Electric Auto Association

CURRENT EVENTS

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MANTA BEATS AURORA II

MIT WINS EXCITING SUNRAYCE '95

by Richard R. Rahders

The MIT solar car "Manta" beat the University of Minnesota "Aurora II" by a bare 19 minutes after nine days and 1,150 miles of racing, finishing in a cold rain at National Renewable Energy Laboratory headquarters outside Denver on June 29th.

The first five cars were within 40 minutes of each other after five fast, sunny days of racing through Indiana, Illinois, Missouri and part of Kansas. Thousands of people turned out at midday and evening stops to view the colorful, exotic solar racecars. Even though clouds and rain settled in during the last four days in Kansas and Colorado, the top eight finishers all beat the University of Michigan's 1993 overall speed record.

The next day Northern Essex Community College's "TNE-3" won the Pike's Peak Solar Challenge Hill climb by more than 50% over second-place "Northern Light III" from Mankato-Winona State Universities in MN. SUNRAYCE '95 started on June 20th after a crowded, gala ceremony and parade in sunny downtown Indianapolis following a week of scrutineering at Indianapolis Raceway Park, a road-racing course a few miles from the Indy Brickyard. Careful structural, braking, maneuvering, acceleration and endurance testing produced 38 qualifying racers for the starting grid.

Sixty-four teams from colleges and universities throughout the US, together with teams from Mexican and Canadian schools, had SunRayce vehicle designs advanced enough to pass registration requirements in January of 1995. Fifty of those teams descended on Indianapolis in early June, creating an exciting solar car tent city on the infield of IRP. The EVent was sponsored by GM/Hughes/Delco/DOE/NREL/MRI/EDS/Chevy.

Average cost per car in the starting grid was about $70,000. Costs ranged from $1.2 million (U. of Michigan) and $850,000 (George Washington U.) to $20,000 (Northern Essex C.C.).

"The week in Indianapolis was heaven for solar- and electric-vehicle enthusiasts", said Rick White, a continuing-ed student and team member from NECC, in Haverhill, Mass. "Scrutineering is open, so you can see how all the cars are made, and then you get to see them perform on a road track. And there are hundreds of students, faculty, sponsors, and officials working against a short deadline to prepare to race."

SUNRAYCE '97, scheduled for the last two weeks of June 1997, will follow the same format, starting in Indianapolis, (assuming funding is continued). EAA members should mark their calendars now. It really is that good.

Qualifiers had six hours each on two of three race days (after passing scrutineering) to travel a minimum of 50 miles at over 25 mph on the 1.8-mile, 8-turn road course. Longest distance traveled on either of the first two days won pole position. Teams that failed on one of those days had a "Last Chance Qualifier" to fill out the grid (to a 40-car maximum) on June 18th.

There were two main qualifying strategies: run as far and fast as you can,

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CA DMV and Craven Attacks on EV Safety

by Clare Bell

DMV - The Scoop

Well, folks, my letter to DMV got a reply to the effect of "what are you talking about—we haven't made any recent changes to the system." While I was puzzling over that, EAA member Paul Thompson (11665) phoned me up to give me the inside scoop. It turns out that local DMV offices CAN enter the "E" designation at their terminals — It's just a little tricky. The instructions for doing so are given in the DMV manual, 100-127 (by Paul's memory). To simplify matters, I'm going to give them here, as I understood them.

What the DMV clerk has to do is this: When the smog query comes up, the response is "Exempt". THEN the screen should allow the clerk to enter the "E" designator (since it's stating WHY the car is exempt). That's all. Should be easy.

I confessed I have not tried it myself yet, since this is being written close to deadline. As for my attempt to get the Porsche registered by having it "suspensed" through Sacramento; well that bombed on me. I got a letter back saying that Porsche doesn't MAKE electric cars. Sheeeeesh. Guess I'll have to get on the horn to old Sacramento and explain that no Porsche doesn't make electrics, but we make electrics out of Porsches. Guess DMV doesn't know that they are located in the most EV-friendly city in the US. Maybe someone should tell 'em.

Anyway, hope this is right and hope it bails out any EVers who are having DMV problems. Let me know.

Don't' Let Them WSPA In Your Ear

California's Zero Emission Vehicle (ZEV) program is being heavily attacked by the oil and auto industries. As a member of the EV community and EAA newsletter editor, I have watched the assault from the front lines. Here are some examples:

Making use of false front groups, such as various "taxpayer protest" organizations, the Western States Petroleum Association (WSPA) and their hired Woodward/McDowell publicity agency are waging war against EVs on every possible front.(All their activities can and have been documented). Why? The answer is disconcertingly simple. Money. Every EV on the road means less gasoline sold, less petro profit.

WSPA has also taken advantage of the concern about the safety of emergency service workers. Their hired gun, Ralph Craven of a Reno, Nevada based organization, stated in a Sacramento Bee article and when questioned by reporters at the most recent California Air Resources Board ZEV workshop, that WSPA petro-dollars fund the dissemination of his newspaper articles and his speaking tours around the state. His mission is to take potshots at EVs on the grounds of safety. The misinformation in his articles and op-ed pieces is intended to agitate the uninformed and easily-alarmed into pressuring the governor to override CARB and scrap the Zero Emission Vehicle program.

Don't let them fool you

Properly designed and built Evs ARE safe; safer than most gasoline cars and trucks. As an example, I've summarized the safety features on EcoElectric's Desert Lightning, (see New Products, p. 8) a new EV pickup that was designed and built with passenger safety as the prime consideration. Even if you can't buy this new EV, you might think about incorporating some of its features into your next conversion.

And let Governor Wilson and the perpetrators of these various attacks know how you feel.

Support ZEV. Don't let the bad guys WSPA in your ear.

Governor Pete Wilson , 1st Floor, State Capitol Bldg, Sacramento, CA 95814- Fax: 916/445-4633. Include your return address. You'll get a reply by mail.

Ralph Craven, National Institute of Emergency Vehicle Safety, Reno, NV 702/425-4300 Let him know what you think of his tactics.

ZEV Activitist Network, Jamie Phillips, Planning and Conservation League. Tel: 916/444-8726 Fax: 916/448-1789.

AAMA American Automobile Manufacturers Association (currently running a radio smear ad campaign against ZEV) Call their 1-800-EVS-1998 number and tell them you are FOR EVS and the ZEV Program.

