tell ya, the personnel at PIR rolled the carpet out for us, and they were all genuinely excited over having their first electric at the street legal drags. Likewise, every single racer we came in contact with, from the V8 muscle car guys, to the turbo rice burners, everyone was way cool, way nice, and way excited over the little electric Datsun that came to play.

OK...on to the race results…I know the title of this post might be misinterpreted as in 'the car went faster than it ever has', but…uh hemmmmm…well…I wish I could tell you that the Zombie 'is' quicker and faster than ever, but the truth is, it's not. In fact, it's now more than a second s-l-o-w-e-r than it was in its hay day when it turned a quick 13.186 @ 99.16 mph. The title of this post refers to the overwhelmingly positive reaction of everyone at the track. It didn't matter that my car was only running in the mid 14's…even the guy who at one point raced next to me and turned a 12.9 @ 103 (coincidentally, the exact time and speed I have predicted my car might someday turn) was blown away that my electric car had beat him off the line, beat him through the first part of the run, and had only lost at the end. He came over to watch the dump-charging thing, and could not stop talking about how impressive my EV was (inside, I was dying and very disappointed).

Here's how the car did. The first run was with the controller turned down to 1000 battery amps, on new batteries that had never been subjected to anything more than 500 amps. I was next to a not-too-potent VW Corado with a coffee can muffler and a few mods, and soundly trounced him off the line and went on to beat him while turning a slow 15.049 @ 92.25 mph...argghh!!! What astounded me was the reaction from everyone when I returned to recharge. There was already a small crowd awaiting the return of the 'electric car'…all they had focused on, was that right in front of the very eyes, a battery powered car beat a fairly peppy gas car. It didn't seem to matter that the ET sucked (it did to me). The next run was better, as I had cranked the battery amps up to the hilt, in the case of Godzilla #3, that's 1400 amps…14.546 @93.70 mph. This time, when I returned to the charging area, the hotter import guys and the V8 dudes, the ones that turn 12's, had come to congratulate me on my amazing mid 14 run.

Again, no matter what I said about wheel standing Mazdas or 8 second electric rails, they were still impressed with my so-so performance...it was kind of weird. The third run was pretty consistant…14.542 @93.61 mph. I had raced against a Subaru WRX that was pretty impressive..it ran a 13.9! It was frustrating as my car used to be able to stomp a car like this, and it would have been nice to have done this in front of everyone, but instead, the Sube was the first to cross the finish line. The last run was with the batteries finally starting to warm up a bit, but with less than a full charge (ironically, our Saturday night racing came to an end when my genset ran out of gas...yes, I forgot to check the fuel level before we left for the track)....14.489 @93.70 mph.

Each time I rolled up to the line, the announcer went nuts with positive comments about the electric drag car..."OK everybody, here's that quick 'eeelectric!' Watch this burnout (I would stick the throttle hard and do a mini smoke show for them)"

We had a great time at the track. I was able to drive the car there, and drive it back home without a single glitch...it ran flawlessly, although s-l-o-w-l-y. The enthusiasm for my electric machine is wonderful, the racers are friendly, and there's a huge turnout each Friday night, I'm told. Todd, the Camaro guy, turned out ot be a custom painter, and is really excited over electric...he's insisting on painting the Zombie up with lightning bolts...I might just take hime up on his offer.

I feel there's a 14.2 possible with the heavier, lower voltage setup the car is presently at…hmmmm…the current record for the 193V-240V street legal class, is held by some guy in California, Otmar Eben-hosersloozenhouser with a 14.399 @ 93.473 mph run. Considering he's hampered with that transmission thingy, all those batteries, and one of those new fangled 'Zillas, it's downright amazing! We're headed back to the track tomorrow night, with the goal to snatch Oat's record and give my battery sponsor a world record in the SC/B class for their contributions. Who knows, maybe I'll take a few batteries out and see what it will do at 192V next week.

The longer term goals are unclear, other than I don't like going slower! Perhaps it's time to return to the formula that had the car so close to the 12's before, perhaps not, I'll have to think about this for a while. In the meantime, I'd like to address this one comment:

In regards to 0-60 in under 4 seconds:

>My guess is that only MM and WZ are contenders, and they are not exactly regular street cars.

When it was running 13.1, the 0-60 was more than likely under 4 seconds. Now, it's probably at the high 4 second area...but, it now gets driven to the track, and has probably a 35 mile range per charge, and it has all of its factory street equipment functional, has all of the factory sheet metal, bumpers, roll-up windows, etc., and is fully licensed and insured, and, is being driven often now...I can even go get bacon with it!
See Ya...John 'Plasma Boy' Wayland

THE NEW WAVECREST ADAPTIVE MOTOR™ SYSTEM

Edited by Bob Oldham, CVEAA

WaveCrest Laboratories, based in Dulles, Virginia, has developed the WaveCrest Adaptive Motor system, which includes a patented adaptive motor, generator, and control system. It capitalizes on a convergence of recent technology advances, including microprocessors, semiconductors, power electronics, high-performance software, specialized motor architecture, and advanced materials.

The Adaptive Motor system consists of a multiple phase DC brushless motor with the rotor, carrying a series of rare-earth magnets, surrounding the stator. The stator contains a group of identical, radially mounted, independently controlled electromagnets. A digital signal processor activates the electromagnets by analyzing motor position, desired torque, and the electrical characteristics of the energy management system that powers the motor. The associated control system and software are integral to the operation of the motor and account for its flexibility and broad range of performance.

The system was developed by Dr. Alexander Pyntikov, a Siberian neurophysicist and former chairman of the Innovation Board of the Russian Government; and Dr. Boris Maslov, an expert on electric motors and controls and the founder of Russia's first private corporation.

Dr. Pyntikov, who is WaveCrest vice president of corporate development, said that the WaveCrest system "is dramatically more powerful and efficient than conventional motors and provides a breakthrough in range and applications."

"Conventional motors waste energy at nearly every point of their operation," explained Dr. Maslov, WaveCrest vice president of research and development. "In the WaveCrest system, motors are mounted directly into each wheel of a vehicle and controlled by microprocessors. Flexible, adaptive algorithms dynamically reconfigure the motor to meet exact application requirements, maximizing torque and efficiency in all environments, at all speeds and under all conditions."

WaveCrest Adaptive Motor System™

WaveCrest Adaptive Motor technology enhances dynamic performance and control of vehicles by providing both positive and negative torque at the wheel, on demand. Because the motors operate at wheel speed, and due to the advantages of a distributed multiple motor architecture, traction control and vehicle stability become programmable features of the motors, and regenerative braking is also possible. The system is also well suited for use with fuel cell powered vehicles, which require lightweight, advanced electric drive propulsion systems to maximize efficiency.

There are more than five models of the WaveCrest motor ranging from 12 to 48V DC, .25kW to 35 kW, all with regenerative braking available.

WaveCrest has created a subsidiary called TidalForce to design, manufacture, and market light electric vehicles (LEVs) powered by the patented WaveCrest Adaptive Motor system. TidalForce is the first business launched by WaveCrest Laboratories.

Powered by a 1,000-watt WaveCrest Adaptive Motor(tm) system in its rear wheel hub, the TidalForce ShockTrooper electric bicycle moves faster and farther with less noise or heat, and no pollution. Its frame — the same DARPA-approved Montague Paratrooper Folding frame being used by the U.S. Marine Corps and other U.S. military units — is rugged, light and durable. All of the ShockTrooper's components are the highest quality available and were chosen for strength and function.

The TidalForce "io" electric bicycle (named for one of the moons of Jupiter) is powered by a 750-watt WaveCrest Adaptive Motor™system in its rear wheel hub, and is ideal for much different transportation and recreational uses. Riders can pedal without motor assistance for exercise, ride easily past congested traffic to run errands, and add as much power as they need to level hills and cover long distances. The "io" is very reliable and durable, extremely comfortable and easy to operate, and incredibly fun to ride. With low noise and heat, and no pollution, it's also good for the environment.

Both electric bicycles feature a novel battery installation: the primary battery is in the hub of the front wheel, with a housing that matches the appearance of the rear hub-motor. An auxiliary battery is available to extend the range, and it mounts of the frame of the bicycle.

WaveCrest also projects the development of an electric motorcycle using the WaveCrest motor system, and foresees the use of the new motor system in cars as well, with a 25hp motor under development for this use.

Mow that Lawn *-continued from page 1*

GE model 16 bigframe) is driven up and hooked up and Mr Sun does the rest.

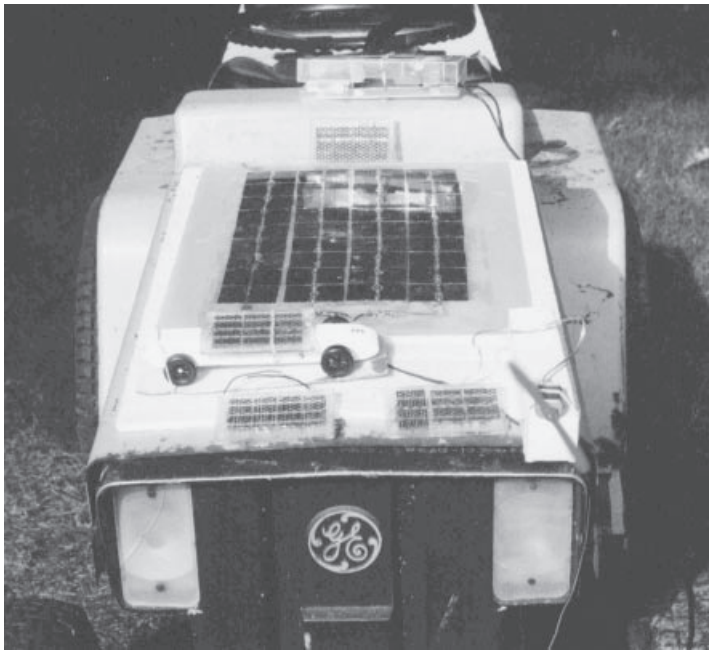
No PV controller is needed, as voltage is read on the tractor's own voltmeter and with a 50 watt panel, the max (for these panels) blue sky current here in New England of 2.5A is only a trickle charge anyway to the 6 big lead/acids aboard. The taller than stock, GE size, Trojan 105's only need the seat hinges extended bout 1 1/2" higher to fit. Stock GE cables and jumpers fit without modification.

The batteries are not even new, but recycled castoffs from the 'road EV ' here, an '81 Ford Courier pickup, factory converted to 120V. A battery that's questionable, reducing range, or even one with a boiling cell in a road EV is fine for an Etrac, which draws a lot less current. The larger heavier 105 size, even used ones, give a much longer range than what GE provided originally, likely smaller than optimum as with new cars today, engineering thought meant to keep the weight down. Electraks can run on three or six 12V car batteries too as this writer's GE 8 does, although even 'quite heavily used' 6 volt types give much better overall performance.

When off mowing on a sunny day, another Electrak gets connected to the charger clips. The 24V motorwheel bike here runs about 15 miles on a day or so charge from the same solar rig. Effectively, this then becomes a 'solar vehicle' too, as does the 24V foldup scooter and 24V 'Rascal' HP vehicle. When everything's charged, the connection goes to a 120v well heater in the domestic hot water storage tank, therefore eliminating it's degree/day loss.

A separate 50W 12V PV/ recycled EV batt system runs the 'boomer type' auto radio shop stereo, charges the 12V 'bread milk and pizza trip' Etrike, and does all cordless charging in both home and shop. Us Swamp Yankees have a saying, 'when it's raining soup, bring out a bucket.' Why waste the power available on a sunny day?

