Electric Auto Association

CURRENT EVENTS

JULY '96 Promoting the use of electric vehicles since 1967 VOL 28 No. 7

Sunrise Breaks Through Again

by Clare Bell and Michael H. Bianchi

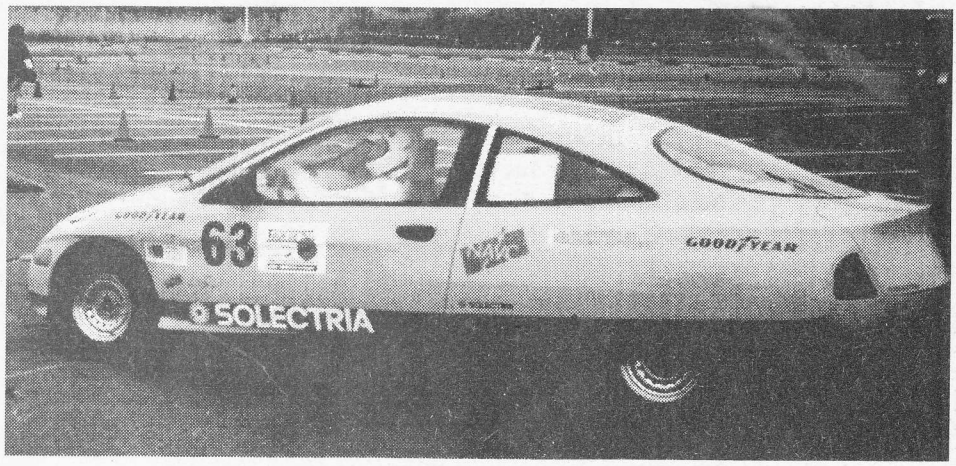
Solectria's composite-bodied Sunrise broke its own distance record twice in the 1996 American Tour de Sol. On 5/13, it exceeded its 1995 mark of 238 miles per charge (MPC) by travelling 258. The following day, Sunrise outdid itself again, racking up 375 miles on a single charge of its Ovonics Nickel Metal Hydride batteries.

Solectria CEO President James Worden drove Sunrise to that landmark record. "The Sunrise is proving to the world that zero emission vehicles can provide both great range and high performance," he stated.

News that the Sunrise had broken the 300 mile barrier came on Tuesday, 5/14 via the Internet EV Discussion list. In an announcement time-stamped 16:58, Solectria's Karl Thidemann relayed the message from James Worden and added,

"Plenty of energy is left in the batteries, and James is hopeful the Sunrise will break the 300 mile mark later this afternoon." Confirmation came at 9 PM Tuesday evening from Tour de Sol Internet EV Discussion List reporter Michael Bianchi. The Sunrise's 32 kW-hr 252 volt pack had taken it 375 miles, an unofficial record that was soon blessed by the race officials from the Northeast Sustainable Energy Association (NESEA).

The Sunrise wasn't the only stellar performer in Solectria's stable. A Solectria Force NiMH sedan beat out a Ford Ecostar for the first pole position during acceleration trials. The Force NiMH then ran 186+ miles in mixed highway/city driving before requiring a recharge.



Sunrise is proving . . . that zero emission vehicles can provide great range and high performance.

The Force NiMH's performance was aided by a battery data collection and management system developed by GM Ovonics for Solectria. Nick Karditas of Ovonics described the system to Michael Bianchi. It tracks module voltages, pack voltage and current, as well as amp-hours and watt-hours. It also guards the battery by giving a three-stage warning. "If battery damage is imminent, the first step is lighting an LED on the dash. The second step is a buzzer that sounds. The third step is turning the controller off." The system is part of Ovonics real-world testing as preparation for mass marketing NiMH.

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Solectria Sunrise starts the Annapolis Autocross.

Photo credit: Peter Barnes

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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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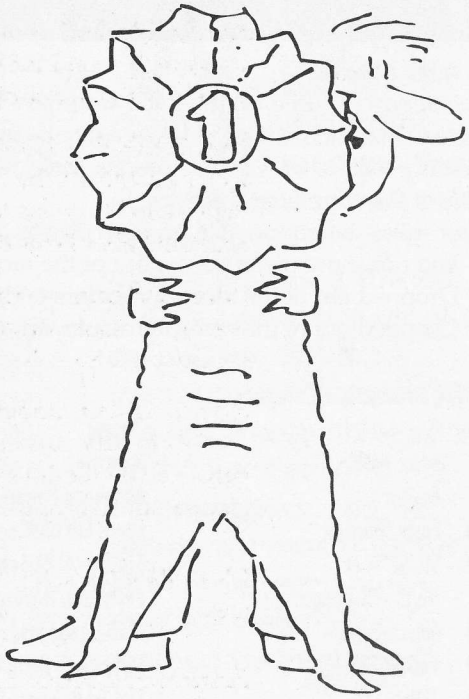
EAA Keith Crock 1996 Award Presented to Solectria

The Board of Directors of of the Electric Auto Association has asked me to present the Association's 1996 Keith Crock Award during Tour de Sol. The Award has been given each year since the early 1980's by the Association in memory of Keith Crock, a mechanical engineer and an early Electric Vehicle enthusiast with a penchant for tinkering and invention. The Award recognizes outstanding achievement and technical advancement in electric vehicles. The 1996 Award is presented to James Worden of Solectria in recognition of his development of the Sunrise vehicle and its technical performance in last year's Tour de Sol.