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"Manta's" Rays - MIT Solar Car wins SunRayce.

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Article Submissions
The deadline for articles is the 25th of each month for the next issue of CE. Articles received after this date will be retained for future issues of CE.

Contact Clare Bell, Managing Editor for further information. If you would like to submit an article for CE, the preferred format is on a floppy disk, along with a printed copy of the article. Include camera-ready photos or graphics in TIFF or EPS.Please specify PC or MAC and identify software and version number.

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EAA Membership
2710 St. Giles Lane
Mountain View, CA 94040

MIT WINS SUNRAYCE

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trying for high pole position, or run a minimum number of laps to shake down the car and preserve it for the long route to Denver.

The Indianapolis results turned out to be a good predictor of the EVent itself: Four of the top five qualifiers (MIT [start 2, finish 1], Cal Poly Pomona [1,3], Queens of Canada [3,6], and Minnesota [4,2]) finished in the Top Ten, while three of the top five fastest qualifiers (Pomona [38.21 mph, speed 1, finish 3], Northern Essex [36.33, 2, 7], and MIT [36.26, 3, 1] were Top Ten finishers.

At the other end, the shocking withdrawal of two-time champion University of Michigan after Day 4 (one of only two teams to withdraw, the other being U. of Quebec after Day 6) was presaged by the collapse of a wheel in first-day qualifying, a fair performance in the Last Chance qualifier, and a starting position of 34.

Last ten starters and finishers included: Cal State Long Beach (start 35, finish 32), U. of Pennsylvania (36, 34), Mercer U. (37, 28), U. of Missouri Rolla (38,30), Mexico (33, 29), Virginia Tech (VPI) (28, 35), and U. of Michigan (34, DNF); but as Race Director Richard King, Ward Phillips, Howard Wilson, Bob Stempel and other officials were fond of saying, "Every team is a winner just for getting here."

Most of the top finishers were variations of James Worden's MIT "Galaxy", an inexpensive delta-three-wheel sixth-place finisher in 1990 that nearly stole 3rd. Howard Wilson calls this the "four meter" design, since cars are several feet shorter than GM "Sunraycer"-based vehicles and give up a third of their rolling solar cell area in search of better aerodynamics.

Cal State LA enhanced this design in 1993, finishing 3rd, and this year MIT, Minnesota, Pomona, Stanford (5th) and Mankato/Winona (9th) finished in the Top Ten using 3-wheel "Galaxy" variants (Pomona actually had a double rear wheel to accommodate their direct drive system). Photos and further items are available from the SUNRAYCE '95 WEB SERVER (see below for address). All of these cars carried stored segments of their solar arrays on the undersides of their bodies so that they could have the full 10.2 sq. m. of solar array deployed and receiving solar gain before and after the racing day.

George Washington (4th), Queens (6th), Western Michigan (8th), and U. of Missouri Columbia (10th) had three or four wheels and larger over-the-road arrays, somewhat reminiscent of the '87 "Sunraycer".

Perhaps the most unusual Top Ten car was the Northern Essex (7th) three-wheel "bullet-shaped car with the stow-away solar panels" (Denver Rocky Mountain News, 6/22/95), a lightweight (475 lb. without driver, including 280 lb. of batteries) study in aerodynamics (CdA of ~ 0.065, about two thirds of the drag of other good cars at 55 mph). It did not use its solar cells at all while it was going down the highway, relying on its Delphi GM "Impact" batteries for power.

NECC's strategy was to finish each day's +/- 150-mi. course very fast with its array fully stored behind a clear rear hatch and then deploy the array in the afternoon and the following morning to recharge batteries as completely as possible. The strategy gave NECC two third, one second and one first place in daily finishes when the first five days provided sunny afternoons and mornings. The unexpected cloudy, rainy afternoons late in the race forced Northern Essex had to stop and deploy its solar array during racing hours each of the last four days, dropping out of contention.

"Practical electric cars of the present and future will not have vast solar-cell areas on their surfaces", said NECC co-captain James Nelson. "We wanted to show that a relatively inexpensive electric car could rely on cheaper off-the-shelf components and improved aerodynamics to travel at highway speeds across country and then recharge at a solar charging station, which in this case we had to carry within the car."

Although NECC's strategy was within the letter of the regulations, one Sunrayce official told co-captain Olaf Bleck that the car was "too close to practical" to be appropriate for this race. Several officials felt that the "TNE-3" was not a "solar" car, since it didn't run power directly from its solar cells to its motor, but others said that any vehicle that can travel over a thousand miles using only stored solar energy produced from an array it carries on board should be considered "solar". Regulatory changes are expected, perhaps as soon as this month, to eliminate the stored-array strategy.

The 638-lb. (without driver) MIT car was fast and dependable, with good aerodynamics (CdA ~0.13). Team Captain Goro Tamai (a grad student and veteran of the '90 "Galaxy" team), faculty advisors Kathleen Allen and David Leip, and the rest of the team tested the car for about 300 miles around Boston before the EVent.

The only problem MIT had during the race was a controller failure caused by rain infiltration on the last leg, resulting in a 20-minute delay and halving the margin of victory. There were no flat tires, which is unusual for solar-car racing. "Our tubeless limited-production Michelin Radial tires were very satisfactory on the front", said Ms. Allen. "We did change them occasionally at the end of the day because of small nicks and cuts, but we had no flats. And our rear tire, a tube bias-ply from Cheng Shin, had the greater lateral stiffness we needed for our drive wheel. It was so good that we were able to run the same tire for the entire race."

MIT maintained the speed limit of 55 or 65 mph in all conditions except steep-

er hills and heavy rain, until the last day, when all cars that didn't charge off the grid or transport by trailer (either of which option produced heavy penalties) crept the last 52 miles into Golden, exhausted by four days of almost constant clouds and rain.

The "Manta" had a Solectria 8-hp. (continuous; 15 hp. peak) brushless permanent-magnet motor and controller that typically drew 800 - 1,600 watts at around 5,000 rpm, utilizing ASE America 14% efficient solar cells (724 cells on top, 58 on sides, 204 stored on belly) that provided 850 peak Watts while racing and 1280 peak Watts while in stationary charging configuration, regulated by four Brusa maximum power point trackers (5 while stationary). Batteries were nine Trojan 12-volt DC-22F deep-cycle lead acid (306 lb., the regulatory maximum) run at a nominal 108 volts and supplied by Jesse James of SUNBELT BATTERIES in Tempe, AZ. Main sponsors of the $75,000 car included MIT, 3M Instron, Canon Systems, Gerber Electronics, Nissan North America, SPIRE, and Ryder Trucks.