A bit of observation over this rig's first full year and some Swamp Yankee head math has shown that this tractor picks up enough power from the PV's that every 10 days rain or shine there is more than enough power put into the batteries to mow the lawn. The lawn she takes care of is large, hilly, and convoluted — running total bout 3/4 acre and with the previous gas tractor, a Sears 10 hp, it took five to seven gallons of gas to mow it. In the grass growing season, it needs to be mowed on average every 10 days. Conclusion: the panels are paying back their costs in this service at that time at a greater rate than normal payback by replacing $1.60 per gallon gasoline. About 80¢ a day payback every day of the mowing season from three panels is phenomonal!



Jim Mell's first attempt with solar car in background

Wheelhorse Electric lawn rider

Another way of stating this is that the rig used here, built of all recycled materials, manufactures gasoline at the rate of about a half gallon a day for most of the Summer without using feedstocks or fuel of any kind to do it. A smaller lawn would manufacture less of course, and a larger one, more. This extra gas is added to the world's supply by not being drawn from it. Any 100% solar powered vehicle does the same.

A bonus of this 'solar Etractor' rig is that the lawn takes about half the time to mow, having a wider cut and not having to get in lower gears and higher rpm to do hills, or backtrack when it's deck belts slip — there are no deck belts. Also; that front deck gets closer to edges so there's less weedwacking. This saved time has already paid back time invested in restoring the tractor. Of course there is a snowblower attachment too, and a yard cart and other towing duties so there is year round use of this machine.

That photo of the snowblower was taken during the record breaking 27" blizzard this year. The blower is capable of shooting the stuff across the street, and handled the whole storm without resorting to a 'line power' charge which should put to rest the thought that battery powered equipment is no good in the cold. Yes, the Etruck's range is a bit less in winter, but the tractor was not affected at all. Except that the seat was cold!

Photo of the Sears Etractor is also the authors, and most recent acquisition. She awaits shop time to get running, but not

GE Electric Tractor Model 15 with snowblower

Sears 10 HP Etractor built of all recycled materials

much of that, as she was always stored indoors and the wiring is simpler than a GE model 8, both use a constant speed motor.

Two photos on the previous page show member Jim Mell's rig. The first is an unsuccessful attempt. Even though changed to be 36V, the panel would not handle the duty cycle of the tractor. Photo also shows one of Jim's solar cars on the hood. Jim also owns Emowers and a Prius (not pictured)... The little Wheel Horse electric lawn 'rider' is also Jim's.

Jim's bigframe GE tractor and PV setup is similar to this writer's but his lawn is smaller. He charges enough in half the time. Jim has a stock GE 42" snowplow blade attachment for winter and in the part of New England he comes from, uses it plenty.

Don't have a photo of President Tony Ascrizzi's setup — but his front deck GE 12 bigframe tractor is mainly used as a snow-blower — even for neighbors — and for moving things around the yard. She charges from temporarily hooked up panels that will be part of his big roof array when he is finished welding up the mounts. The roof array will provide 120V for house/shop lighting as well an equalizing charge for 120V vehicles and dump charging lesser voltage vehicles, and likely dump charge the tractor from a section of it's just installed battery rack when the snow flies. Incidentally, Tony says that many of the Etracs found have electrical parts such as relays and control boards missing. The EV 'guru' of our chapter recommends adding a conventional controller to model 15 and 20 bigframes to replace the ancient history, therefore trouble prone relay system. This is not terribly expensive for a 36V EV. Model 8, 10, 12, and 16 tractors or the small Wheel Horse type have simpler electric circuits and unless unobtainable electrical control parts are missing from the 'variable speed motor' types, will not benefit from it.

A lot of tractors are still out there rusting away for want of the right people to restore and use them. We EV people just happen to be the 'right people'. They seem to have been sold in every state of the US, so there's a good chance all of us can find at least one.

If you find a tractor, be sure to ask about attachments for it. Decks, snowblowers, plow blades, etc are a lot harder to come by than the tractors themselves. Likely because they were easier to bring to the dump long ago. Bigframe tractors also have an accessory outlet for a 36 volt plug in hedge trimmers, edgers, or even an electric drill. Always ask about these.

Another item which can be found — battery electric, regular type single blade, power mowers. Several companies made these including Sears. These too can be converted to 'solar' mowers — even with an onboard panel. A single 12V panel can be switched manually daily — or better yet with a 555 timer chip and relay — to charge each of the 12V gelcell type batteries that most of them use. But for these, you need a panel that will give you an amp or more — not one of those little 'maintainer' types — useless for anything but eliminating self discharge of auto batteries.

So there it is. Our Etracs can be true '100% solar vehicles' — and are ZEV's — although not in the sense that is commonly thought of. They can be fueled by 'pennies from Heaven'. Who could ask for a better green power symbiosis than the recycling of these 'rusty junk' tractors and 'half dead' road EV batteries to what we have done with them?

Another bonus — we can mow our lawns quietly on weekend mornings without getting flak from the neighbors. Can you?

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CONVERSION WORKSHOP, STEP 20
CARE AND FEEDING OF YOUR NEW EV

By Michael P. Brown ©2004

You've done it. Your conversion EV is finished. You have driven it maybe sixty to eighty miles in a series of short test runs, gradually increasing the length of the trip. These trips have let you become used to the conversion's acceleration, braking and handling characteristics. At the same time, you were gently cycling the batteries to help them build up to their full capacity. Your EV is ready to take its place in your daily life. Now is the time to start forming the maintenance habits necessary for a safe, economical, and pleasant EV experience.

Getting It Down on Paper

If you haven't already done so, you should start keeping a logbook. Let's look at what goes in it and why. An entry should be made in the logbook each time the converted car or truck is driven. This entry should include mileage at the start of the trip, battery pack voltage at that time, destination (this will tell you the terrain and traffic conditions you were operating under), and mileage and battery pack voltage at the end of trip. Why all the detail for each trip? Because a detailed logbook is the most important diagnostic tool you can have.

The overall trip mileage, when used with the end-of-trip battery pack voltage, will give you a rough volts-per-mile reading. A higher end-of-trip voltage reading for the same trip (which is why you record the destination) will show you how much a new battery pack's capacity grows as the batteries break in. It will also show how much your EV driving skills are improving.

The logbook can also alert you to a potential problem. Since EVs usually make the same trip each time they are driven, if you keep a logbook any change in the logbookentries will stand out. A lower voltage reading at the end of the your usual trip could indicate a failing battery or some other problem.

A battery failure problem is most likely if the beginning battery pack voltage is also low, as a bad battery won't take a full charge. If the beginning pack voltage is the same as usual and a check of each individual battery's voltage at the end of the trip shows that all of the batteries in the pack are at nearly the same voltage, maybe you should look elsewhere for your problem. Some places to look are a low tire or a dragging brake.

Care and Feeding

The only part of a conversion EV that requires regular maintenance is the battery pack. How the batteries are cared for will influence their capacity and overall life. Since the majority of conversion EVs are powered with deep discharge flooded lead acid batteries, we will limit our maintenance instructions to this type.

Keep Them Wet

The most important maintenance item is checking the fluid level. Since gassing and fluid loss during the charging cycle is normal, the batteries will need to be watered from time to time.

When you are starting out with a new battery pack, you should check the fluid level once every two weeks. Once you get an idea of what the fluid consumption actually is, then you can lengthen the interval between checks to every month, maybe every two months. The batteries should be checked at least every three months, especially in the summer when higher temperatures might increase water consumption.

After you have checked the water levels, it is a good idea to check the voltage of each battery. Doing this during the battery pack's first few months is a good idea. Battery failure usually occurs early in the battery's life due to manufacturing defects, or at the end of its cycle life. Early detection of a weak battery will allow you to replace it before the pack's balance is upset.

How much water to add, and when to add it, is as important as how often you check it. The battery is properly filled when the electrolyte level is a quarter of an inch below the bottom of the fill tube in the battery's top. The fluid level should never be allowed to fall below the top of the plates. If the plates are exposed to the air, the battery's energy capacity is reduced and sulfation could start to damage the battery permanently. The sudden loss of range is the only warning of low water levels you will get from the batteries, and by then it will be too late. Check those batteries!

The batteries should only be watered when they are fully charged. This is because the volume of the fluid in the battery expands during charging due to the chemical reaction taking place and the gas bubbles that form on the plates at the same time. Topping off the batteries when they are discharged leaves no room for the additional volume of fluid to expand into. The only place for the extra electrolyte to go is out the vent cap and onto the tops of the batteries.

This talk of electrolyte on the top of the batteries leads into the next part of battery maintenance: cleaning.

Keep Them Clean

As mentioned above, a little gassing and fluid loss is part of the charging cycle. Over time this leads to thin coating of acidic electrolyte on the tops of the batteries. If allowed to accumulate, this film becomes thick enough to start corroding battery terminals, interconnect cables, battery holddowns, and even battery racks. This corrosion, in addition to being an unsightly mess, can lead to short circuits, structural damage, and ground faults.

Fortunately, battery top cleaning is just a matter of some rubber gloves, paper towels, a cleaning solution, and some elbow grease. The only one of the items above that needs any explanation is the cleaning solution. Some EV'ers use a mild baking soda/water solution. However, I have found that a little too messy for my tastes. I have had good luck with both Simple Green general purpose cleaner and Windex window cleaner.

During the cleaning process, be generous with the paper towels and elbow grease but

stingy with the cleaner. The object of the cleaning exercise is to remove liquid from the battery tops, not add more. I usually do my battery top cleaning after I have checked and watered the batteries so I can mop up any water spilled during the refilling process

Corrosion causes resistance. Enough resistance in a circuit that is carrying a 400-amp current can generate sufficient heat to melt a lead battery terminal, open the series circuit, and bring the tow truck, if you are lucky. However, if the molten lead catches another part of the car on fire, or a cable with a new loose end causes a short circuit and then a fire, you have a car that not only won't run, but is also burning up.

Since you are starting with a new EV with a new battery pack, cleaning corroded battery terminals will probably not be an issue yet, but it will become necessary in the future.

If you come across one or more terminal/interconnect assemblies that have some corrosion, it's time do some serious cleaning. Clean one terminal at a time if you have more than one needing work. If the corroded terminal is on one of the battery interconnects, remove the cable or strap from the pack for cleaning. Remove the clean end of the interconnect first if there is one.

If it's a cable interconnect, cover the lug at the end of the cable with a piece of rubber or plastic hose that fits firmly over the lug, and then remove the corroded end from its terminal. A floppy cable with one end still connected can cause fireworks if it gets to the wrong terminal.

Clean the lug end of the interconnect first by removing the corrosion with a wire brush or other abrasive cleaning tool. Brush the lug until all the corrosion is removed and there is only clean shiny metal showing.

If the interconnect is the cable/lug type and the corrosion is bad, make sure it has not spread into the area where the cable is crimped into the lug. Corrosion there can only be removed by cutting off the lug and replacing it with a new lug crimped onto clean cable. If the corrosion has spread up the cable under the insulation far enough that cutting it to find clean cable makes it too short to reach its intended terminal, you will have to replace it.

The battery terminal involved should be cleaned with the cleaner used on the battery tops and the wire brush. The contact area of the terminal should also be cleaned down to shiny bare metal.

Keep Them Tight

After the battery tops are clean, it is time to check the nuts and bolts that hold the interconnects to the battery terminals for tightness. A loose connection will cause the same kind of resistance problems as corrosion.