The Award is a bit anitclimactic given Solectria's outstanding multi-vehicle performance over the past week in this year's EVent. However, given those events, it is clear that we in the Electric Auto Association have chosen well. I have observed Mr. Worden's professional focus and dedication to the technical performance of Solectria's vehicles. I am sure this will be only one of many accolades that Mr. Worden will receive for his accomplishments with electric vehicles.

Mr. Worden, will you please come forward to receive the 1996 Keith Crock Award from the Electric Auto Association for outstanding technical achievement with the Solectria Sunrise. — PB

(Text of presentation speech at Tour de Sol by Peter Barnes, EAA Secretary)



Urban Driving — The EVantage

Results from Argonne Lab's Tour de Sol vehicle testing show the efficiency of ICE cars falls off sharply in urban driving conditions, giving EVs an even greater advantage. In order to compare "apples to apples" between Evs and ICE's, Tour de Sol officials ran a Chrysler Neon, a fairly efficient gasoline car as entry #9. In a dyno test cycle simulating congested New York City driving, the Neon's efficiency fell to less than 12 mpg. The cause? Lots of idling and low speeds.

In comparison, the best hybrid got approximately twice that at 22-23 mpg while the Solectria Force NiMH got the equivalent of 60 mpg.

"A Whale of A Lot of Sense"

To quote Internet TdS reporter Michael Bianchi, "That is the kind of increase in efficiency that shows that in urban settings EVs make one whale of a lot of sense"

A modelling study by the Center Trans - portation Research showed that replacing 12,000 ICE vehicles in downtown Chicago would reduce air pollution by an amount equal to all industries within the city limits. According to vehicle test engineer Robert Larson of Argonne Labs, "...[T]here is a highly disproportionate emissions benefit to replacing Internal Combustion Engine vehicles in cities with EVs. If we could work on electric or even hybrid buses (and other high emitters), that could give big, big benefits." — MB

TABLE 1

For those who prefer to think in Whrs/mi, here's the Day 3 data, including the gas Neon:

NAVC Production	12 Twike	68Wh/mile
US DOE Commuter	63 Sunrise	89 Wh/mile
Chrysler Hybrid	84 Paradigm	237 Wh/mile
Open Category	92 Sunpacer	80 Wh/mile
Comparison	Gasoline Neon	500 Wh/mile

Sunrise

Continued from page 1

NESEA AMERICAN TOUR DE SOL FINAL SUMMARY

by Michael H. Bianchi

This report is based on the Race Summary I received at the closing ceremonies on Friday afternoon. It is the best information I have at that moment and I believe it to be the final results. (Total Miles) is the distance actually traveled. Tour Miles is Total Miles minus penalties for various reasons, including not being ready to start on time, moving and safety violations, failure to be on display at the appointed times, etc.

Tour miles determine pole position day-to-day and the winner of each Category.

X Did not show up or maybe out of the race. (Did not show up.)

Y Dropped out of the race (my understanding)

Z Dropped out of the race, but displaying vehicle at stops

NAVC Production Category

No.	Car	Team	Tour Miles	Total Miles
4	Force NMH	Solectria	604.7	(609.7)
17	Ecostar	Allegheny Power	538.7	(543.7)
10	Force/Horizon	Conn. EV/NAVC	388.6	(409.7)
34	State Power	STAPPA/ALPA-Solectria Force NiCd	385.5	(391.4)
7	Nordic Challenger	EVermont/NAVC	383.3	(422.0)
15	Solect. Force	JCP&L Lead-acid	382.2	(387.2)
12	Twike	Technick & Design	316.7	(319.5)
14	TEVan	Met-Ed Penelec/JCP&L/GPU	286.2	(322.7)
US DOE Commuter Category				
3	Sunrise	NAVC/BECO/Solectria	772.7	(810.5)
72	Sungo	NHT Electric Car Team	384.6	(393.6)
57	George the Geo	FMRHS-Sol. Elec. Racing	382.3	(386.1)
32	Porsche 914	Shadow Mt. Elec. Matadors	378.6	(378.6)
88	OHM Ranger	Neocon/NYSEG	361.4	(361.4)
31	Spyder Juice	Simpler Solar	357.4	(362.5)
43	KA1000	Polytech Chargers	356.4	(361.4)
39	Sparky	EV Moore-CEVA	344.2	(344.2)
35	Kineticar	CSERT-NVCTC	342.3	(352.8)
42	Golden Gear	MAVTS-G/G Racing	336.7	(336.7)
38	Sparky 2	Wooster's Charge	335.5	(345.3)
65	Electric Hare	Wattsmen	331.7	(336.7)
66	Genesis I	Genesis Team	328.1	(328.1)
33	Solar Bus	Bridgewater Solar	324.1	(328.1)
46	Utility EV	PETC	296.9	(332.5)
74	Lightning Volt	Parkland HS	289.7	(324.7)
44	SolarSaurus	Rocky Hill HS	159.8	(265.3)
82	Lectric Lion	N. Hunterdon HS	83.4	(241.1)
54	Roadrunner	Greenwich HS	20.8	(287.4)
79	'59 Berkeley	Team New England	-1.1	(210.6)
47	Electruck	Taylor-Dunn	-7.5	(171.0)
45Y	Regen. Braking	Alt. Energy	-230.7	(3.6)
24X	B-U-LLET	Boston U. SEV Team		
2X	Trans2-AC	Wallingford AC, Inc		