Components of choice among the Top Ten included Solectria BRLS-8 motors & controllers (MIT, Minnesota, Stanford, Northern Essex, Mankato/Winona, and Missouri-Columbia), Unique Mobility (Queens, Western Michigan), and Hathaway (Pomona). George Washington ran an impressive wheel motor designed in conjunction with Dean Patterson of Northern Territory U. in Australia, which is now available for $15,000 (each). Pomona used their double-shaft Hathaway as a direct drive, with one rear wheel attached to each shaft. Stanford ran slowly the first few days, corrected some bugs, replaced their Unique Mobility drive system with a Solectria BRLS-8 borrowed from Cal Berkeley's '93 car, and hummed to a 5th-place finish after standing 12th at the end of Day 3.

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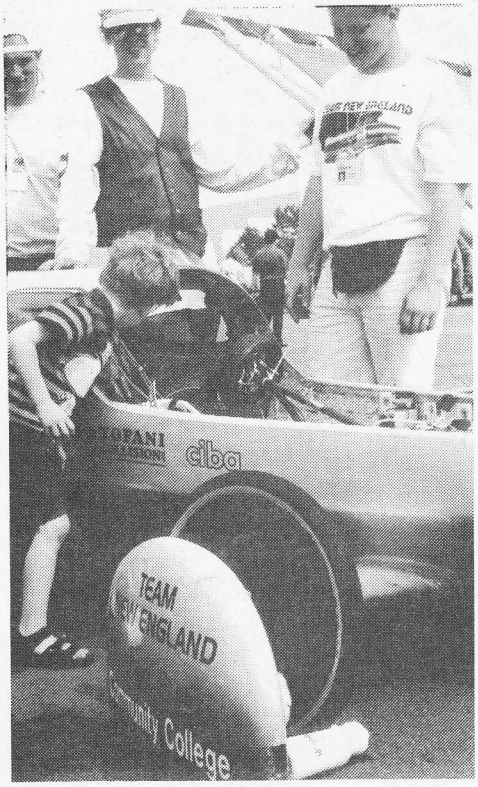
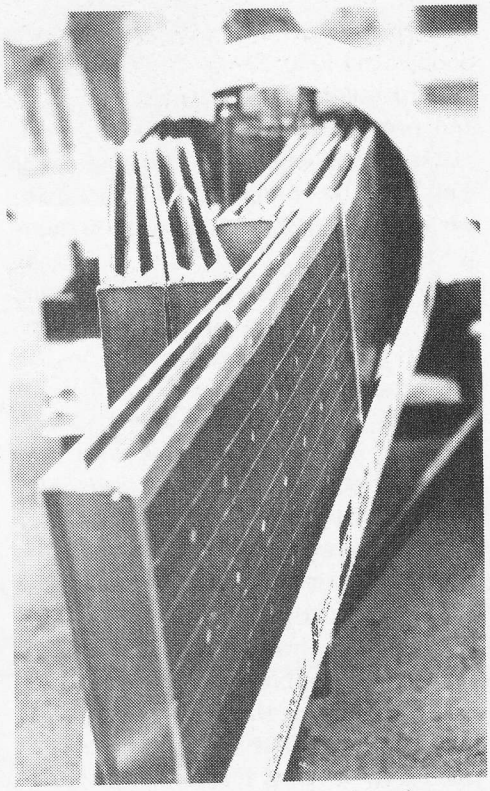
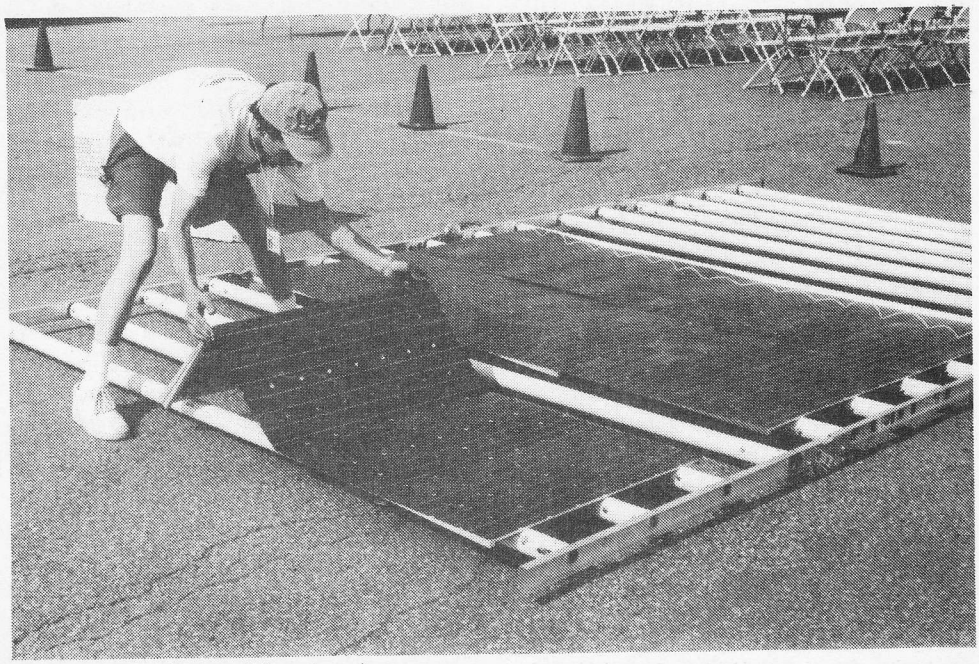


"Whatcha got in here?" Future solar driver gets peek at TNE 3.



TNE's stored solar array in place for racing. (Plex cover off.)



TNE's array deployed for charging.