Now is the time to dig out the battery wrenches I told you how to make in the article titled "Final Hookup And Testing". In case you can't find them or didn't make them, here's the how and why again.

Do not just grab a pair of ordinary wrenches and start tightening the battery terminal nuts and bolts. Stop and make yourself some special battery wrenches. This is done by

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Shop Talk *- continued from page 11*
buying two cheap combination open and box end wrenches that fit the nuts and bolts your EV uses (most battery hardware is 1/2" hex head but you should check this before you buy the wrenches).

Next, cover all of one of the wrenches with electrical tape, leaving only the open end of the wrench uncovered. Repeat the operation with the other wrench but this time leave the box end exposed. You now have a pair of dedicated battery wrenches that you can use on the battery pack without fear of causing a short by accidentally connecting the wrong two battery terminals with the wrench.

Now you can start checking your terminal connections for tightness. Work methodically, either following the series string of batteries, battery by battery, or by going down the rows of batteries in the battery box, one row at a time. Whatever system you use, make sure to check every terminal. The one you miss could be the one that gets you.

Finally, once the battery tops and interconnects are clean and checked for tightness check the cables that lead from the battery pack to the other components. Look for corrosion at the lugs and check the insulation for wear anywhere it makes contact with the EV's body. If you see some slight wear, try to reroute the cable to reduce contact with the body or secure it to the body more tightly to prevent the movement against the body that causes the wear.

Keep Them Charged

When you were doing the conversion and the time came to install the charger, you probably read just enough of the charger's manual to get it wired and installed. After the first test drive, you were getting ready to charge the batteries for the first time and you looked at the manual again to find the charger settings for your battery pack. So by now you probably have the charger set up and charging. Since you are going to put your new EV to work, lets take another look at charging. How you charge the batteries will have a big effect on your range and the lifespan of the pack.

Starting at the wall, check the circuit that the outlet is on. An adequate charging outlet should be protected by at least a 15-amp circuit breaker in your household breaker box. A 20-amp breaker is better, since AC amps in has a direct relationship to DC amps out. To avoid overloading the circuit breaker and causing a nuisance trip, your charging circuit should not have any other devices plugged into it. Any charging outlet that is outside and exposed to the weather should be equipped with a ground fault interrupter. The last thing to check is the extension cord between the wall outlet and the EV. Most charger manufacturers specify a cord made with #12 wire no more than twenty-five feet long. The use of smaller gauge wire or a longer cord could lead to a dangerous amount of resistance and a melted or burnt cord.

With the charger plugged in and running, recheck the manufacturers instructions to be sure that you have adjusted the charger to suit your AC current source and DC amperage and voltage requirements.

The finish voltage of the battery pack should be checked from time to time. If it is too low, you won't be getting a full charge. This is more critical if your charger uses the finish voltage to turn the charger off completely, as opposed to leaving it running at low amperage until you unplug it. If the finish voltage is set too high, there is a risk of battery damage from overcharging and excessive gassing, which will result in the need for more frequent battery top cleaning.

Check the finish voltage by taking a battery pack voltage reading near the end of the charging cycle with the charger running. A flooded lead acid battery is fully charged at a voltage of 2.5 volts per cell. To find your finish voltage, multiply 2.5 volts tines the number of cells per battery times the number of batteries in the battery pack. For example, the finish voltage of a 96 volt pack of six volt batteries is worked out like this: 2.5 volts x 3 cells per battery x 16 batteries in the pack (2.5 volts x 3 = 7.5 volts x 16 = 150 volts). The finish voltage setting of the charger will need to be reset as a new battery pack breaks in to reach its full capacity, and then as its capacity declines as it ages.

One other important thing about charging, charge the batteries at the end of the day if the EV has been driven, even if the pack is only partly discharged. If your conversion has a total range of sixty miles but it only goes ten miles a day, don't wait six days to charge it. This charging routine will result in steadily decreasing range and possible battery damage.

Lead acid batteries don't like to sit partially discharged, and will lose capacity if they are treated this way. A modern commercially built charger won't overcharge a pack that has only been partially discharged. However, if your charger is the type that tapers down to a low constant amperage but keeps running, find out how long it takes to reach finish voltage from the point the batteries were discharged to. If it only takes a couple of hours to get to the finished point shut it off after that length of time. There is no point in wasting electricity and gassing the batteries unnecessarily.

If you are not going to use the EV for an extended period of time such as a vacation trip, fully charge the battery pack before you go and leave it unplugged while you are gone. When you get back, drive the car a short distance to "wake up" the batteries and run it through the charge cycle.

Paying attention to the details given above will assure you of a safe pleasurable EV experience for a long time. That's all for now. There will be more on the EV lifestyle later.

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CA to Host Michelin 2003 Challenge Bibendum

Michelin recently announced that its 2003 Challenge Bibendum, an event featuring "environmentally positive vehicles from the world's automakers," took place September 23 through 25 at the Infineon Raceway in Sonoma, CA.

The 2003 Challenge Bibendum included more than 35 learning center technology displays; top industry speakers from Europe, China and the U.S.; and demonstrations of 11 fuel cell vehicles, 18 hydrogen-powered vehicles and an even split between prototypes and production models from such automakers as Audi, BMW, DaimlerChrysler, Ford, Freightliner, General Motors, Honda, Hyundai, Isuzu Truck, Nissan, Peugeot, Toyota, Volkswagen, Volvo and Volvo Truck.

ZAP to Import Electric Vehicles from China

Santa Rosa, CA-based electric vehicle marketer and distributor ZAP recently signed an "exclusive agreement" with Heibao Group Co., Ltd. to import electric automobiles from China. Under the agreement, ZAP said it plans to distribute the new electric car in the U.S., Central America and South America.

"This is an exciting time for electric transportation," said ZAP chief executive officer Steve Schneider. "New developments are happening almost daily in nearly every part of the world. We believe this is not only the first Chinese production electric car available in the United States, it is most likely the first Chinese-made car of any type to be imported into the U.S.A."

Reva Electric Car Company Launches EV in India

Bangalore, India-based Reva Electric Car Company (RECC) recently launched its Reva electric vehicle in the city of Ahmedabad, India. The Reva, which has a starting price of 268,000 rupees (about $5,800), has a maximum speed of 65 kilometers (km) per hour (about 40 miles per hour).

RECC said it also has plans to launch the Reva in the districts of Vadodara and Rajkot. (INDIAN EXPRESS: 9/1)

ZAP to Offer Unlimited Mileage Warranty

Santa Rosa, CA-based advanced transportation company ZAP recently announced that its electric cars will now include an unlimited mileage warranty dubbed the "Zap Consumer Confidence Guarantee."

Under the warranty, which will be available for "selected new cars" including the ZAP L.U.V. and the ZAPCAR LSV, officials said "all new ZAP cars will receive a manufacturer's guarantee, regardless of the mileage accrued," while ZAP car owners "will have the benefits of parts and service protection at the service center of their choice in all 50 U.S. states."

AC Propulsion Debuts 'tzero' Prototype

San Dimas, CA-based AC Propulsion recently showed a newer prototype of its "tzero" electric vehicle (EV), which is now equipped with a lithium-ion (Li-ion) battery.

AC Propulsion assembled the tzero Li-ion battery from "6,800 cells....designated '18650' based on dimensions of 18 millimeters [in] diameter and 65 millimeters [in] length."

AC Propulsion said the new battery, which reduces the weight of the tzero by 500 pounds and "carries three times more energy," improved the prototype's performance by allowing the electric vehicle to travel "over 300 miles" on "any type of standardized drive cycle" and achieve "acceleration from zero to 60 miles per hour under four seconds."

EDTA to Host International EV Symposium in CA

The Electric Drive Transportation Association (EDTA) hosted the 20th International Electric Vehicle Symposium and Exposition (EVS-20), a "gathering for the exchange of information and the conduct of global business for the battery, hybrid and fuel cell electric vehicle and associated infrastructure industries," November 15 through 19 at the Long Beach Convention Center in Long Beach, CA.

The conference officially opened on November 17 with a morning plenary session focusing on sustainable transportation, followed by concurrent sessions on fuel cells, advanced batteries, drive systems, marketing/market research and military applications/heavy duty/public transport. Later in the day, concurrent sessions covered propulsion systems, batteries for HEVs, environmental impacts, non-road/industrial, and energy supply and infrastructure. The day concluded with a "small lecture series" divided into battery, hybrid, fuel cell and general technologies sessions.

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Industry News *- continued from page 13*

Keio University Develops 'Eliica' EV

Researchers with Keio University in Japan recently unveiled a one-fifth scale model and technical specifications for a new concept electric car, known as "Eliica," that could potentially reach speeds of up to 400 kilometers per hour (about 248 miles per hour).

According to researchers, plans for the eight-wheeled, 640-horsepower Eliica call for a streamlined design to minimize wind pressure. Researchers said more than 40 businesses have teamed up with the university to develop the car at a cost of approximately 500 million yen (about $4.5 million). MAINICHI DAILY NEWS: 9/26)

Local OR Police Department Purchases Gizmo EV

The Hillsboro Police Department in Hillsboro, OR recently purchased a three-wheeled Gizmo electric vehicle (EV). The $12,000 Gizmo, manufactured by Eugene, OR-based Neighborhood Electric Vehicle Company, can reach speeds of up to 40 miles per hour and costs approximately 80 cents per day to operate. Officials said the vehicle, which can travel approximately 45 miles per eight-hour recharge, is ideal for daily trips around the city, such as from the police station to city hall.

The police department also has plans to begin operating a neighborhood electric vehicle (NEV) manufactured by DaimlerChrysler subsidiary Global Electric Motorcars. (THE OREGONIAN: 10/2)

Universal Introduces New Line of Electric Scooters, Bicycle

Addison, TX-based Universal Power Group recently introduced its new Universal Mobility line of battery-powered electric scooters and bicycle, which are "mainly marketed for recreational use." The new offerings include the UB Scootin I "kid-scooter;" the UB Scootin II "stand-up teen scooter;" UB Zippin, a scooter with seat and trunk; and the UB Cruzin electric bike.

ZAP Introduces New Adult Electric Scooter

Electric vehicle company ZAP recently introduced its new "Whiz-Bang" electric scooter, which the company said is designed for "adult riders looking for an inexpensive thrill-ride."

The Whiz-Bang is powered by a 24-volt drive system, which uses electronic controls and a current response power-manager to help optimize performance and battery life, "enabling it to reach speeds [of] 17 miles per hour and distances of 10 miles per recharge for less than a [dime's] worth of electricity."

The new scooter is constructed of a lightweight steel tube frame with a high-impact anti-lock braking (ABS) deck, 12-inch wheels, pneumatic tires, "V-style" front brakes and rear band brake and safety power cutoffs.

Tufts University Operates Four Electric Vehicles

Tufts University recently is collaborating with Toyota Motor Corporation and Boston, MA-based shared vehicle services firm Zipcar to begin operating four Toyota Rav 4 electric vehicles on the university's Medford/Somerville campus as part of Tufts' commitment to combat global warming. Two of the donated electric vehicles have been assigned to the university's security and mail services departments, while the remaining vehicles have been designated for use in the campus' Zipcar program. (TUFTS DAILY: 10/14)

AC Propulsion EV Earns Highest Grade at Challenge Bibendum

San Dimas, CA-based AC Propulsion, a developer, licenser and manufacturer of system and component technology for electric vehicle (EV) drive systems, recently announced that its all-electric "tzero" sports car garnered six "A" ratings, two "B's" and two "C's" during the 2003 Michelin Challenge Bibendum held last week at the Infineon Raceway in Sonoma, CA, earning the vehicle an overall grade point average (GPA) of 3.40.