No.	Car	Team	Tour Miles	Total Miles
Solar Commuter Category				
83	Sol Survivor IV	CONVAL Solar Car Team	93.0	(248.2)
58	Sol Machine	Newburgh Free Academy	-135.9	(149.0)
93	Helios the Heron III	Riverside School	-213.6	(91.4)
36	Texas Native Sun	Longstar Solar Racing	-313.1	(38.9)
75X	Commuter Car	Villanova Univ. EV Team		
Chrysler Hybrid Category				
94	Hopper EV	`Tom Hopper	471.	1(673.1)
96	Project e-	Mt. Everett High School	470.9	(505.3)
23	Viking 23	Western Washington U.	427.9	(440.3)
48	Electric Lion	Penn State SAE	366.9	(382.1)
81	VT Ani mul SL	HEV Team of VA Tech	288.4	(318.4)
26	Hyperion	Wentworth Inst. of Tech.	251.8	(304.1)
84	Paradigm	Team Paradigm, U. of Wisc	240.3	(340.9)
25	Viking 25	Western Washington U.	81.7	(229.3)
28	Hybrid Lumina	Clarence Ellers	-248.3	(71.3)
19Z	HEV U Florida	Univ. of FL HEV Soc.	-274.9	(78.0)
21Z	Hy Potential IV	U. of Tennessee	-387.9	
Open Category				
92	Sunpacer	Cato-Meridian HS Tech Team	257.8	(322.7)
64	Proteus 1	Union College	83.8	(262.6)
52	Electrobike	CTC NEastAdvVehTecCtr	81.8	(276.5)
37	Ottawa Orange IV	Tech Prep	43.3	(246.2)

Date: Fri, 17 May 1996 19:40:51 -0400. From: Michael H Bianchi <bianchi@BELLCORE.COM>

We were hoping to beat 300 miles (per charge in the Sunrise). When we found out the extra lap course was on a highway, we thought would do less. It turned out that once the car got rolling, the efficiency went up so high it didn't matter. The combination of the light weight, the aerodynamics, and the drive train meant that it didn't matter so much that we were doing 55 mph on the highway."

(James Worden, Solectria CEO, on the `Sunrise's (#63) new range record.

From an interview with Mike Bianchi.)

How'd They Do It?

For most of the race, `Sunrise' ran in the 'Economy' mode, which limits the battery current drawn, except while accelerating. Michael Bianchi commented, "On my Force, Economy limits to 60 Amps, Normal to 120 Amps, Power to 200 Amps. I'm guessing the numbers are similar for the Sunrise, especially since the Sunrise weighs 1972 pounds while the Force is 2390."

Solectria CEO James Worden added, "The Ovonics battery gave us great energy. But the real magic is combining that good energy in a light-weight battery, with a very light-weight car, with good aerodynamics, with an efficient suspension, with very efficient vehicle design, and a low loss drive train to achieve low Watt-hours per mile.Over 90% of the electrical input from the battery shows as mechanical output to the wheels over a wide torque and speed band."

Solectria winners under finish banner.

OP - ED

Protest Underscores Public Perception

by Michael Bianchi

Tom Hopper, who I would never have described as "angry" or "emotional" in a negative sense, staged a protest on the Pottstown PA to Chesapeake City MD leg. `Hopper EV' (94) was the first one under the finish banner, 10 minutes ahead of everyone else, even though he started back in the pack. He averaged 37.3 mph, well above the second place 34.1 mph.

What's going on here?

Well in years past, the NESEA Tour had a problem with people speeding.There was a speed component to the scoring, and so being first meant something tangible in the score. We heard protests from town police when cars went through their towns too fast or ran stop signs and traffic signals.

So the rules were changed to take high speed out of the scoring. Instead, people were expected to drive the posted speed limit and those who got in too early were penalized, as were those who got in too late. But if you arrived anywhere within your window of time, you got full credit for the leg.

But that raised other problems noted by several drivers. If you didn't drive with the traffic flow, which is almost always above the posted limit outside of towns, here was this car or truck, prominently labeled "Electric Vehicle", apparently having trouble keeping up with traffic. On top of that, the estimates of allotted time to drive a leg were based on earlier drives, often at different times of day and in different weather and traffic conditions. I suspect they may not always have been precise enough.

So Tom protested. "I'm not driving on eggs any more. I am driving like a normal person and staying with the traffic." He wanted to bring to the Race Jury and rule-makers' attention that the window system based on strict adherence to posted speed limits not only made us look bad, but created safety problems as annoyed people tried to pass cars under circumstances that did not really permit it. (Because much of the race is on country roads and not on major highways and interstates, we were often in hilly areas where there is no passing lane, no passing zone, and no shoulder. The slowest vehicle defined the speed for everyone behind.)

> But [efficiency] isn't what's going to sell it. Beating an ICE will sell it."

And if that was an EV

"The public is not going to pay attention to EVs unless they out-accelerate ICE cars at the stop sign, out-distance them, and outlast them,"said Tom. "The most important thing that has happened in all the Tour de Sols happened on our trip from New York City to Lambertville. Mr. Larson said we got a factor 4 times better in the city than on a gasoline production car.

But that isn't what's going to sell it. Beating an ICE will sell it."I'm not going to drive my EV like an EV any more. I'm going to drive it like a normal car. I'm driving with the traffic, and staying right with them."