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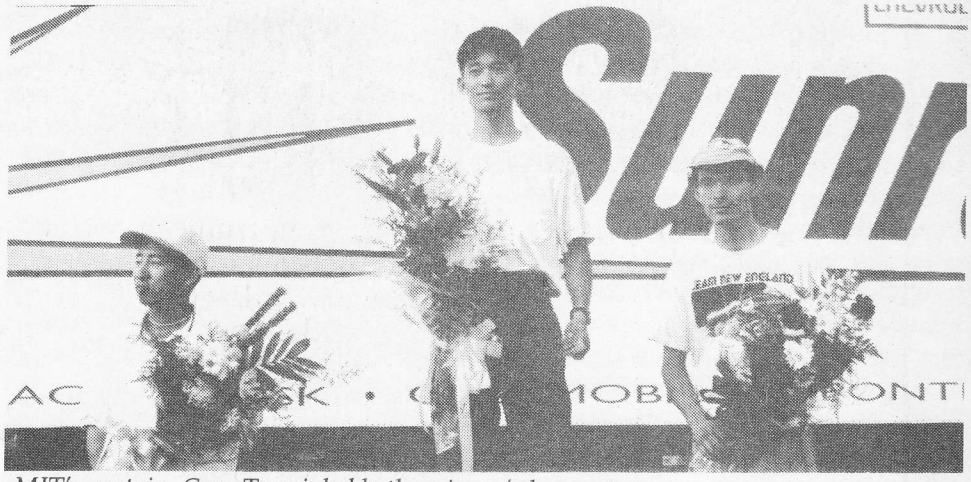
Many teams used Delphi sealed, flooded-cell 40-lb. 12-volt batteries which were developed for the GM "Impact" and provided free to each team. Some teams didn't use them because they could only be grouped in 84-volt, 280-lb. packs, but those teams that did use them were impressed. "Dan Prater of Delphi was very helpful to everyone," said NECC's Nelson. "I got to tour the factory near Indianapolis where the batteries are made, see how they fit into the Impact, and test and select the best batteries available for our team. The seven we ended up using for the race remained well equalized, provided good power at a range of temperatures, and did not suffer from the very deep discharges needed on two of the last three days."

Independent results from bench tests of these Delphi batteries, conducted by William Lynch of NECC and U. Mass at Lowell Lowell, are available, compliments of Team New England, from CURRENT EVents if a stamped, self-addressed envelope is sent to the Editor.

Further information is available from the Sunrayce '95 Web Server (http://www.nrel. gov/sunrayce/) which should remain on-line for another month or so; the new Sunrayce '97 Web Server, not yet available; and Matt's Solar Car Page (http://www-lips.ece.utexas.edu~delayman/ solar.html), a dormant site which nevertheless provides access to several solar car team homepages which are frequently updated.

Richard Rahders is a solar/electric vehicle videographer and sponsor/team member of Team New England Solar/Electric Racing Group, the primary sponsor of the Northern Essex Community College entry in Sunrayce '95. Rahders lives in Santa Cruz, CA., and is currently working on the TNE Australia World Solar Challenge '96 entry.

— Access: Richard R. Rahders 408/426-3783
Email: FMJG56C@prodigy.com



MIT's captain, Goro Tamai, holds the winner's bouquet.

3rd placer Cal Poly Pomona.

Author R. Rahders with TNE/Essex Comunity College Solar Car at SunRayce '95.

NEW PRODUCT

Designed for Safety — EcoElectric's Desert Lightning

by Clare Bell

The new Desert Lightning EV pickup, recently displayed at the Silicon Valley Rally, is the best and most appropriate answer to Ralph Craven and others who are attacking Evs on the grounds of safety. Based on the 1996 Chevy s-10, EcoElectric's truck conversion impressed even fellow EV business competitors with its design, fit and finish. EcoElectric's co-founder and engineer, John Witt has put the experience gained from racing at the APS Phoenix Electrics into this EV pickup. Both he and Mary Ann Chapman are well aware of possible EV hazards, and have made EV safety a major part of Eco Electric's mission.

Here are some of the features that contribute to the Lightning's durability and crashworthiness.

First of all, the Desert Lightning retains the safety features of the original Chevy S-10. These includea driver's side airbag, ABS braking, power steering and radial tires for nimble handling. Second, the electric conversion incorporates additional hazard-prevention items that have appeared separately in Evs from other vendors, however this design is themost extensive combination yet of such features. It could well be a model for an industry standard. Here's a list:

Mechanical safety

All batteries are totally enclosed in steel boxes with non-conductive sprayed urethane liners.

Battery containments and structural modifications are finite element stress-analyzed by computer to withstand a 30 G frontal collision.

Vehicle has been/will be crash-tested to confirm results of modelling

Low battery position and correct weight distribution give good handling. (Batteries are located under bed and hood, with manual-tilt bed for rear battery access)

Full-time power steering for maneuverability and collision avoidance

Environmentally sealed control package (to prevent failures that could be caused by dust or corrosion)

Vehicle with driver and 500 lb cargo is under GVWR of 4900. Axles are rated at 2500 front, 2900 rHigh-load capacity rear springs are available to raise GVWR to 5150 lbs

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EYEBROW HEADING

New Cruising Equipment E-METER (TM)

by Ken Koch, KTA Services, Inc.

What should an EV's dashboard contain? The more instrumentation an EV has, the better its performance can be monitored and characterized. While 15 or more separate functions can be monitored in an EV, tracking all of them would require enough meters to fill up a whole dash. This would be confusing and distracting to the driver, who primarily needs to watch the road, not the instruments. A "meter for everything" can also be quite expensive.

Minimal instrumentation should include some way of measuring and displaying battery state-of-charge, i.e. a battery system "fuel gauge". The standard conversion's ammeter and voltmeter provide meaningful information, but more accurate ways of measuring state-of-charge are by means of a dedicated amp-hour or watt-hour meter rather than a "fuel gauge". We at KTA have been long-time advocates of meters that display multiple functions rather than a meter for each. Multiple-function meters can scan over less important readouts for a quick check, then "parked" on the most critical or most often used function.

At last December's EVS-12, in Anaheim, CA, Cruising Equipment Company introduced their new E-METER, which came to market in May 1995 for under $200. It is now available from several distributors

The microprocessor-based E-METER has a multiplicity of functions packed into a 2" automotive-style case. It provides volts, amps, amphours, kilowatt-hours, time remaining on a battery charge, battery history and more. The E-METER indicates digital amp-hours consumed (amp hours are how battery capacity is rated).

The operator need only program in a battery capacity value and the microprocessor tells how much has been used and how much operating time remains.

Battery state-of-charge is displayed on a multi-color bar-graph. It even flashes red to indicate time for recharge. The E-Meter also reports power consumption in kilowatt-hours, the units you purchase from your utility to recharge your EV.