According to AC Propulsion, none of the other competition entrants achieved a GPA greater than 3.20 for the 10 grades given for driving performance and environmental impact.

"Electric cars can be fast, clean and efficient, and the tzero's grades bear that out," said AC Propulsion founder and tzero designer Alan Cocconi. "In the important acceleration, emissions, and efficiency tests, the tzero got straight A's, the only entry to do so. Everyone knocks EVs for limited range, but after the tough Bibendum efficiency run, Michelin rated the tzero at 240 miles of range. When we pointed out an error in their EV range calculations, they agreed that 280 miles was a more accurate number. That's enough to ease most people's range anxiety. It's far better than the best fuel cell car."

OSU Electric Car Sets National Speed Record

Ohio State University's "Buckeye Bullet" electric car has broken the 251.3-mile per hour (mph) national speed record for an electric vehicle. Built by a team of engineering students at the OSU Center for Automotive Research-Intelligent Transportation (CAR-IT), the Buckeye Bullet completed two certified runs at the Bonneville Salt Flats in Utah, reaching speeds averaging 257 mph. For the first of the two runs, the car was clocked at 271 mph.

The university noted that the CAR-IT team collaborated with both faculty and industry experts to build the 30-foot-long vehicle, which is equipped with a 500-horsepower electric motor powered by more than 12,000 nickel-metal hydride batteries.

ZAP Introduces ZAP Q Electric Stand-On Transporter

Electric vehicle company ZAP recently unveiled its latest vehicle, the ZAP Q Electric Transport, which it said "looks and performs like other two- and three-wheeled stand-on transporters and scooters in its class, but with more features and handling for less than half the price of some models."

The ZAP Q is ridden in a standing position with one's feet placed side-by-side while gripping the handlebars. Two wheel-motors on the front drive the vehicle while two smaller rear wheels provide steering and stability. Other features include adjustable handlebars, a headlight, turn signals, running lights, a variable speed throttle, voltage and speed gauges, an LED display panel and keyed ignition.

Davis, CA Launches NEV Lending Program

The Alternative Vehicle Taskforce of the city of Davis, CA recently announced the launch of a neighborhood electric vehicle (NEV) lending program designed to promote the use of NEVs for short trips around the city.

Under the program, taskforce officials said residents may rent one of two NEVs manufactured by DaimlerChrysler subsidiary Global Electric Motorcars for one week free of charge. Officials noted that the NEVs will be available only to licensed and insured residents who have access to a covered parking area. (CALIFORNIA AGGIE: 11/3)

Arotech Successfully Demonstrates All-electric Bus

Arotech Corporation recently announced the successful demonstration of its zero-emission, all-electric bus in Schenectady and Albany, NY. The Electric Fuel bus demonstrations were among the final tasks of the third phase of the company's zinc-air all-electric transit bus program with the FTA.

Arotech said the fourth phase of the FTA cost-shared program, to begin next month, will explore "steps necessary for commercializing the all-electric zinc-air/ ultra-capacitor hybrid bus."

DaimlerChrysler Comments on GEM NEV Sales

DaimlerChrysler division Global Electric Motorcars (GEM) expects more than 28,000 of its GEM neighborhood electric vehicles (NEVs) to be in use by the end of the year.

According to GEM, the NEVs have proven popular with planned communities, industrial and commercial parks, manufacturing facilities and college campuses, as well as been utilized through partnerships with a variety of government entities.

John R. Wilson, Ph.D. ©2004
TMG/The Management Group
Detroit, MI and Windsor, ON

SUMMARY

This brief overview is a summary of a longer paper that presents the conclusions of current and recent work by the author and many others on global warming and its origins[1]. It is intended for technically informed but non-specialist readers[2] and presents some new conclusions and outlines the technical evidence to support them.

In our paper, we propose that global surface heating associated with modest increases in solar irradiance since about 1800, combined with the resulting increases in the average level of water vapor in the atmosphere (currently 2-3% or 20,000-30,000 ppmv), have been the primary contributors to surface warming and that the combination of natural and anthropogenic carbon dioxide at a total of only about 370 ppmv in the atmosphere and increasing by only 1.5 ppmv/year is only a small player in the current global warming period.

We therefore suggest very strongly that there is an urgent need to call a "time out" on such drastic measures as the Kyoto Treaty and some alternate fuel programs, most notably hydrogen, until further research has led to a technically sound basis for action that takes account of all of the important factors contributing global warming. We are currently on the wrong path, both technically and politically. There may be good reasons to reduce our CO2 output, but global warming is not one of them.

Our conclusions are:

There should be no doubt that global warming is a real and measurable phenomenon, but it is a natural phenomenon, not greatly different than many previous global warming events that have occurred over geologic time.

The root cause of global warming is still not completely clear and there are many competing theories. However, we believe that most of them, especially those that assign responsibility to anthropogenic (man-made) greenhouse gases such as carbon dioxide, are unsustainable.

Increases in natural solar irradiance (or insolation) following the end of the "Little Ice Age" (roughly 1550-1850, with its minimum temperatures occurring in 1640-1720) and the consequent slow increase in global surface temperatures have resulted in a steady rise in average, equilibrium atmospheric water vapor levels since about 1800, perhaps earlier. It is water vapor and not carbon dioxide that is the primary contributor to global warming.

Most models of global warming assume that carbon dioxide, methane, nitrous oxide and other gases are the primary cause of global warming and incorrectly relegate water vapor to a secondary and dependent role without examining the effects of water vapor on an equal footing with the other atmospheric gases. In reality, the reverse is true — increases in atmospheric water vapor completely dominate the global warming process and a secondary result is the observed increase in atmospheric carbon dioxide. The effects of methane and nitrous oxide are currently relatively trivial.

The increase in water vapor content, while originally due to the post-Ice Age increase in solar irradiance, and a consequence of the extreme sensitivity of atmospheric water vapor to changes in surface temperature (about 6% or ~1,800 ppmv per 1OC temperature rise), results in a major 'feedback loop' that has further increased global warming. This well-known feedback or 'ratcheting' effect has been the dominant factor in determining global temperatures throughout geologic time.

Some climate models take account of this feedback, but only as a result of global warming induced by CO2 and other greenhouse gases. They therefore incorrectly attribute all of the warming to these gases with the much greater water feedback identified as secondary without benefit of objective analysis.

The greenhouse effect of the so-called non-water greenhouse gases is almost trivial. Their concentrations are increasing at only 1.5 ppmv (CO2) or much less annually and the effect of these increases is so dominated by the effect of rising average atmospheric water vapor levels (increasing at up to 300 ppmv annually) that it is effectively lost in the noise of the geographically and temporally variable effect of water.

Both natural and anthropogenic carbon dioxide is largely buffered or absorbed by plants, the oceans, lakes and wetlands to maintain a near-constant level in the atmosphere. An increase in temperature expels CO2 from the ocean and has caused the observed (but unimportant) increases in atmospheric CO2. This is consistent with the observed lag of increases in atmospheric CO2 levels behind temperature increases - i.e., the temperature rise is the cause, not the effect.

It is apparent that global warming is a predictable natural phenomenon that has occurred frequently in geologic time and that there is very little that we can do to change it. If this is indeed the case, much re-thinking is needed of our society's future problems, actions and opportunities.

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August, 2003

[1] The full paper will be available at *www.tmgtech.com* on or before September 2, 2003. Click on "Publications", then on "Global Warming". If it is needed before then, please email the author at *tmg@tmgtech.com*.
[2] A separate paper to follow this one later in 2003 will present our analysis in much more technical detail. It will be available only to TMG clients.

What's New In Electric Vehicle Drive Technology

By Mark E. Hanson © 2003
Long Beach, Cal

Introduction and Executive Summary:

EVS-20 put on by EDTA (Electric Drive Transportation Association) was the largest (2000 engineers/presenters) event I have been to so far in the last 20 years with over 100 electric drive businesses and many technical sessions for three days. The ride and drive program was the largest I have been to also with electrics, hybrids and fuel cell vehicles.

Some of the new battery technologies such as lithium polymer and sodium nickel are required to run hot and require elaborate thermal and equalizing battery management systems. The more viable technologies such as the mature Ni-Cads ($600 per kwh) and NiMH ($1.2k per kwh) batteries have been proven and enjoyed by users. Bill West with Southern California Edison really liked the Panasonic (http://panasonic.jp/) NiMH batteries in RAV4's, which he still has four vehicles left with over 100k miles each on the original battery packs.

On the vehicle front, the large automakers have shifted their interest through government fund-ing over to fuel cells. Hybrids such as the new Toyota 04' Prius was a leap forward in techno-logical improvements. Smaller companies such as ZAP www.zapworld.com and Reva www.evworksus.com as well as some motor-cycles/scooters like WaveCrest and the well-engineered Vectrix are selling pure electrics. ZAP has had management/money boondoggles in the past so it will be interesting to see if this Chinese import takes off with crash test requirements.

Most of the pure electrics were forced into a NEV category for cost/crash test reasons. Reva hopes to raise their US vehicle to 50-mph from the present NEV 25-mph requirement since it's already being used in India at 50-mph. Selling EVs at glorified golf cart speeds doesn't help the EV cause.

DChrysler FCell fcv cutaway display

AC Propulsion's plug-in hybrid

GM Ken Stewart, as well as Bill West, noted that customers prefer plug-in hybrids (from EV-1 and RAV-4 focus groups) and see that as a desired feature so they don't have to bother with gas stations. GM said they are working with Daimler-Chrysler to have a 30-60 mile range plug in hybrid available in the next few years to fleets.

Information spanned from Rob Reiner who gave an excellent pointed speech regarding sustainable awareness to a new more efficient AC drive.

My Focus is on the technological improvements since the last Symposium and sampling some of the highlights. Since there were five technical classes going on simultaneously, it was difficult to cover everything so from an engineer's perspective, I picked the highlights. Complete information can be found on www.electricdrive.org or www.evs20.org.

The Vehicles:

Initially on Sunday, I attended the Ride & Drive starting with Toyota. The 04' Prius (www.toyota.com) was substantially improved over the previous model years although it wasn't plug-in yet. The engine compartment was laid out more cleanly and easier to service than previous year models. I could easily reach under and grab the oil filter for changing and the spark plugs on top of the engine. The price was the same as last year $20k for a better vehicle. The Honda hybrid Civic was also well laid out.

With a $2k tax credit, that would be about $18k. The vehicle is roomier with the same fuel economy 60 mpg city / 51 highway.

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An antique EV, and two Honda EV plus vehicles on display

A side by side comparison of the canceled battery Honda EV plus and the Honda FCX fcv prototype. Note FCX uses EV plus chassis.

EVS-20- *continued from page 17*

Toyota has sold 100k hybrids so they have the most experience and improvements that I could see. It was also less frumpy (more futuristic looking) than last years typical marsh mellow car-pod look.

I rode in some fuel cell vehicles, Honda, GM and Ford which at present cost a million or more to build each one. They hope the price will come down to $100k in 10 years but presently are not yet ready for prime time. The 1.7 billion dollars mentioned the last state-of-the-Union speech in January has yet to materialize, according to the manufacturers that are presently building fuel cell vehicles. It should hopefully be divvied out over a five-year period I was told.