Tom's action, along with other similar driver comments, caused the Race Jury to reconsider the issue, and the early arrival limit was dropped. However, the Jury also decided to consider any unsafe action or unsportsmanlike conduct much more seriously and to exact stricter penalties. I suspect the issue will be reconsidered in some detail before next year's event. — MB

Clean Pace Cars

by Bob Mueller, SJ EAA

The San Jose EAA Chapter has started running EVs as pace cars at athletic and triathalon events where health conscious people abound.

EAA had a static display at the parking lot of the San Jose Mercury News 10K Run in March. On June 2nd, San Jose ran pace cars and had static displays at two separate EVents.

One EV drove 24 miles behind two police motorcycles and in front of 500 cyclists, while the other preceded the runners for the first 1/2 mile of a 6-mile event. We got great visibility and the lead runners didn't have to suck ICE exhaust.

> I would like to see this "Clean Pace Car" idea catch on very quickly at races throughout the US.

We have more shows coming up. I would like to see this "Clean Pace Car" idea catch on very quickly at races throughout the US. It may get to the point that race promoters may call our 800 number asking for an EV pace car. I will field all these requests for now and relay the caller to the appropriate chapter for a EV.

All chapters should be prepared to provide a nice-looking EV as a pace car if the request is made. Bet yet, be proactive by going out to your local run and triathalon events and ask them if you could provide an EV. — BM

Bob Mueller (408) 922-6627

0006489760@mcimail.com)

Dyno Testing - Sunrise Too Good To Be Measured

by Michael Bianchi

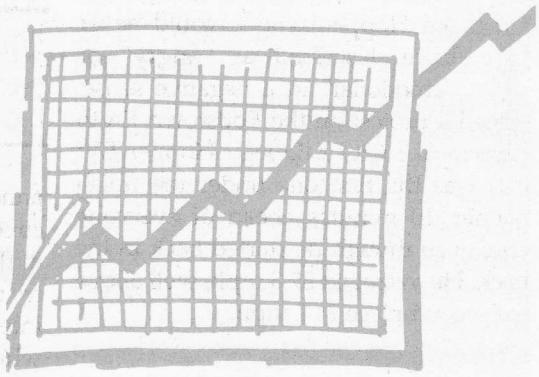
Bob Larsen is here with several colleagues from Argonne National Labs performing tests on the cars. Many (most?) of the cars were put on a dynamometer at the NYC Department of Environmental Protection Testing Lab in Brooklyn NY sometime during the week before the race started. I caught Bob, who gave me some early impressions.

Dyno Can't Go Low Enough

`Solectria Sunrise' (63) got 125 Watt-hours per mile on the dyno running the Federal Highway Driving Cycle (FHDC). For the New York Light Duty City Cycle and the Urban Driving Schedule, the `Solectria Force NMH' (4) actually did better than the `Sunrise'. "That may have something to do with the fact that the `Sunrise' is so light and efficient that the dyno setting cannot go down low enough to accurately represent what is going on."

They both got on the order of 200 Wh/m on a very challenging city cycle without much regen and lots of repeated, short acceleration.

Internet EV List post on Thursday, 16 May 1996.



Ideas that Worked

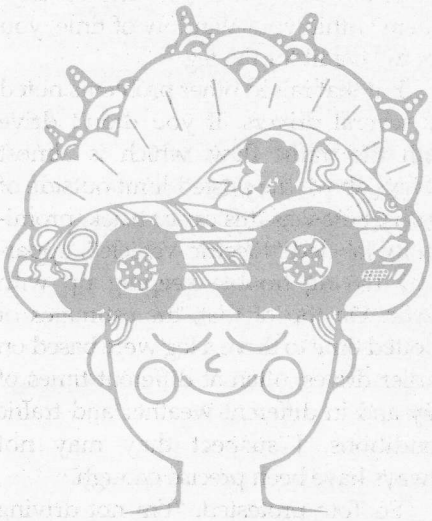
by Michael Bianchi

George the Geo (number 57) is from Fall Mountain Regional High School in Langdon NH. I spoke with Greg Bascom.

This car has 2 120-Volt strings that the driver switches between manually. Thus when one string builds up surface charge they can let it rest while using the other. The result should be greater range without having to stop to let the batteries "rest". One string is 10 12-Volt modules; 2 in the front of the car and 8 in the back. The second string is 20 6-Volt modules in a detachable trailer.

`George the Geo' (57) made it all the way through from NYC to Lambertville. Their 2-string battery strategy apparently paid off.

Internet EV List post on Thursday, 16 May 1996.



GEORGE THE GEO'	
Base Vehicle	1991 Geo Metro hatchback
Solar Array	150 W Siemens, single cell, double crystal
Batteries	Trojan lead-acid
Motor	Advanced DC 9 inch
Controller	Curtis 500 Amp
Chargers	onboard: K&W transformerlessoffboard: Lester transformer

Failures and Fixes

by SPARKZ

In some ways, the American Tour de Sol is a real stress test for EVs. It isn't surprising that many entries did experience mechanical or electrical failures. Components designed for street service actually held up fairly well, but things did break, as they do in gas-car competitions ("that's racing!") However, as EV Discussion List reporter Michael Bianchi observed, there were fewer breakdowns in '96 than previously and "several cases where 'never say die' proved to be the right answer."

The Tour de Sol is an arena where knowledge gained can translate directly from competition to the everyday EV driver. Many of the reasons for breakdowns or failure to complete a leg might have been avoided by better planning or logistics. So, what were the major problems?