The E-METER calculates and displays how long you can operate at a given power consumption rate. The rate can be evaluated over several time intervals: instantaneous, a 6-minute average, a one hour average or even a 24-hour average.

Battery current and voltage can be digitally displayed on the E-METER. In addition, it tracks the number of recharge cycles a battery pack has experienced, the average depth of discharge, and the greatest depth of discharge. It simplifies the task of managing a battery pack for longer life and higher performance. Fifty percent depth of discharge for each cycle yields the most miles for your battery dollar. That is easy to quantify with an E-METER.

All of the previously-mentioned functions can be scanned automatically, if you want this mode of operation. The E-METER also adapts to its environment. Under low light conditions, a photo-sensing device on the front panel dims the display. As ambient light increases, the display brightens.

Well, what more could an EVer ask for?. The new E-METER certainly is a powerful instrument in a small package! Easy access to its front panel buttons is vital, so don't mount it in a spot that forces you to reach through the steering wheel. It's also a good idea to keep an analog ammeter in your instrument package since battery current fluctuates rapidly while driving and the swing of the analog needle is easier to read than a jumping digital display.

The basic E-METER (Cruising Equipment part #90091, $199.95) is only rated to 50V, so most on-road "EVs" will need a 0-500 volt pre-scaler module.(part # 90086, $69). For EVs with battery packs that are isolated from the frame (a strong safety recommendation), the E-METER also needs a small 12 V-12V dc-dc converter (part # 310375, $79)

The E-METER reads its current signal from a 500 amp/50mv shunt as found in most EVs.

Note: Be sure to place this shunt in the NEGATIVE battery pack lead to avoid damaging the instrument.

E-METERS, pre-scalers, DC-DC converters and shunts are available through:

KTA Services, Inc. 944 21st St., Upland, CA Tel. 909/949-7914, FAX: 909/949-7916

The Battery M.D. (Kitty Rodden) 417 Sturtevant Dr. Sierra Madre, CA 91024, Tel: 818/355-2927

1995 EAA Election Results

All ballots are in for the 1995 Board of Directors Election.

Name	# of Votes	%
Stan Skokan	63	72.4%
Clare Bell	52	59.8%
Peter Barnes	50	57.5%
Anna Cornell	40	46.7%
Tony Cygan	25	28.7%

Write-ins:
Bruce Parmenter - 1
Lloyde Wenzel - 1
Dorothy Hemstreet - 1

There were 87 valid ballots, which puts the total over the 5% of current membership (as of 10/23/95) required and makes the election legal. Seven ballots were invalid.

The vote count was made by Lee Hemstreet and June Munro on Nov. 3, 1995. CE thanks Lee and June and the rest of the Election Comittee.

News in Brief

Compiled by Ruth Shipley

News in Brief...is compiled by Ruth M. Shipley from information provided by Environmental Information Networks. If reprinted, please credit CE and Ruth Shipley.

Prototype EVs Donated to Thailand

US Diplomat Ralph Boyce recently presented the Thai government with three prototype electric rickshaws which could eventually replace the nearly 10,000 noisy, polluting, three-wheeled taxis, called "tuk-tuks," that currently ply the streets of Bangkok. The Zero Emission Electric Tuk-tuk Testing project, funded by the US Agency for International Development, will donate 30 electric tuk-tuks to Thailand. The vehicles, which are modeled after US golf carts, cost about $6,000 each and run for 3 hours on a charge. Each vehicle has its own recharge, can be plugged into any electric outlet and may cost as little as 47 cents a mile to operate.

(UPI: 9/27)

Cities Join Station Car Project

By the end of 1996, some 10 to 12 transit systems around the country will implement station car demonstrations, growing into full scale by 1997, according to projections made by the National Station Car Association in Oakland, CA. Station cars are EVs housed at mass transit stations to transport commuters to and from the station. The cars can be recharged while idle at a station or at a commuter's house. The San Francisco Bay BART public transit system will introduce 40 "City Bee" station cars powered by Saft STM5-100 nicad batteries in October. Station cars are also being used at several sites in

(METRO Magazine September/October 95)

Former GM Engineer Drives EV Cross-Country

To prove its real world practicality, former General Motors contract engineer Alan Cocconi is driving his converted Honda Civic across the country and back. The Civic contains Cocconi's AC 150 EV drive system, which he says solves every major obstacle, including limited range, lengthy recharge time, and poor performance. It can go from 0-60 mph in just 6.2 seconds and travels 80-110 miles on a charge at normal highway speeds. The battery can be fully recharged in 1 hour on 220 volts or 8 hours on 110 volts. According to Cocconi, the California Air Resources Board has rated the AC 150's performance as the best of any EV they have tested so far.

(Washington Times: 9/29, p E9)

Partnerships Prepare Communities for EVs

The US Departments of Energy and Transportation will fund a series of workshops sponsored by the Electric Transportation Coalition (ETC) and the Electric Vehicle Association of the Americas (EVAA) to help cities prepare for the introduction of EVs. The "EV-Ready" workshops will be held in Los Angeles, Sacramento, Atlanta, Phoenix, Washington, D.C., Boston, New York City, Richmond, Detroit, and Ft. Lauderdale. The workshops will provide information about Evs, infrastructure requirements necessary for the widespread use of EVs, and related infrastructure equipment. For more information, contact Gail Hendrickson at 202-508-5995.

(ETC News: 9/29)

Japanese EV Completes North American Trek

To demonstrate the feasibility of EVs, a team from a Japanese university completed an 11,300-kilometer journey across North America and back. The experimental trek, headed by Masaharu Fujinaka, Professor of Engineering at Tokyo Denki University, began in Seattle on July 25. The five-member team traveled through the northern United States and southern Canada, reached New York and Washington, DC in late August, and then turned back to Seattle, where they arrived on September 23. The car was equipped with a small, light electrical motor, storage batteries and solar batteries. It traveled an average of 80 km per hour and cost about 1 yen per km to recharge.