Stuart Technology demonstrated a very interesting small hydrogen manufacturing plant suitable for home (or on location) hydrogen production. It used solar panels to separate water using a standard electrolysis process with oxygen as a byproduct. It pressurized to 6Kpsi in gas form to fuel a car. The goal is to go to 10Kpsi for more on board storage and better range. The vehicle tanks are made of carbon composite, which should disintegrate in an impact and not explode a Stuart spokesman said. The conversion process is 50% efficient.

I asked, "why not just hook the solar panels to batteries in an EV and charge them directly". He responded that better range could be had with this set-up even though the process isn't as efficient as a direct charge con-nection. Presently the hydrogen manufacturing station generates 3kg (210kWh equivalent) of stored hydrogen. 1kg = 60 miles so 180 miles per day is realized from the generation station.

Air Products (www.airproducts.com) Donald Eichelberger noted his company, and not Stuart, was actually fueling the Ride & Drive fuel cells. He said his $6 billion 18k employee company fuels most fuel cell operations and taps off of existing underground hydrogen lines that are already connected to refin-eries for the refinery process. The hydro-gen is reformed from natural gas presently. This can continue in this mode to fuel small amounts of fuel cell vehicles for the next 10 years.

I asked why vehicles don't burn the natural gas directly, in like the Canadians do, for more efficiency. He replied that by at least mixing some hydrogen with natural gas in a direct burn engine, the hydrocarbons and CO2 are drastically reduced resulting in a far cleaner burn. The britilization of a metal engine must be considered (modified) to accommodate pure H2. Air Products claims they sell more hydrogen than all the other suppliers combined and fuel all NASA missions.

I rode around on the Vectrix (www.vectrixusa .com) scooter, which had impressive performance, ran up to 60mph. It had regen on a unique bi-directional throttle and has a range of about 60 miles per charge. I also rode a M750 E-bike by WaveCrest (www.wave crestlabs.com) that has 20 miles per charge. Wavecrest is in Dulles, Virginia and their bike is being looked at by the military for its stealth like silent drive and no heat signature.

Maxwell Technologies (www.maxwell.com) demonstrated their Ultra-Caps in a Las Vegas NEDRA race last year, going 1/4 mile in a drag race starting at 400V and dropping to 180V. The car accelerated to 77mph in 15 seconds. The caps are being considered for hybrids to eliminate the battery but don't have enough energy storage to replace the battery in a standard EV. The car weighed 1800 lbs and was charged with a 10-minute dump charging pit stop.

Their development team said it would be 1-2 years before they can replace batteries in hybrids and the new 42V cars. They expect that the caps will last the life of the vehicle,

ebus brought several buses: ice hybrid & fc hybrid buses

(above) Zytek using DChrysler Smart to promote their product (right) John Deer fc landscape concept vehicle (only made to show their R&D could do one)

removing the battery worries of customers. Their cost has been dropping and is now at 1 cent per farad. But the auto industry needs the price to be down at 1/2 cent per farad to be viable. Honda is trying an ultra-cap hybrid.

PEI (www.personalelectric.com) had a Personal Electric Transport to help here with urban sprawl in China/India. They had a quick-change swappable battery pack, which was nice.

Daimler Chrysler (www.media. daimlerchrysler .com) will introduce a diesel Jeep Liberty next year with a 35% fuel efficiency improvement over the present model.

The VW beetle clean burn diesel was similar in fuel economy to the hybrid Civic and Prius. Chrysler is looking more at clean burn diesels since they are very popular in Europe and should be here. A Diesel-Electric hybrid would have a 70% improvement over present gas vehicles with particulate emissions removed. Presently they are selling flex-fuel ethanol vehicles today. Chrysler has a hemi engine which is 10% more fuel efficient in their 5.7-liter engine. They now have 28000 GEM NEVs on the road, the largest of any manufacturer. They are one of the few actually making profits on EVs because they are cheaper DC drives. The shunt (sep-ex) 5hp GE drive and control has the same efficiency with regen capability as an AC drive but with lower cost and complexity. 40% of their sales are in California. My patent no, 6,218,812 on www.uspto.gov for a 1200W switch mode EV charger can be used for these and similar electric vehicles.

PEI 3-wheel chariot, Escooters, Ecycles, and Sunray EV (built to order)

Dr. Truckenbrodt with Chrysler talked about fuel cells that are clean and quiet, reduce our dependency on foreign oil but must get the platinum cost out. They are making 100 vehicles for testing but direct burn hydrogen piston engines are not being pursued (although by others) since Chrysler says fuel cells wells to wheels are more efficient. BioDiesel is also being pursued he said.

NREL (www.nrel.gov) (National Renewable Energy Labs) and DOE www.doe.gov were also present at three booths for the Clean Cities initiative and electric vehicle evaluations. The EnergyStar www.energy star.gov folks were also there with ways to improve your energy efficiency. The EVS-21 in Monaco France was presented for April 2-6, 2005.

At the Media Roundtable, Robert Stempel, president of Ovonics and former president of GM, said that across all lines hybrid technology would prevail by 2005. Andreas Truckenbrodt with Chrysler said we must have sustainable transportation to protect our resources. Presently annual solar energy dwarfs all oil reserves. Mike Schwarz with Ford said they are coming out with a hybrid Escape model in '04.

Ken Stuart with GM talked about the new Autonomy vehicle platform that can be used for fuel cell and hybrid vehicles. GM has put hybrid busses on the road equivalent to 8000 cars. They prefer working with larger scale vehicles than cars because of their impact.

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Toyota may have plug-in hybrids by '05 but battery may be so large as not to be commercially viable.

Compressed H2 is easier to handle than liquid H2 that must be -250C. Ken Stewart with GM said that the EV-1 charge was equivalent to 1.7 gallons of gas for 120 miles range with a 7.5-hour recharge. Presently they have a 250-mile range with fuel cell vehicles. They said that the EV-1 customers really liked their vehicles and missed them when they pulled them out of service.

At the Plenary session David Garman, Assistant Secretary of Energy, noted that there is 1.7 billion allocated for the next five years for fuel cell development. The fuel cell people I have talked to haven't seen any of this money so far. He noted that we would need to improve the CAFÉ standards further. The consumer must be enticed to fuel cell vehicles in order for them to become viable.

Robert Stempel of Ovonics noted that India and China would be the largest consumer of cars in the next few years with the biggest pollution problems. China has MPG ratings more stringent than the US. Vehicles must be developed for these markets. China sales reached 1.3 million, up 73% in 1 year. By 2020 China will be the number one consumer of vehicles. India has been increasing at the rate of 10% per year and will continue for the next 10 years foreseeable.

Long Beach Community College EV

T.J Glauthier President of Electric Innovation Institute thanked Kateri Callahan President of EDTA for all her hard work in putting on the symposium. He is looking at upgrading the grid from a 1950's technology to a smart self-healing grid which finds the fault and re-routes power around to prevent widespread blackouts.

EVT displaying an Electric Polaris Snow mobile using their product

Dennis Campbell CEO of Ballard Power Systems noted that fuel cells could also be used to feedback from the car or stationary systems to power homes during outages or where power is not available. He noted that Honda FCX and Mercedes are using their fuel cells. Reduced cost on fuel cells is following the Moore's Law for a 25-fold decrease from their Mark-3 to present Mark-9 design.

Rob Reiner, Director and actor, gave an excellent speech on the importance of having a sustainable environment. He said that he has connections to other movie stars if developers would like to see certain technologies/vehicles included in programs to promote them contact him. He noted that from his early childhood development programs "I am Your Child Foundation" to the environment he practices what he preaches by driving a Toyota Prius.

There is a consciousness growing that people recognize the need for better fuel efficiency and to protect the environment. Since 1979 the polar ice caps are melting as much area as California and Texas combined. In 100 years we will loose the polar ice caps by global warming if something isn't done. Children and the environment are two key issues that effect society.

There must be a sustainable world. Kennedy said we would put a man on the moon in 10 years. We could be energy independent within 10 years. The war on terrorism would be eliminated if we were. 60% of our oil is imported with 25% coming from the Middle East. If we all drove hybrids, that would eliminate the need for oil from the middle

east. We can not only save our resources but also improve the safety of our planet.

The Advanced Batteries session was reviewed looking at lithium metal polymer battery with Anthony Sudano, Avestor (www.avestor.com). Their pack weight is 1/3rd that of lead acid, however they have to be kept at 70C with heaters and a battery management equalizing system which drives up the cost. It has no gels or liquid. They are presently being tested in telecom products. The cost is $800 per kWh, which includes the electronic control & equalizing. It takes 18 minutes to get up to operating temperature.

The Zebra Battery was also reviewed part of Chrysler, which had to be kept at 300C to operate using salt and nickel, 35ah modules.

Saft (www.saft.com) Phillippe Elrich showed a NiMH battery used on a hybrid bus. The battery long life reduces the need for battery exchange and no overhead wires are needed. "After many years of demonstrated Ni-Cads, NiMH are ready", he said.

Ken Kelly, with NREL (www.nrel.gov), showed a "Six-Sigma" process for measuring better thermal performance of batteries. Note: "Six-Sigma" is a new buzzword coined by the manufacturing industry for the previous "Zero Defects" quality control programs that were prevalent in the 80's and early 90's. He showed charts and graphs indicating flow and pressure differences for NiMH optimum cooling.

Looking at Drive Systems, Boryann Liaw from the University of Hawaii showed in a PowerPoint presentation graphs mileage and drive variations in different parts of the Hawaiian Islands. He used rapid chargers and a fuzzy-logic based analytical tool.

Stuart Energy Electrolized hydrogen refueling station, Ford refuels one of their fcv prototpyes. The two hose cable for refueling , one for the refule, the smaller for sensing the tank pressure.

Ken Stewart, marketing director for GM noted that they have cut smog by 95% with a 9% fuel economy improvement. People presently buy larger inefficient vehicles that cost more when it would be more cost effective to buy cheaper more fuel-efficient vehicles (probably due to marketing hype). GM/Allison are selling hybrid busses that cut usage by 60% and emissions by 90% over previous busses. 75kW stationary fuel cells can also be used for home power generation (in remote areas). Hybrid Silver-ados are for sale in fleet operations.

Bill West with Southern California Edison (www.sce.com) noted that by reducing

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WaveCrest Ebikes, developed for the military, foldable

ground ozone by half would reduce health by 1 billion dollars annually. They now have 10 million EV miles logged since 1990 that will help reduce our need for foreign oil and help global warming.

Southern California Edison has been replacing their EVs since the major auto companies are pulling them out. The EVs are being replaced by hybrids for electric meter readers. Plug-in hybrids would be better, more like on an EV that is preferred for 40% emissions reduction. Southern Cal Edison is using GEM NEVs for meter maids since EVs are desired. Some Segways are used for foot meter readers that reduce reading time by 50%.

West was skeptical about fuel cell vehicles but will try them. All non-read forklift and golf cart applications are electric. He enjoys electrics and will not give up just because the technology is no longer available from the manufacturers. (They sued CARB with the federal government to eliminate EV production requirements last year.) They still have four Toyota RAV-4 EVs with over 400k miles on the original NiMH battery pack by Panasonic.

The Hawaii EVs were also NiMH and lasted as long as the vehicle. Plug-in EVs with a 20-40 mile range would be desired. It is more convenient to plug in at home overnight most users noted, than going to a gas station. GM plug-in hybrids will be developed with Chrysler for fleets. The Chinese are implementing fuel economy standards more stringent than those in the US.