Insufficient Charge

The same old bugaboo that plagues everyday EV commuters dogged Tour de Sol entries; inability to get enough amps-hrs on board. Causes varied from interruptions at the plug to batteries that were too new or too worn-out to contain a full charge.

Pop Goes the Breaker

The EV autocross star Spyder Juice (#31, Al Simpler, MendoMotive) kept popping its 20 A breaker until charging station electricians reassigned the team a 30 amp-er. A heavier charging cord also helped.

Newburgh Free Academy's "Sol Machine" (#58), racing in the Solar Commuter category, had an innovative charging scheme, with individual batteries each being charged by a smart charger. Their setup, however, drew 40 amps, which got choked off by the 20 A panel breaker. The first day they only got half the juice they needed; however by the second, they got the charging sorted out. Another panel breaker victim was SolarSaurus, who had to trailer into Annapolis on the second day after doing additional laps before going into Chesapeake City on the first day. The pack was sucked so low that "we kept tripping the 20 A breaker all night long," team member Don Brown told Michael Bianchi.

Wimpy Chargers

Some entries had chargers that were too undersized to pull enough amps from the panel. Proteus I (#64) had charging problems during the night on 5/21, but re-wired their charger before the following evening

Bummed-out Batteries

Some TdS teams repeated the very common EV racer's mistake of going into competition with under-cycled batteries. This for the most part, was not due to ignorance but the time crunch in preparing. Scott Isgard's "Solar Deliver's" (Staten Island) batteries were newborns; just 24 hours old. Infant batteries, New York City stop-and-go driving and steep hills before the finish did in Lightning Volt (#74) who died a frustrating 4.7 miles short of the banner.

Generous Genesis I suffered from batteries at the other end of the spectrum. The elderly pack was clearly falling off; team representative Brad Notter reported that last year's capacity of 24 kW-hrs had fallen to 20. Sitting in winter storage and having to replace two batteries contributed to the problem. The truck also fell victim to cold and wind in the city.

Team New England's '59 Berkely, engineered for lightness and efficiency, got torpedoed by under-inflated tires and lazy batteries that sat and sulfated over the winter. Remember folks, stretch 'em and use 'em or else you lose 'em.

Poof Goes the Controller

If some ill-prepared or ill-fated packs folded up under the strain, it is not surprising that controllers also fried. An unwelcome sound for the Florida HEV-y Gator team was their 28 controller MOSFETs going off like Jiffy-pop 35 mile shy of New York. Attempts to rebuild failed and the car became a static display.

Regen took out some controllers, such as the one in Bill Glickman's "Regenerative Braking" (45). The failure was complicated by insufficient charging in NYC and amp-hunger during the 32 mi to Lambertville, NJ. While positioning for the start of the next leg in Lambertville, something went "snap" and let the smoke out of his older (SCR?) controller. Upon autopsy, he found holes in the transistor cans. Genesis I's Mark Parthe pulled a Curtis out of a hat to put "Regen" back in the race.

Nearly Sunk by Not Sinking

The elementary school kids on the Helios the Heron III (#93) team can be forgiven for not knowing that plywood makes a lousy heat conductor. They know better now, but they almost learned it the hard way. Their plywood-mounted Curtis heat-stressed and packed up, but Generous Genesis I came to the rescue with a replacement (the same Curtis that was returned by Bill Glickman after he blew up his motor, poor guy.) The enlightened Helios team mounted their controller on an aluminum plate and got back in the race.

Non-fatal controller overheating dogged Electruck (#47), which didn't make the Sunday mileage they wanted. Removing the cover from the controller box fixed the problem (the truck's rear faring kept curious fingers away).

Golden Gear's '94 Glitch

The Golden Gear Special Fiero-based EV had an interesting controller wiring problem in 1994. Michael Bianchi found out about it when he interviewed the team in his 5/14/96 report. The symptom was subtle; a loss of efficiency.

continued on next page

The car consumed 1 kW-hr per mile and thus had to struggle to the end of each leg. Just prior to the last leg, the team discovered high resistance in a control lead to the controller, caused by an improper crimp. This high impedance in the control input made the controller underpower the motor and resulted in poor power usage. Once repaired, the car delivered about 5 mi/kW-hr.

Toasted Motors

It wouldn't be an EVent without one motor going bang due to over-reving. This was "Regenerative Braking" again, though human factors obviously contributed. Mike Bianchi tells the story in his 5/19 report.

"From Tuesday night and Wednesday morning: Poor Bill Glickman. No sooner does he get his controller for `Regenerative Braking' (45) replaced with a loaner from Mark Parthe of `Genesis I' (66) than his brand new, $2000 motor fries. "I had it all connected up, so I try to run it in neutral. 25 Amps; looks good. So I try 50 Amps; looks good again. So I try 100 Amps and the motor blows up! I'm getting a good night's sleep and going home."

(I wonder if Bill was so sleepy after working on replacing his controller that he forgot the dangers of over-reving a motor with a wound rotating armature. If [it is] rotating too fast, the centrifugal force causes the windings to expand and hit the stator, usually with spectacular and disastrous results.)"

Twelve Volt Blues

Glitches and twitches in the 12V control systems sidelined some cars. Ottowa Orange made an unfortunate stop in the Holland Tunnel when a loose wire disabled the forward/reverse control switch. A quick fix got them out but as one team member says, "Now we don't go backwards." During extra laps, Electric Hare's (#65) 12V battery developed an intermittent problem that prevented the contactors from closing.