(Kyodo: 9/30)

Fuel Cell Achieves Record Density

Ballard Power Systems of Vancouver, BC, recently announced that it had achieved a power density in its Ballard Fuel Cell appropriate for use in an automobile. The new fuel cell can produce 1,000 watts per liter — or more than 28 kilowatts per cubic foot — which exceeds the company's original goal of 25 kilowatts per cubic foot. The new density is more than five times higher than that of earlier fuel cells used in Ballard's 1993 fuel cell bus and Daimler-Benz's 1994 fuel cell van and is the highest ever achieved in proton exchange membrane cells. For additional information contact Paul Lancaster at Ballard Power Systems, Inc., 604-986-9367.

(Ballard Release: 10/3)

Horizon Battery Meets Energy Standards

Test results from the Electric Power Research Institute (EPRI) have confirmed that the Electrosource, Inc. Horizon battery has exceeded performance goals for a viable EV battery. In tests performed at the Argonne National Laboratory, the Horizon reached a specific energy of 44.2 wh/kg, which is about twice the normal specific energy of a conventional lead-acid battery. "In addition to its superior specific energy, the Horizon

battery delivers excellent peak power giving it the edge to provide the acceleration required for electric vehicles," said EPRI program manager Jack Guy. For more information on the Horizon battery contact Robin Roberson at 512-445-6606.

(PR Newswire: 10/3)

Safety Institute Urges Mandate Cut

The National Institute of Emergency Vehicle Safety wants the California Air Resources Board to delay the EV mandate until all safety issues have been resolved. "If it cannot be proven that electric cars can be operated without jeopardizing the safety of emergency workers and the public at large, then the state's electric car mandate must be abandoned," said Ralph Craven, vice president of the Institute and California Fire Chiefs Association board member. "In the rush to meet the mandate, there is a very real possibility that potentially life-threatening hazards peculiar to that technology will be overlooked."

(Business Wire: 10/05)

Calstart Unveils CITI EV

Calstart and Clean Intelligent Transportation, Inc. (CITI) recently unveiled the inexpensive and totally recyclable CITI EV at Calstart's Burbank, CA offices. The two-passenger vehicle will cost less than $10,000 and will be built in California by late 1996 or early 1997. The cars are manufactured using lightweight materials and powered by lead-acid batteries, and are freeway-friendly as well as federally-certified for safety. Initially, the vehicles will be used as station cars, which are used to shuttle transit users between transit stations and their homes, offices or elsewhere. For more information contact Bill Van Amberg or Dave Sotero of Calstart at 818-565-5600.

(Business Wire: 10/6)

Turbogenerator Has Hybrid Potential

Capstone Turbine Corporation, (Tarzana, CA), has introduced a new compact, lightweight turbogenerator that could meet the ultra-low vehicle emission standard set by the California Air Resources Board (CARB). If fitted with a catalytic converter, it would qualify as a zero-emission engine. The turbogenerator integrates the engine and generator on one shaft, produces about 24 kilowatts of electrical power (about 32 horsepower) and can burn several fuels, including natural gas, gasoline or diesel. The company expects to start shipping turbogenerators in limited quantities by the end of 1995, according to company president Jim Wensley. For more information, call 703-758-1740.

(PR Newswire: 10/9)

Battery Audit is Pessimistic

Results of an audit ordered by the California Air Resources Board on the state of EV battery technology indicate that a commercially feasible, mass-produced battery is not likely to be developed in the near future. "The evidence seems to indicate that advanced batteries aren't going to be ready by 1998," said California EPA spokesman Dan Pellissier. "It seems there probably is cause to look hard at what adjustments need to be made to make the program successful. I wouldn't use the word 'likely' but I would say the possibilities [of changing the mandate] are stronger now than they were prior to receiving the audit results."

(Washington Times: 10/12)

GM PrEView Comes to Florida

GM launched the South Florida leg of its nationwide Impact test drive program in October at the Museum of Science and Discovery in Fort Lauderdale. Government officials and assorted VIPs took a short test drive and many were impressed. Broward County Commissioner Lori Parrish compared the experience to "riding on a cloud." Sixty South Florida drivers will test the car for two weeks over the next six months, providing GM with a written log of the experience. Florida Power and Light is staffing a service center for the program's duration and will install 220v chargers in the homes or workplaces of test drivers who need them.

(Sun-Sentinel: 10/14)

SPECIAL ANOWLEDGEMENT

CE would like to give a special recognition to Ruth Shipley, who does such an excellent job on News in Brief. Ruth is a medical writer who is concerned with the effects of air pollution on health. She believes that EVs can help solve the problem. Ruth is one of the essential parts of CE, so please join me in thanking here for her unstinting effort and her reliability — she's great to work with — CB.

Convert It: The Workshop: Hands-On Training From A Pro

by Shari Prange

Electro Automotive (Felton, CA) has announced a hands-on electric car conversion workshop to take place Jan 17-20, 1996. This class is intended for the amateur mechanic interesting in learning about the conversion process. The four-day class will include lecture segments, but the primary focus will be the actually assembly of an electric conversion.

This is a hobbyist version of a workshop previously offered by Electro Automotive only to professional mechanics. Students will learn which shortcuts can make their conversions easier—and which one will lead to disaster. Emphasis is on producing a safe, practical, professional quality conversion.

Instructor Michael Brown's credentials are unmatched in the industry. He has 28 years of professional experience in auto repair, including three years building Sports Car Club of America race cars, and 15 years of experience in electric conversions. This foundation has given him extensive knowledge of how components function—and malfunction—under the heat, vibration and g-forces of a car in motion. It has also given him a thorough understanding of the human factor: common mistakes, common misdiagnoses, and driving and maintenance habits.

Michael Brown is the author of Convert It, the book that is the industry standard in hands-on conversion manuals. This book was chosen by the Dept. of Energy to be used as a text by the schools participating in the 1994 Mid-Atlantic Electric Vehicle Competition. Mr. Brown was founder and first president of the Electric Vehicle Industries Association. He is a past chapter officer of the Automotive Service Council and the Electric Auto Association. He has consulted on projects for various universities, municipalities and utilities, and served on the President's Federal Fleet Conversion Task Force.

The workshop will take place at Electro Automotive in California. Cost is $400.00 per person. Pre-registration required, space is limited. Call for details.

The knowledge you receive from instruction is only as good as the knowledge of the instructor. — SP

Electro Automotive, POB 1113
Felton, CA 95018-1113
408-429-1989

Q: How Can I Compare Battery Models?

Tough question. First, let's narrow it to the most common type, lead acid traction batteries. The entire market for these is dominated by three manufacturers: U.S. Battery, Trojan, and Exide. Interstate, Sears, GNB, and other battery sellers buy from them.