Errol Wallingford (Royal Military College of Canada) acsystem@kingston.net implemented from a Patel & Hoft reference revolutionary new AC design with patents on AC drives. (Note: I requested a standard dynamometer or equivalent efficiency comparison for his drive vs. a typical vector 3-phase drive such as Siemens and he didn't have any efficiency comparisons. This must be left up to future testing).

This design is more efficient and eliminates cooling requirements for the motor and control he said. Wallingford disconnected the Y connection on a standard 3-phase motor and controlled the three coils individually with three independent H-bridges. His test bed was a '97 GeoMetro with 820-pounds of batteries, 14ea 12V. This full wave bridge inverter has the windings separated instead of a delta or Y configura-tion. He used a microprocessor instead of a DSP, since the control is easier than vector control—with square wave pulses using a lookup table on a Motorola microprocessor MC68HC711. The three H-Bridges with three separate coils had six snubber caps and a laminated buss for the six leads going to the 25hp Baldor 230V 3-phase 60-hertz induction motor. The motor individual coils calculate to 132V rms per coil instead of 230V.

The resulting vehicle uses 150 W-hours per mile. With peak voltage requirement a 163-volt buss is used. The five most significant harmonics are removed with 2k bytes of code. A PWM look-up table is used to synthesize the duty cycle of a sine wave. There must be a 12usec dead-time delay to prevent shoot through for the Collmer IGBT's. A set/reset flip-flop was used for all alarm conditions and a laminated buss is required. The 5-speed transaxle was retained although 1st gear wasn't used. Wheel speed was measured with a hall-effect device for the feedback speed/acceleration firmware loop. The rate of change is every 4th cycle for smooth performance. A button on the steering column controls regen. Greater than a 20% throttle demand results in full torque under software and less than 20% is delivered at 75%.

So, What's New and Real?

Vectrix, an excellently designed ergonomic scooter at 60 mph and 60 mile range is quite an improvement over previous motorcycles with very limited range. The scooter design is preferred due to the inability to place enough batteries on a traditional motorcycle layout. Electrovaya's Li-Ion, Panasonic and Saft's NiMH & Li-Ions had excellent 150-250 mile range (depending on the vehicle). They also had a long life with greater than 2000 80% dod BCI life cycles. The REVA electric car at $10k price looks ready for prime time. Unique Mobility developed a fuel cell drone electric plane for the military. It's 89lbs, 71 hp PM BLDC motor called "Caliber EV-53".

Arnold Schwarzeneger plans to put in hydrogen fueling atations every 20 miles by 2010. These will initially probably use the existing hydrogen lines going to refineries.

Aerovironment's Paul McCready designed Helios 2nd generation project for NASA. The high flying electric plane reaching up to an altitude of 96,863 feet, will now have a hydrogen fuel cell and solar power to stay aloft for weeks between fueling. It will be used for an alternative to communications satellites.

Alan Coconie's AC Propulsion T-Zero demo'd 280 miles per charge on Li-Ion batteries from LA to Vegas. The Toyota Prius and Honda Civic are affordable clean burn hybrids. Maxwell caps have demonstrated battery replacement in mild hybrids by drag racing at Vegas only with UltraCaps. GM, Chrysler and Toyota are evaluating true hybrids or plug-in hybrids, which would be the best of all worlds.

EVS-20 Photos provided by Bruce Parmenter

Mellow Yellow's first real EV adventures... part 3

By Richard Bebbington

...continued from part 2...

I woke up early on Sunday morning, knowing that this was Mellow Yellow's big day.

There was just enough time to trickle a few more electrons into the batteries while I made breakfast and packed some lunch for the day. After about 30 minutes, I had to unplug as it was time to go - I was already late for meeting up with my friends at their house, at 8:15 am!

Up at my friend's house, we met up and they decided to follow in his Nissan Pulsar, a total beast of a hopped-up hatchback... 250 BHP with full 4 wheel drive, turbo and 17 mpg. Ughh...

I asked him to remember what maximum speed I got to, and I'd remember what my speedo read. I could then work out how accurate my speedo really is.

So we set off, and I deliberately went along the back roads to avoid the high-speed highways. There was one stretch where I couldn't avoid the highway, so I just put my foot down and prayed the motor and/or belt drive would be ok... ...and it was. A short 1/2 mile later, I turned off onto slower roads, and happily cruised along at 45 mph, using an average of 70 amps from the 120v pack. The little truck actually feels better with 800 lbs of battery pack on board, rather than 550 lbs, the extra springs I have must be too stiff for the lighter pack (it used to be like an empty flatbed truck — very jarring!)

As we approached the show, we noticed more and more unusual vehicles. Some of these vehicles were positively antiques! I turned into the exhibitor's entrance, and my friends had to go into the public car park, but no problem, those mobile phones make finding each other easy!

I parked up where the attendants showed me to, and the gent next to me asked
"Is that electric?"

"Yes!"

"Nice. Reminds me of the hybrid I built once..."

and we got talking about electrics and hybrids in general. He was quite interested, and I gave him a tour of the electric mini. I also put up a printout in the windscreen, giving some info on Mellow Yellow and the EV List (I didn't have time to do a really good EV info sheet, that'll have to wait until next time)

After some more chitchat, I went off to find my friends Rich and Dave, and we then went straight to the autojumble stands, where all the old weird junk is for sale. I just love looking through all these things, seeing if there's some strange widget I can use for some arcane purpose... ;-)

All in all, we spent several happy hours wandering around, looking at everything from Ferraris to Trabants, and at around 4 pm we decided to call it a day. We returned to Mellow Yellow and the gent-next-door-hybrid-builder dude, who said that there had been quite a few people looking at my pickup. Darn it! I know I should have made some Plexiglas covers — then I could have left the hood and load bed covers up, so people could see the electric stuff. I hadn't left them open, because I didn't want someone to touch something dangerous... Oh well, another thing for my to-do list.

Now, the moment of truth had arrived. I had driven 12 miles out to the show, and was committed. Would I have enough power to get back? There was only one way to find out!

I drove slowly towards the exit, with my friends walking alongside. There were still so many people around that it was impossible to go faster than walking pace anyway. Quite a few people didn't notice the funny little yellow Mini creeping up behind them, until they heard the gravel crunching under the tyres.

After negotiating the vicious speed humps, I made my way out onto the streets, and started home, knowing that it wouldn't take long for my friends to catch up. On the way back, I pushed the little yellow truck a bit harder, and got up to 52 mph on the speedo (which turns out to be pretty accurate after all). I got to the outskirts of Cardiff before my friends appeared in the rear-view mirror — what was taking them so long?

We drove back to my friends house without incident, even driving up a couple of steep hills near his house, and went inside for a well-earned cup of coffee! The pack was pretty tired, but none of the batteries were getting below 11.0v even under load, so there was still some juice left.

After the coffee and a good "chewing the cud" session about the day's events, I said goodbye and left for home. By the time I approached my house, the pack WAS getting tired, with one battery approaching 10.8v. I pulled into my drive, and plugged the PSU charger in. 25 amps rushed into the batteries, and it carried on for over 3 hours before it began tapering off! Eventually, after babysitting the PSUs to top the batteries off, I unplugged and reviewed in my mind the whole eventful day:

1. 25 miles on just the 2nd charge cycle — I've got enough range to get to work in my electric mini!

2. 50mph top speed, which is not bad for a direct-drive 7 HP motor By tweaking the belt drive ratio, I might be able to get 60mph

3. My first car show exhibiting an electric vehicle.

So all in all, Mellow Yellow and I had a most excellent adventure!

Richard Bebbington
Electric Mini pickup "Mellow Yellow"
http://homepage.ntlworld.com/electric.mini/

By Terry Wilson, SJEAA member and EAA historian

The following article is another in a series of articles intended to inform our readers about the material contained in our EAA Historical Collection. This is not a book review but more of a description of what the topic covered are, and general information about the book. In other words—I don't read the book, I merely peruse it! If you have read the book, feel free to review it and send your review to: ceeditor@eaaev.org

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Curtis Battery Book One, Lead Acid Traction Batteries
Written by the staff of
Curtis Instruments, Inc.
Copyright 1981, Third printing 1994
ISBN: 0-939488-00-0

The book is $7.95 and is 72 pages long, with 31 Illustrations. (There are also 8 Tables that pertain mostly to forklift shift charging.) It can be purchased from Electro Automotive, www.electroauto.com/. It is a good basic Battery book. It gives brief explanations, and covers the most critical points.

The book focuses on the lead-acid traction battery, primarily with the electric forklift user in mind. The writers intention is to help assist people in minimizing their energy costs. There are five sections to the book;

1. Energy, Work and The Storage Battery
2. About Lead Acid Batteries
3. Battery Charging
4. Optimizing Energy Usage
5. Wear and Tear

Each chapter is about 17 pages in length. Each section has around 12-17 topics. For example, Section 2. About Lead Acid Batteries is broken down as:

Introduction
- How a Lead Acid Battery is made
- Electrolyte
- Producing an Open Circuit Voltage
- Producing Current
- State-of-Charge
- Determining Battery Capacity
- Capacity and Discharge Rate
- Capacity and Temperature of Electrolyte
- State-of-Charge Measurements
- Specific Gravity and Open Circuit Voltage
- Voltage Under Load
- Ampere-Hour Measurements

Curtis Instruments designed the State of Charge Indicator for NASA's Lunar Rover, in order to warn the Astronauts if the battery charge dropped too low (they didn't bring a charger)! Curtis also developed a 933 Fuel Gauge for battery powered forklift trucks in order to warn the driver when the battery has reached a safe limit of discharge.

San Diego center offers full line of alternative fuels at pumps

by Seth Hettena - Associated Press
Reprinted from San Jose Mercury, Sept. 14, 2003

SAN DIEGO — At a just-opened San Diego fuel station, attendants in white, 1950s-style uniforms clean customers' windshields and offer to fill their tanks with biodiesel made form fish fry grease.

Or, at the ethanol pump, fuel made from waste scraped off the floor of a cheese plant.

Electric cards can charge their batteries for free. There's also natural gas and liquefied propane gas or LPG, both popular, less-polluting gasoline alternatives.

"No one has ever put all of these in one place," said Mike Lewis, 37, the West Virginian who manages the Regional Transportation Center, which offers gas, diesel and six alternative fuels.

Regional Transportation Center attendant John Palma charges a Think City electric car at the San Diego fuel station.

But so far, the station, which opened in early August, isn't seeing a steady flow of customers for the exotic combustibles. The No. 1 fuel at the station is plain old gas.

Still, gasoline and diesel sales pay the bills and leave the center well-positioned for California's clean-vehicle movement aimed at fighting the nation's worst air pollution while cutting dependence on oil. California has set a goal of having one of every 10 new vehicles sold in the state of be non-polluting by 2018.

"You want these products to be marketed and sold just like gasoline," said Dan Fong, a transportation technology specialist with the California Energy Commission. "You don't want to go to a dark corner in a barren location and get fuel for your vehicle."