Mechanical

The mechanical driveline also proved to be the vulnerable link in some cars. Others ran out of poop when underinflated tires, flats, misaligned chains or inefficient gearing sucked too much juice. Ottowa Orange IV started strong from Lambertville, but an over-geared direct driveline forced it onto the trailer after about 40 miles, team member Noah Williams told Mike Bianchi. They changed the gear ratio for the next leg.

Helios the Heron III had the same problem as some 10-speed bikes — it kept throwing the chain. Team members traced the problem to insufficient tension in the idler arm, which couldn't keep the chain taut when the rear wheel went over bumps. Even after an idler arm fix, Helios still kept shedding its chain due to misalignment problems. Nevertheless, the elementary school entry made 39.1 miles on Monday and 37 miles on Tuesday, doing surprisingly well despite the difficulties.

Broken Axles

Hyperion (#26) broke an axle. As Judy Cooke told Mike Bianchi, "We were at an intersection, going nice and easy and then, pop." Since the hybrid runs a Geo Metro engine, one spline is from Geo while the other is from Saturn and required custom machining. They got back in the race.

Broken Drive Gear Components

To quote TdS's indefatigable roving reporter, "`Roadrunner' (54) looked very much out of it Sunday night, with a broken drive shaft and messed up rear end." However the team recovered, got the parts they needed by Monday morning and could drive the Lambertville to Boyertown leg. The flexibility of the NESEA Tour de Sol rules allowed them back in, so they recorded their start and finish times and took a "not ready at post time" penalty.

Miracles

Paradigm (84) had the most amazing break-and-fix story. They almost had to say "die", but dug in and refused.

From Michael Bianchi's report:
"On Monday the car was driving down a hill and they hear knocka-knocka-knocka-ROAAAARRR! The ROAR was when the spline on the coupling from the motor to the transaxle tore out all the teeth. Olaf Bleck of Team New England happens to be nearby and says, "Think really hard before you put your car on the trailer. The penalties for trailering are pretty severe."

"Fortunately we didn't give up too soon," said Ted [Bohn]. Instead, some miracles occurred.

Miracle number one: They were at the top of the hill when all this happened.

Miracle number two: At the bottom of the hill is Histands, a truck dealership of Doylestown PA. "Yes, you can borrow our cherry-picker to pull out your drive train." So they lend the team tools, rags and everything. "By the way I know someone at Zenco Machine Tool Company (also of Doylestown)."

I'll Do It Personally

The manager of Zenco says, "All my guys are busy; I will do it personally." He likes the concept of the car so much that he makes the part personally; charges $130 for 4 hours of labor. We go to a Ford dealership, buy an Escort clutch, strip out the center coupler by drilling out the rivets, turn it down on a lathe, reassemble the transaxle to the motor, put the motor and transaxle back in the car, get it all lubed and adjusted, drove it down the highway and were back at the race by 9 pm."

(My thanks to Michael H. Bianchi for permission to use his material.) — SPARKZ

Lead-Acids Go 100+

by Clare Bell

Day 3 of the 1996 Tour de Sol saw performances less dramatic than Solectria's Sunrise, but equally important. Vehicles powered by lead-acid batteries repeated broke the 100 mile mark, an indication that every-day EV street technology has advanced along with the high-tech exotics.

Hundred-mile-busters in the NAVAC production category include Connecticut EV/NAVC's Horizon-powered 14kWhr Solectria (#50), with 132.4 total miles, STAPPA/ALPA State Power E-10 truck (#34), running on 16kWhrs of GNB's made 106.6, and JCP@L's Solectria Force (#15) running on Interstates, did 132.4.

The largest number of 100-mile-munchers were in the US DOE Commuter class. (Distance is given in total miles before penalties.) From the top down, it was NHTI's Sungo (#72) with 123.8 total miles. Sungo ran on 1000 kW-hrs of Electrosource Horizon cells with an assist from 96 watts of Astropower monocrystalline solar cells. George the Geo (#57) from FMRHS-Solar and Electric Racing made 123.8 on his Trojans and 150 watt Siemens single cell, double crystal solar panel. The Electric Matadors from Shadow Mountain High School's fielded their APS-proven Porsche 914, Electric Bull (#32) which tossed off 123.8 without using a solar array. The Porsche did it on 21 kW-hrs of Trojan 125s, used in many street EVs. , Neocon/NYSEG's Ohm Ranger (#88) packed away 106.6, on Horizon Lead-acids. Spyder Juice (MendoMotive and Al Simpler, #31) wrapped up 115.2 on 16kW-hrs of new GNB absorbed electrolytes. KA1000, from the Polytech Chargers (#7), pulled 106.6 out of its 12.18 kW-hr pack of Trojans.

Several hybrids topped the mark as well, with the outstanding Hopper EV (#94) at 330.1 total miles. Hopper went with 8 kWhrs of Optimas boosted by a 100 W array of Astropower monocrystallines. Mount Everett Project e (#96) racked up 196.1 on 27.6 kW-hr worth of good old US Battery 6-volters. Penn State SAE's Electric Lion stalked down 127.3 on its 11.52 kWhrs of Exides. Car #84, Paradigm, overcame mechanical setbacks to post a Day 3 total of 161.1.