Ratings. Batteries are commonly rated by amp/hrs. However, it is important to know at what rate. The 20 hr. and 75 min. rates are common. At the same rate, higher amp/hrs. means more range.

Cycles. Batteries are also rated for the number of cycles per lifespan. To compare accurately, you need to know the depth of discharge for each cycle. A battery discharged to 90% of its capacity will last for more cycles than one discharged to 80%. Some comparison charts mix discharge depths to skew the results.

Weight. You can't cheat on the laws of physics. If a lead acid battery is substantially lighter, it will have less capacity and range. For example, you can fit a 96 volt pack into a much smaller space using 8 or 12 volt batteries, but it won't have the range of a pack made up of 6 volt batteries.

Experience. Ask advice from someone who has hands-on experience with different kinds of batteries, but no personal axe to grind. Talk to some golf course pros, not just the battery factory's sales rep.

Send your questions to Mike Brown's EV Q&A, POB 1113, Felton, CA 95018 or fax (408) 429-1907. Include address for reply. Mike Brown has 28 years of professional automotive experience, & 16 years of professional conversion experience. His book, "Convert It", is available for $30.00 postpaid in the U.S. & Canada.

FOR EAA MEMBERS ONLY

EV Want Ads

For Sale

For Sale: '79 Voltsrabbit. 7000 EV miles. Built with Electro Automotive Voltsrabbit kit: Advanced DC 8" motor, Curtis controller, Sevcon DC/DC, K&W charger, 96V, power brake pump. Turnkey EV for cost of kit & donor. Runs fine, batteries 3 yrs. old. $7000/as is or $8,000 with new batteries installed. Call Mike Brown at (408) 429-1989.

For Sale: '81 Jet 007. 20,000 freeway miles rebuit with PMC controller, DC/DC charger, extra rims/tires, belly pan .33 drag, battery heaters, many awards. $5445. Call (510) 837-7086.

For Sale: '80 Reault Le Car. Converted by American Electric Car, upgraded to 72 V system, Curtis PMC controller, tow bar, top speed 60 mph, range 35-50 miles, 7,000 miles, $4,000. Call (503) 899 1127.

For Sale: '80 Commuta Car. 48 V power, top speed 35 mph, range about 40 miles, runs good. $2000/obo. Call (707) 769-9112.

For Sale: '60 VW Karman Ghia Electric Project. Includes adaptor place, motor, relays, and cables. $1200/obo. Call (415) 593-3931.

For Sale: Cushman "Meter-Maid" 3-wheeler converted to electric. Was 22 HP gas. Now runs faster, with no fumes, heat, noise or vibration. Tops 40 mph. 30 mile range. 72 V Trojan 5-SHPs, Advanced DC K-91, Curtis controller, Sevcon DC-DC. $5995. Anaheim. Call (714) 956-3016.

For Sale: Surplus EcoScoot motors and controllers. 1 HP continuous, 3 HP peak. Ideal for Electrathon or motorscooters. $260/ea. Call (714) 956-3016.

For Sale: New Aircraft Generator. Extend your EV range with a new $14,000, 27.2 KVA 116 or 201 V, 3 phase, 400 cyle Aircraft Generator. Weighs 48 lbs. Can be powered by a motorcycle engine. $300. Call (415) 388-0838 or (916) 441-4161.

Want Ad information

Print clearly or submit typed copy of your ad with your name, address, and phone number. The EAA is not responsible for the accuracy of ads. Want ads must be received before the 1st of each month and must include payment to run in the next issue of CE.

$7 for the first 25 words. Each additional word, 25 cents. Want Ads are available to EAA members for the sale of electric vehicles, equipment and parts only. Please see advertising rates on next page for commercial products.

If you want to run your ad in more than one issue, please specify and include payment for each issue requested. **Send check payable to: EAA Want Ads, 18297 Baylor Avenue, Saratoga, CA 95070.**

ADVERTISING RATES

Full page		7.25" x 9.25"
1 ad	$400 ea	
3 ads	$300 ea	
12 ads	$250 ea	

1/2 page		7.25" x 4.50"
1 ad	$200 ea	
3 ads	$150 ea	
12 ads	$100 ea	

1/4 page		3.50" x 4.50"
1 ad	$150 ea	
3 ads	$100 ea	
12 ads	$ 75 ea	

1/8 page		2.0" x 3.5"
1 ad	$100 ea	
3 ads	$75 ea	
12 ads	$50 ea	

Ads may be placed for 1, 3 or 12 months. Camera-ready copy for each ad must be submitted along with payment. Ads may be submitted on diskette in TIF or EPS format on the PC or MAC. For 12 ads, an invoice will be billed quarterly. A minimum of 3 ads need to be prepaid per quarter.

Ad Deadline

The Deadline for camera-ready copy is the **1st of the month**. Copy received after the 1st will be run in the next issue. Ads will be placed in the priority received. Prepaid ads will receive 1st priority.

Advertising Manager

Susan Hollis, AdvertisingManager
Office: (408) 374-8605
FAX (408) 374-8750

Address

Make check payable to EAA. Camera-ready copy and payment for the ad should be sent to: **Electric Auto Association**
18297 Baylor Avenue
Saratoga, CA 95070

CE ADVERTISERS

EVents Calendar

by Anna Cornell

Nov. 18

EAA Silicon Valley Chapter !SPECIAL JOINT MEETING with IEEE! 10AM-12PM at Hewlett-Packard, 5301 Stevens Creek, Santa Clara, CA Speaker - Clare Bell of Current EVents on The Future of EVs: Technology and Politics.

* See IEEE GRID, Nov 95 issue. EAA San Jose Chapter members will have their EVs out front on display.

EAA contacts: Lee Hemstreet, Tel#:(415)493-5892 Fax#:(415)857-0823 Chuck Olson, Tel#:(408)296-6944 Fax 408-243-2136. IEEE contact Dennis Paull at Tel# 415-948-9275 or Email:* (d.paull@ieee.org)

Nov. 18

EAA East Bay and North Bay Chapters JOINT MEETING 10-12pm at North Bay Savings Bank, 20 Petaluma Blvd South, Petaluma, CA.