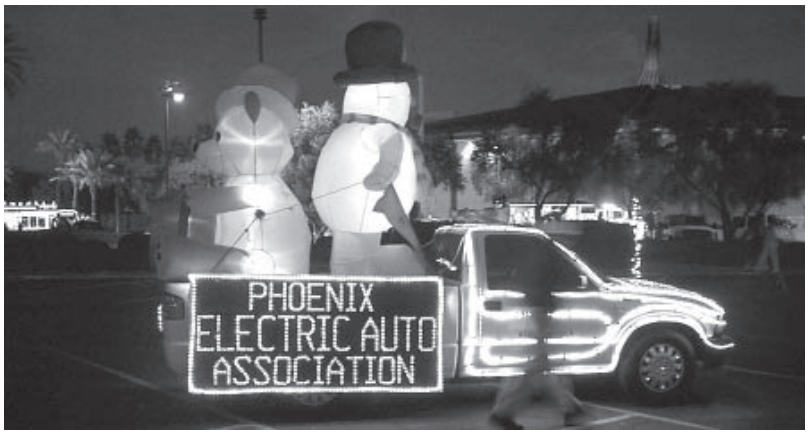
FIESTA OF LIGHTS CHRISTMAS

By Jim and Elaine Stack,
PEAA Members

The Phoenix Chapter of the Electric Auto Association strives to advance electric vehicle (EV) awareness. The group also serves as a means for electric vehicle owners and future owners to gain further knowledge on EV technology. Meetings include technical discussions, question-and-answer sessions, electric vehicle stories and vehicle displays. One of the recent public outreaches involved some of our electric vehicles in the 2003 APS Fiesta of light Electric Light Parade.

The parade, held on the first Saturday of December, attracts hundreds of thousands of people to downtown Phoenix every year. With well over 50 entries and live television coverage, the event is one of the many ways the Phoenix EAA gets out to showcase the practicality of electric vehicles.

Photos are courtesy of Jim and Elaine Stack.



Mason Convey's '94 Chevy S-10 with a full bed

GM Van certainly lights up the night

Mike Pengelly's '90 Ford Mustang Convertible decked out for the holidays

CANADA

VANCOUVER EVA (VEVA)

Web Site: http://www.veva.bc.ca/
Contact: Haakon MacCallum,1-604-258-9005, info@veva.bc.ca
Mailings: P.O. Box 3456, Vancouver, BC V6B3Y4, Canada
Meetings: 3rd Wed./month, 7:30 pm
Location: 3750 Kitchener St., BC Transit

UNITED STATES

ARIZONA

PHOENIX EAA (PEAA)

Web Site: http://www.phoenixeaa.com/
Contact: Sam DiMarco, 1-480-948-0719, voltek_2000@yahoo.com
Mailing: PO Box 6465, Scottsdale, AZ 85258-6465, USA
Meetings: 4th Sat./month, 9:00 am
Location: Varies, see Web Site for details.

CALIFORNIA

CHICO EAA (CEAA)

Web Site: http://geocities.com/chicoeaa/
Contact: Chuck Alldrin, 1-530-899-1835, calldrin@sunset.net
Mailing: 39 Lakewood Way, Chico, CA 95926-1555, USA
Meetings: 2th Sat./month, 10:00 am.
Location: 1350 East 9th St, Chico, CA

EAST (SF) BAY EAA (EBEAA)

Web Site: http://geocities.com/ebeaa/
Contact: Ed Thorpe, 1-510-864-0662, eaa-contact@excite.com
Mailing: 2 Smith Ct., Alameda, CA 94502-7786, USA
Meetings: 4th Sat./month, 10:00 am.
Location: 1515 Santa Clara Ave, Alameda, CA

LOS ANGELES EAA (LAEAA)

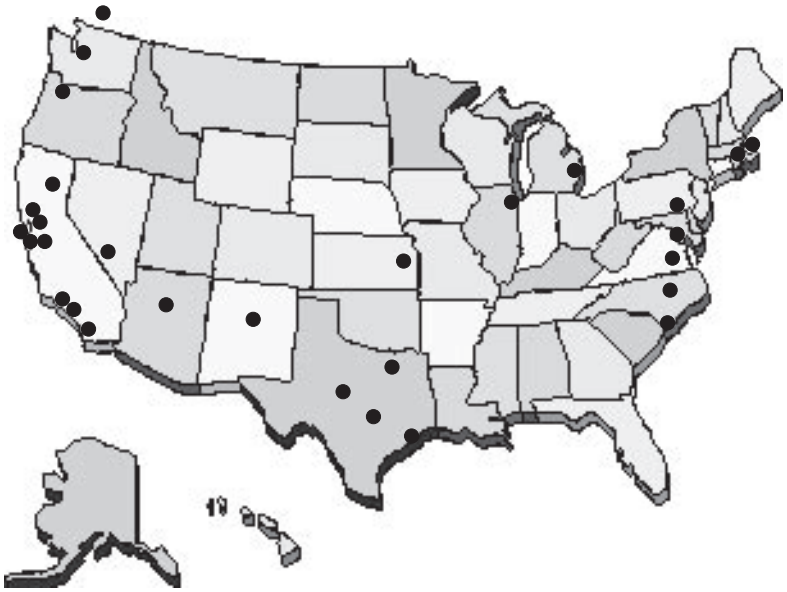
Contact: Louis Weiss, 1-323-935-2690, warbucks@attbi.com
Mailing: 1811 Hi Point St., Los Angeles, CA 90035-4621, USA
Meetings: 1st Sat./month, 10:00 am
Location: 1200 E California Blvd, Pasadena, CA

NORTH BAY EAA (NBEAA)

Web Site: http://geocities.com/nbeaa/
Contact: Dr. Nick Carter, 1-707-573-9361, nick@npcimaging.com
Mailing: 2228 Magowan Drive, Santa Rosa, CA 95405-4924, USA
Meetings: 2nd Sat./month, 10:00 am.
Location: Call for meeting details.

SAN DIEGO EVA (SDEVA)

Web Site: http://home.att.net/~NCSDCA/EVAoSD/
Contact: Chris Jones, 1-619-913-6030, NCSDCA@WorldNet.ATT.net
Mailing: 315 South Coast Highway 101, Encinitas, CA 92024-3543, USA
Meetings: 4th Tues./month, 7:00 pm
Location: 2080 Pan American Plaza, Balboa Park, San Diego



Listing updated, verified and current as of 12/31/03. Please check main web page for any changes in current listing. The Electric Auto Association is a 501 (c)(3) nonprofit organization.

SF PENINSULA EAA (SFPEAA)

Web Site: http://geocities.com/sfpeaa/
Contact: Bill Carroll, 1-650-589-2491, billcarroll@eaaev.org
Mailing: 160 Ramona Ave., San Francisco, CA 94114-2736, USA
Meetings: 1st Sat./month, 10:00 am
Location: 601 Grand Ave, South SF, CA

SAN JOSE EAA (SJEAA)

Web Site: http://geocities.com/sjeaa/
Contact: Terry Wilson, 1-408-446-9357 dongillis@yahoo.com
Mailing: 20157 Las Ondas Way, Cupertino, CA 95014-3132, USA
Meetings: 2nd Sat./month, 10:00 am
Location: 2350 Cunningham Ave., San Jose, CA

SILICON VALLEY EAA (SVEAA)

Web Site: http://eaasv.org/
Contact: Will Beckett, 1-650-494-6922, will@becketts.ws
Mailing: 4189 Baker Ave., Palo Alto, CA 94306-3908, USA
Meetings: 3rd Sat./month, 10:00 am
Location: 3000 Hanover St., Palo Alto, CA

VENTURA COUNTY EAA (VCEAA)

Web Site: http://geocities.com/vceaa/
Contact: Bruce Trucker, 805-495-1026, tuckerb2@adelphia.net
Mailing: 283 Bethany Court, Thousand Oaks, CA 91360-2013 ,USA
Meetings: Call or email for location/meetings.

KANSAS / MISSOURI

MID AMERICA EAA (MAEAA)

Web Site: http://maeaa.org/
Contact: Mike Chancey, 1-816-822-8079, eaa@maeaa.org
Mailing: 1700 E. 80th St., Kansas City, MO 64131-2361, USA
Meetings: 2nd Sat./month, 1:30 pm
Location: See web site for details.

ILLINOIS

FOX VALLEY EAA (FVEAA)

Web Site: http://www.fveaa.org/
Contact: Bill Shafer, 1-708-771-5202, assessorbill@cs.com
Mailing: 1522 Clinton Place River Forest, IL 60302-1208, USA
Meetings: 3rd Fri./month 7:30 pm
Location: 2000 Fifth Ave., River Grove, IL

MASSACHUSETTS

NEW ENGLAND EAA (NEEAA)

Web Site: http:/neeaa.org/
Contact: Tony Ascrizzi, 1-508-799-5977, tonyascrizzi@juno.com
Mailing: 34 Paine Street, Worcester, MA 01605-3315, USA
Meetings: 2nd Sat./month, 2:00 pm
Location: Call or email for meeting location.

PIONEER VALLEY EAA (PVEAA)

Web Site: http://geocities.com/pveaa/
Contact: Karen Jones, 1-413-367-9585, pveaa@hotmail.com
Mailing: P.O. Box 153, Amherst, MA 01004-0153 USA
Meetings: 3rd Sat./month, 2:00 pm
Location: 43 Amity Street, Amhurst, MA.

MICHIGAN

DMC-EAA DETROIT MOTORCITY CHAPTER (DMCEAA)
Web Site: http://geocities.com/detroit_eaa/
Contact: Richard Sands, 1-734-281-4087, rsands01@comcast.net
Mailing: 13162 Fordline St, Southgate, MI 48195-2435, USA
Meetings: Call or email for location/meetings.

NEVADA

LAS VEGAS EVA (LVEAA)
Web Site: http://www.lveva.org/
Contact: William Kuehl, 1-702-645-2132, bill2k2000@yahoo.com
Mailing: 4504 W. Alexander Rd., N. Las Vegas, NV 89115-2489, USA
Meetings: 2nd Sat./month, 10:00 am
Location: 1401 E. Flamingo Rd, Las Vegas, NV

NEW MEXICO

ALBUQUERQUE EAA (AWAA)
Web Site: http://abqev.org/
Contact: Tom Stockebrand, 1-505-856-1412, info@abqev.org
Mailing: 1013 Tramway Ln NE, Albuquerque, NM 87122-1316, USA
Meetings: 1st Tues./month, 7:00 pm
Location: 6810 Menaul NE, Albuquerque, NM

NORTH CAROLINA

COASTAL CAROLINAS (EAACC)
Contact: Jayne Howard, 1-910-457-4383, EAAofCC@aol.com
Mailing: 4805 E. Southport Supply Rd., Hwy 211, Southport, NC 28461-8741, USA
Meetings: Varies, call for details.
Location: 4805 E. Southport Supply Rd., Hwy 211, Southport, NC

TRIANGLE EAA (TEAA)
Web Site: http://www.rtpnet.org/teaa/
Contact: Ken Dulaney, 1-919-461-1241, teaa@rtpnet.org
Mailing: 202 Whitehall Way, Cary, NC 27511-4825, USA
Meetings: 3rd Tues./month, 5:30 pm
Location: Varies, call for details.

OREGON

OREGON EVA (OEVA)
Web Site: http://www.oeva.org/
Contact: Ralph Merwin, prizmev@yahoo.com
Mailing: 2905 NE 29th Ave., Portland, OR 97212-3558, USA
Meetings: 2nd Thur./month, 7:30 pm
Location: SW Salmon & 1st St, Portland, OR

PENNSYLVANIA

EASTERN EV CLUB (EEVC)
Web Site: http://members.aol.com/easternev/
Contact: Peter Cleaveland, 1-610-828-7630, easternev@aol.com
Mailing: P.O. Box 717, Valley Forge, PA, 19482-0717, USA
Meetings: 2nd Wed./month, 7:00 pm
Location: 201 E Germantown Pk, Plymouth, PA

TEXAS

AUSTIN AREA EAA (AAEAA)
Web Site: http://www.austinev.org/
Contact: Aaron Choate, 1-512-453-2890, info@austinev.org
Mailing: PO Box 49153, Austin, TX 78765, USA
Meetings: Call or email for location/meetings.