'George the Geo' trucks battery trailer in NYC. $1800 trailer holds second battery string.

'Hopper EV' pops its top. This has been the best EV for several Tour de Sols. It also drove from and to the event.

(My thanks to Peter Barnes for pointing out the Day 3 performance of lead-acid powered cars.)

Ref: Tour de Sol Race Summary and Newsletter

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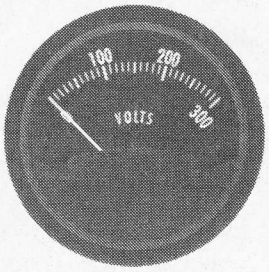
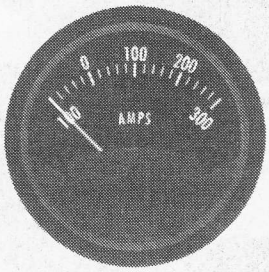
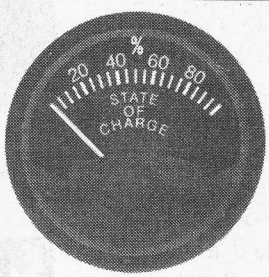
Electric Vehicle Instruments







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SFBEAR 1996

by Bruce (EVangel) Parmenter

T'was the night before SFBEAR, and all was hectic for the Big Guy. Yes, I had done the prep for one of the Best EVents the EAA SF area annually offers, but work-work and (of course) last minute ToDo's had me staying up too late.

I did have a grandiose plan to be well ahead of my usual busy schedule, and 'get to bed Early' that night, get to SFBEAR by 6 am for a top-off, and not miss a single minute of what I have been waiting a year to experience (again. BruceDP-> 1995 SFBEAR veteran).

Don Gillis and Bob Mueller of my EAA San Jose Chapter, were anxious and ready for the EVent. I was offered to 'Caravan' to SFBEAR (making it easy & fun all around) but, I had to decline (Bummer :-/).

New kid on the block. Toyota RAV4 EV debuts at SF Bear.

Fitting Photos

I did meet a later schedule, and arrived at 8 am the starting time (still having to unload my EV from the rented Ryder transport, and all the posters, cones, and literature that I stayed up late to make). Most everyone was there, already had taken their SFBEAR '95 EV photo at Crissy Field in the San Francisco Presidio (the Golden Gate & smog in the background. Fitting, eh!?).

I counted over 20 EVs there, of all kinds: Porsches, trucks, sedans, Blazers. There were College solar races, ... even Don Bright brought the Tropica, and Kent Harris of PG&E (our Utility) brought the Toyota RAV4 [image at:ftp://pitzer.edu/inbound/tmcrav4a.jpg].

It is the new design, trying to be sporty (I guess so, if you ignore the windows and top, the body is shaped like a running shoe :-o).

Since, I have a well-suited 40 mi highway range, I didn't plan to do the three bridge (Golden Gate, Richmond, and Bay Bridge) run/loop. Instead, (similar to last year), I wanted to do one of the shorter trips (over the Golden Gate, stopping at the Vista point, a little EV promoting, and/or then back over the Bay Bridge to Emeryville, meet up with the EVs that were completing the three bridge run, and go back with them (I would decide that on the fly as sometimes you have to 'punt' when you are trying to coordinate, and have fun at the same time :-?).

Focus: San Jose Chapter

It was our chapter's task to: handle the EAA literature and paraphernalia table, plus arrange rides for the public (with our EVs, and tapping the shoulders of the other EV drivers).

Don and I had been to last year's SFBEAR, but this was Bob's first time. I could see his glee, as he was giddy with the exhilaration of taking his EV to totally new places (as it is for us all :->).

When everyone left on the rally, Bob would let another EAA SJ Chapter member take his EV over the Golden Gate Bridge with Don. Bob and I would handle the literature table, plan the EV rides course/loop, and wait until they returned on their short excursion.

The entrants were ready, the SFBEAR Rally started (as I waved them on, standing in the middle of the four way stop, holding the traffic at bay with a bullhorn). " SFBEAR RALLY Is Off And Running! "

Many people had seen our signs (SFBEAR Rally, EVs on display and Rides), but some were attempting to attend the other activities that were occurring nearby. As they strolled by us, they would stop to ask questions. Not only did we give out EV literature, but also let them know that we would be giving rides when all the EVs had returned, after lunch.

Just off the Bay, Crissy Field was breezy, with the light overcast mixed with the smog. Most people were fooled into a lull of safety, while the sun cooked our skins (I remembered everything except my hat and sun screen :-/.

continued on next page

SF Invaded by EVs

Our two members had returned from the Golden Gate vista point. Bob Mueller and I passed the baton. Bob led and I followed, winding our way through the SF city streets, with Bob exuberant with energy, (Honking our horns, pointing to the "Electric Car" lettering on our EVs, usually yelling "GO Electric" out the open windows). Bob took an additional route through the Marina/Wharf (tourist trap) area, to get more attention to the EV cause (the sudden face-slap gas price rise, still stinging in the minds of the public). Some people were pointing, a few thumbs up, some were still watching (hands on their hips), as we cruised down the street (we were quite a sight, the 'Hans and Franz of the EV cause. " Ve're Her' to Show EVs!").

Eventually, we got on Highway 80, driving over the Bay Bridge. Except for a bit of squirrelly driving to find the correct lane, it was a blast going over the bridge (the rest of the ICE drivers were more interested in getting there than who was alongside :-/).