Contacts: Andy & Jeannine Clary Tel#:(707)526-7692 {Santa Rosa} Chuck Hursch (gandhi!chuck@uunet.uu.net) Anna Cornell, Tel#: (510)n Diego Automotive Museum, 2080 Pan American Plaza, Balboa Park, San Diego Ron Larrea, Tel#: (619) 443-3017, Fax#:(619) 561-4558 Jeremy Phillips (PHILLIPS@GAV.gat.com)

Nov. 29 - Dec. 1

Global Electric Vehicle Conference focuses on EVs aand their impact on international business, and the global environment. Crystal Gate Marriot, Arlington, VA Presented by Intertec publications.

Contact Janne Romanek 610/566-7080 or Betsy Norberg at (913)-967-1865.

Dec. 2

EV Christmas Party at Peninsula (SF) Chapter meeting, 10AM-12Noon at San Bruno Public Library 701 W. Angus Ave., San Bruno, CA. Take hwy 280 to the San Bruno Ave. exit, go East 1 mile, right onto El Camino, past one light, right onto Angus. Potluck. Guest speaker Bruce (EVangel) Parmenter of the S.J. Chapter on EVs and the Internet, charging stations.

Contact: Peter Barnes,Tel#:(415)592-2099 (pbarnes@octopus.wr.usgs.gov)

Dec. 2

EAA Los Angeles Chapter Meeting 11AM-1PM (1st Saturday of the Month) Winnett Lounge, at Hill Ave & Calif Ave., Cal Tech Institute, Pasadena, CA Irv L. Wiess Tel#:(818)841-5994 Leni Goldberg (len@wcc.wnsnews.com)

Dec. 12- 14

1995 North American EV and Infrastructure Conference, held in Atlanta GA at the Stouffer Renaissance Hotel. International EV Synosium and Exposition combined with EPRI's National INfrastructure. Exhibitor info: (415) 855-2050, conference info: (415) 855-2010.

1996

Jan. 6

Battery Chargers - How they work and what's new. Peninsula Chapter (SF) meeting 10AM-12Noon. Speaker, Stan Skokan.

Contact: Peter Barnes,Tel#:(415)592-2099 (pbarnes@octopus.wr.usgs.gov)

Jan 22-23

ENV '96, Hyatt Regency, Dearborn, MI 313/995-4440

Mar 1-3

1996 APS Electrics at Firebird International Raceway. For info, contact EVTC at 602-256-2599

May 25

June 8 ENER*RUN4. Starts from Hardy, AR and goes all over. Stay tuned for details.

Late June

Pike's Peak Challenge. For Solar and electric vehicles. Stay tuned.

Thanks to the Internet EV Discussion List. We need more non-California items! Calendar info should go to Anna Cornell, (510) 685-7580.

Safety *continued from page 8*

Electrical safety

Electrical design meets national standards (NEC, SAE)

High-voltage cable runs enclosed in tough plastic conduit

High-voltage systems are protected by fuses and are totally isolated from vehicle chassis

Impact-actuated high-voltage cutoff switch

All electronic components are mounted in environmentally sealed containers.

Battery enclosures are lined with non-conductive urethane and fan-ventilated during charge

Protective boots are used on battery terminals

Charging interlock to prevent driving away while plugged in

20000-strand 2/0 copper high-voltage cabling

All control connections through OEM-quality sealed connectors

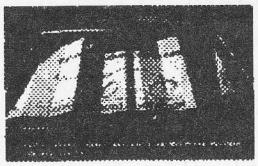
Watermaster battery watering system (to prevent premature loss of power due to low level of electrolyte.)

Access: EcoElectric Co. PO Box 85247, Tucson, AZ 85754. Tel 520/770-9444 Fax: 520/770-9980

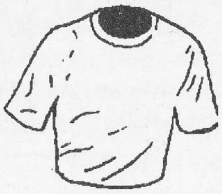
Email: ecoelec@primenet.com.
Web: http://www.primenet.com/ ecoelec

EAA Reprints Order Form

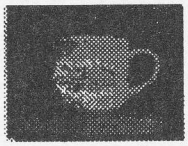
100% Cotton Cap Forest Green "Charging into the Future" EAA Logo
CAP001.....$6.50



Auto SunShade
SS001.....$8.00



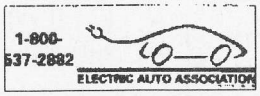
T-Shirt with EAA Logo
TS001 .....$14.50



Porcelain Mug with "The Switch is on" and EAA Logo
MUG001 .....$5.00

Thermal Auto Mug
MUG002 .....$6.00

Window decal "The Switch is on to Electric Cars" Black and Red printing. 3 x 9 inches
DC001.....$3.00



Bumper sticker 3.75 x 15 inches
BS800.....$2.50

Bumper sticker 3.75 x 15 inches
BS002.....$2.50

EAA Key Chain , actual shape may vary
KC001.....$1.50

Printed materials

CE	Selected Current EVents ***(specify specific issue)***	$3.00 each issue
CEFY	Current EVents - Full year ***(specify specific year)***	$20.00 each year
PB001	Discovered:The Perfect EV Battery	$ 2.00
FW001	Flywheel Energy Storage	$ 5.00
BG1995	1995 Buyer's Guide to Electric Vehicles (Feb 95 issue CE)	$ 2.95
TT001	Team Tucson Land Speed Record Plans	$ 5.00
IDX001	EAA Current Events Index - 10 Years!	$ 4.00
XA100	EAA XA-100 Hybrid	$ 5.00

Other EV Items

CS001	Current Solutions/Motor Show Video Tape (14 minute runtime)	$14.00
WL001	Window Literature Holder (fits pages 8.5 x 11 inch)	$22.00
PARK01	"EV Parking Only" Sign (18"x12") green icon on white background	$22.00

Electric Auto Association **Reprint** Order Form
Send order to: EAA Reprints
5820 Herma St., San Jose, CA 95123-3410

Name _____
Address _____
City,St,Zip _____

Item#	Size	Quantity	Item Description	Unit Cost	Amount

Subtotal	
Postage +10% for USA*	
Handling	$2.00
Total	

* for Canada add 15% or for other foreign destination add 25%

Make check payable to: **EAA** (US dollars)

ELECTRIC AUTO ASSOCIATION
2710 St. Giles Lane, Mountain View, CA 94040

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

• Address Correction Requested •

EBAY
996

• Time Dated Material - Please Do Not Hold •