HOUSTON EAA (HEAA)
Web Site: http://www.heaa.org/
Contact: Dale Brooks, 1-713-729-8668, brooksdale@usa.net
Mailing: 8541 Hatton St., Houston, TX 77025-3807, USA
Meetings: 3rd Thurs./month, 6:30 pm
Location: 3015 Richmond Ave., Houston, TX

NORTH TEXAS EAA (NTEAA)
Web Site: http://www.geocities.com/nteaa/
Contact: Paul Schaffer, 1-972-437-1584, pshf@hotmail.com
Mailing: 430 Ridge Crest, Richardson, TX 75080-2532, USA
Meetings: Varies, call/email for details.

VIRGINIA

CENTRAL VIRGINIA EAA (CVEAA)
Contact: Ernest Moore, 1-804-271-6411, ernie_moore@yahoo.com
Mailing: 4600 Melody Ct., Richmond, VA 23234-3602, USA
Meetings: 3rd Wed./month, Call for details.
Location: Westwood Ave., Richmond, VA.

WASHINGTON

SEATTLE EVA (SEVA)
Web Site: http://www.seattleeva.org/
Contact: Steven Lough, 1-206-524-1351, slough1@mindspring.com
Mailing: 6021 32nd Ave. NE, Seattle, WA 98115-7230, USA
Meetings: 2nd Tues./month, 7:00 pm
Location: See website, call for details.

WASHINGTON D.C.

EVA OF WASHINGTON DC (EVA/DC)
Web Site: http://www.evadc.org/
Contact: David Goldstein, 1-301-869-4954, goldie.ev1@juno.com
Mailing: 9140 Centerway Rd., Gaitherburg, MD 20879-1882, USA
Meetings: 2nd or 3rd Tues./month, 7:00 pm
Location: Building 31-C, 6th, Bethesda, MD.

Board of Directors 2003

Chairman
Ron Freund
chairman@eaaev.org

Membership Chapter Relations West
Will Beckett
membership@eaaev.org

Secretary
Scott Leavitt
secretary@eaaev.org

Treasurer
Gabrielle Adelman
treasurer@eaaev.org

Chapter Relations East
Jerry Asher
ChapterRelationsEast@eaaev.org

Elections Board Calendar
Bill Carroll
electionadmin@eaaev.org

Education Program Manager
Kim Rogers
education@eaaev.org

East Coast Coordinator
Karen Jones

Delegates:
Tom Dowling - *EV Charging*
charging@eaaev.org

Charlie Garlow - *Junior Solar Sprints*
juniorsolar@eaaev.org

Bruce Parmenter - *EAA Technology*
webmaster@eaaev.org

Ed Thorpe - *CE Publications*
ceeditor@eaaev.org

Terry Wilson - *Historian, Awards*
historian@eaaev.org

EAA Board contact:
board@eaaev.org 1-510-864-0662

Notice: IRS requires us to ask for a full disclosure by the donor for donations of $1000 or more. This should include Full Name, Complete Address, Phone Number, and Social Security or Tax ID Number.

Nominations For The EAA Keith Crock and Fellow Awards

By Terry Wilson, EAA Historian

The EAA would like to receive nominations for our EAA Fellow Award and Keith Crock Awards. These awards will be presented at the 2004 Annual EAA meeting in February next year.

The Fellow Award is made to individuals for outstanding activities in areas relating to support of the EAA, advancing the cause of electric vehicles, or other activities of benefit to the EV industry.

The Keith Crock Award can be given to an individual, a group, a company, or other organization. This award is given for technical excellence and can be in the form of a vehicle, component, a drive system, supporting infrastructure, etc.

We ask that anyone wishing to make a nomination, submit in any form they chose, all pertinent information such as nominee's:
- full name
- email address
- phone number
- PO mailing address
- which award (Fellow or Keith Crock)
- a detailed description of their EV activities and accomplishments.

Please provide photos or images in jpg format if possible. Submissions will also be considered for profile in CE, and in our historical records. As part of EAA policy, personal addresses and phone numbers will not be given out, without the nominee's permission.

Please send your nomination by end of **Dec 2003** to: Terry Wilson
20157 Las Ondas Way, Cupertino,CA. 95014-3132
eaahistorian@care2.com, 408-446-9357

Recipients of past awards
Fellow Award (most resent):
'02 Stan Skokan
'02 Anna Cornell
'02 Ed Thorpe
'03 Don Gillis
'03 David Goldstein

Keith Crock (last 5):
'95 Bob Schneeveis
'96 Jim Worden
'97 Lloyd Healey
'03 Rich Rudman
'03 Joe Smalley

Lifetime Achievement:
'03 Mike Brown
'03 Shari Prage

Keith Crock was an EAA Member who passed away in 1982. Keith developed a diode based speed controller that he used and which he extensively and meticulously tested. From EAA News July 1982 (EAA News was the original name for CE), titled "We Have Lost a Champion", by Bill Williams.

For those of you not yet aware, we are grieved to announce that Keith Crock passed away from a heart attack on March 29, 1982. Keith had been a very active member of the EAA since 1975, when he performed his conversion of a Nash Metropolitan. A veteran of seven consecutive Annual EAA Rallies, his "Metro" was widely recognized as being "one of the best," having received several endurance awards as well as Most Beautiful Electric.

Besides serving one term as President and one as Educational Vice President of the Santa Clara Chapter, Keith frequently spoke out for The Electric Vehicle cause to California Legislatures, Public Utility Commission, radio and television stations. Keith was always willing to "take time off from his daily Ford Aerospace job" to display his car to the public in order to further the cause of Electric Vehicles.

NATIONAL EAA MEETING

Remember to mark your calendars for Saturday, February 2, 2004, for the Annual National meeting, held at the SVEAA meeting location - HP headquarters in Palo Alto, California.

ALL-CHAPTERS MEETING

The next All-Chapters EAA Conference will be in Vancouver, BC, Canada, along with REV!2004, on the weekend of June 5, 2004.

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.

EV Charging Maps & Info:

EV Charger list
Covers Arizona, California and Georgia.
Web Site: http://evchargernews.com/

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

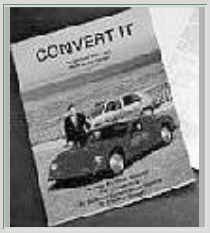
-- General Items --

	*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 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)

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

January 23, 2004
NEDRA PRE-SEASON OPENER/TEST AND TUNE, Las Vegas, Nevada, USA
First electric drag racing of the season, at the Las Vegas Motor Speedway.
Web Sites: http://www.lvms.com/ http://www.nedra.com/upcoming html

February 21, 2004
EAA NATIONAL ANNUAL MEETING, Palo Alto, California, USA
Review of 2003, looking forward to 2004, announcement of annual awards and appointment of new Board of Directors.
Web Site: http://www.eaaev.org/

April 2004
EARTHDAY EVENTS, Everywhere
Various local celebrations of Earthday. Plenty of opportunities to participate with EVs, from display to presentations and rides.

April 2, 2004
NATIONAL AFV DAY ODYSSEY, various locations, USA
Showcasing cleaner choices in transportation. Coordinated through the National Alternative Fuels Training Consortium at West Virginia University.
E-mail: obyssey2004@mail.wvu.edu
Phone: 1-304-293-7882 *Web site:* http://www.nationalafvdayodyssey.org/

April 2 - 3, 2004
EV CHALLENGE, FINAL EVENTS, North Carolina, USA
Premere College event, sponsored by the Triangle EAA Chapter, to promote education and student exposure to EVs.
Web Site: http://www.rtpnet.org/ev/
Web Site: http://www.evchallenge.org/

April 19 - 24, 2004
INTERNATIONAL H2/FC GROUP EXHIBIT, Hannover, Germany
The world's biggest commercial exhibition on Hydrogen + Fuel Cells, presenting their latest H2/FC developments and products.
E-mail: arno@fair-pr.com
Website: www.virtual-fair.com

April 24, 2004
EBEAA EV DISPLAY AND DRIVE/RIDE RALLY, Concord, California, USA
Annual East (SF) Bay Chapter EV distance rally and display/ride event.
Web Site: http://www.geocities.com/ebeaa/

April 27 - 30, 2004
15TH U.S. HYDROGEN CONFERENCE AND HYDROGEN EXPO, Los Angeles, California, USA
Annual hydrogen Conference and Expo.
Phone: 1-202-223-5547
Fax: 1-202-223-5537
Website: www.hydrogenconference.org

May 2 - 5, 2004
10TH NATIONAL CLEAN CITIES CONFERENCE AND EXPO, Fort Lauderdale, Florida, USA
A voluntary, locally based, government/ industry partnership that mobilizes local stakeholders in order to expand the adoption of alternative fuels and alternative fuel vehicles (AFVs). Focused on sharing new technologies, research and development and to attract AFV purchasing.
Phone: 1-303-275-4358
Website: www.ccities.doe.gov

May 21 - 25, 2004
2004 TOUR DE SOL, New York to Philadelphia to Washington, DC, USA
17th annual green car show and performance rally.
Web Site: http://www.nesea.org/ transportation/tour/

June 4, 2004
REV2004!, Vancouver, BC, Canada
Annual Vancouver Chapter EV event, with parade, EV displays, EV rides, Electrathon races and Junior Solar Sprints.
Web Site: http://www.veva.bc.ca/

June 5, 2004
3RD EVER EAA ALL CHAPTERS CONFERENCE, Vancouver, BC, Canada
This will be the third annual conference to bring together EAA members from different chapter and work together for reaching out and promoting the use and development of EVs. Hosted by the Vancouver EAA Chapter.
E-mail: chapterrelationseast@eaaev.org
Web Site: http://www.eaaev.org

June 26, 2004
NEDRA POWER OF DC, Hagerstown, Maryland, USA
This will be the 4th annual electric drag race event in the Washington, DC area.
Web Site: http://www.powerofdc.com/
Web Site: http://www.nedra.com/

June 27 - 30, 2004
2004 FUTURE CAR CONGRESS, Washington, DC, USA
Presented by the U.S. Department of Energy (DOE) and the U.S. Council for Automotive Research (USCAR) tol showcase the latest developments in automotive technologies.
Phone: 1-202-328-2000
E-mail: meetings@sae.org
Web Site: www.futurecarcongress.org/

July 31, 2004
EV AWARENESS DAY, Portland, Oregon, USA
Annual Portland EVA Chapter EV display event in downtown Portland.
Web Site: http://www.oeva.org/

August 21, 2004
EBEAA EV DISPLAY AND DRIVE/RIDE RALLY, Hayward, California, USA
East (SF) Bay Chapter EV distance rally and display/ride event.
Web Site: http://www.geocities.com/ebeaa/

August 28, 2004 (tent.)
NEDRA NATIONALS, Woodburn, Oregon, USA
Premiere electric drag race event at the end of summer.
Web Site: http://www.nedra.com/

Email information to <cenews@eaaev.org>.

EAA **Chapter** Event =
EV related **Event** =
EV related **Conference** =

ELECTRIC AUTO ASSOCIATION
2 Smith Ct, Alameda, CA 94502-7786

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