Bob's LeCar was cruising nicely up the bridge at 60 mph. The grade of the bridge was deceiving, as I tractored & held at 50mph. But, that's about right for when I do the Dunbarton Bridge (normal for me).

Bob led us to the Emeryville Bart station where all the SFBEAR Rally participants were waiting to return. The EAA East Bay Chapter members had shown up for support. After a short hang-out session, we all headed back, over the Bay Bridge to Crissy field (EVs Ho!).

Cruising in a group like this, with all our EVs donning the SFBEAR Rally placards, let all the people see. "Hey, there sure are a lot of Electric cars aren't there!?". The EV caravan, traversing the SF city streets made it easier not to get lost (especially, for non-locals). I put

continued on page 14

Willl Beckett stamps his Clean Air Passport at Sausilito.

Mike Slominski (left) checks out the Toyota RAV4-EV.

Tropica was the center of attention at the Emeryville stop.

SFBEAR

continued from page 13

myself in front to arrive first, and (again) I stopped the traffic to let the rally EVs return. Back at Crissy Field, the Evs were positioned to allow not only for EV rides, but as a public display (most people show up toward the end of these functions).

Held Over By Demand...

Checking with the EV drivers, our Chapter was able to give plenty of rides (too bad the Toyota RAV4 took off early. I wanted to check it out more closely). We made a simple short .5 mi course, which meant plenty of people could get rides, and many of them got rides in different EVs (got out of one, to ride in another).The EVent was really supposed to stop at 4 pm, but the public kept on coming. The EVs were leaving one by one, until there weren't enough to give rides.

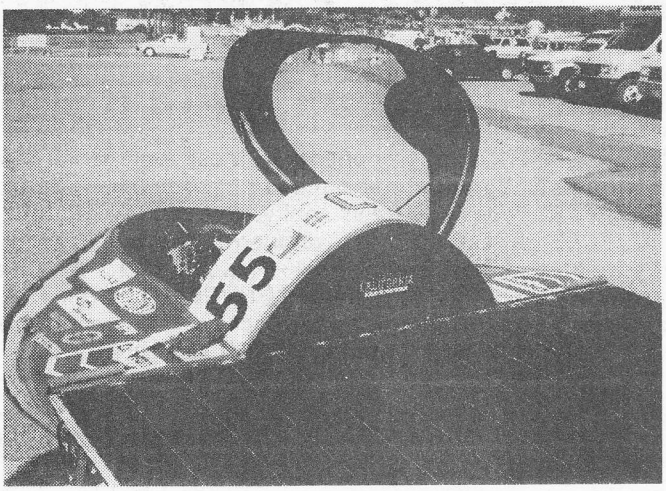
Just like having all your wagons in a circle, but with not enough wagons. When the Park Ranger decided to rearrange the barriers, there was no way to stop the ICE cars from trying to drive right through our display (time to shut down, or get some libation-lubricated drivers bashing into the EVs).

EVent over, David Coale and I went to the charging site the SFBEAR team had arranged. There was an offer to go out and enjoy a nice dinner, but after spending 10 hours on my feet, talking EVs non stop, I thought it was best to hang loose with our two EVs while charging a couple of hours. The other rally participants would go to dinner, and I would catch some well deserved zzz's (my face a glow, -Sunburn City-).

That worked well, as on David's return, the facilities people hadn't locked/blocked us in. We said our goodbyes, and before leaving that evening, I enjoyed tooling around the SF City streets just one more time in my EV :->

<BRUCE_PARMENTER@HPATC3.DESK.HP.COM>

(BruceDP@aol.com) Fax: 408-746-5368



Angle on U.C. Berkeley's solar car.

Man-eating Clam invades SF? No, just a Citi-El taking on a driver.

Rough and Tough - Wilde EVolutions' Landrover EV.

News in Brief

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

Production Begins on Ford Ranger

Ford Motor Co. has announced that it will start production this summer of its electric-powered Rangers in con junction with Transportation Design & Manufacturing, Inc. (TDM), a Michigan-based vehicle development and manufacturing firm. The vehicle is being produced as part of Ford's EV Qualified Vehicle Modifier program. Under the program, Ford provides gliders — Rangers without drive systems, transmissions or other components — to qualified conversion companies who then install electric drivetrains. The TDM EV Ranger will use an advanced lead-acid battery and will have a range between charges of about 50 miles.
(PRNEWSWIRE: 4/22)

Horizon Battery Breakthrough

Electrosource, Inc. has announced that the energy capacity of its Horizon advanced lead-acid batteries in production has increased to more than 50 Watt-hours per kilogram (Wh/kg) when tested at the three-hour discharge rate. This technological breakthrough gives the battery the highest specific energy of any lead-acid battery on the market today and makes the Horizon competitive with nickel-metal hydride batteries, according to Electrosource. Though the company achieved higher capacities in the past in laboratory testing, it only recently achieved higher capacities during production of the batteries. According to company officials, the battery delivers higher peak power characteristics compared to other cycling batteries in production today.
(ELECTROSOURCE RELEASE: 4/25)

Smart Car Comes to U.S. in 2003

The Smart car, a 100-inch long, two-seater to be produced by Micro Compact Car AG — a Swiss-based joint venture company between Mercedes-Benz AG and Swatch — will be marketed in selected U.S. cities sooner than originally planned. Johann Tomforde, Micro Compact Car engineering and design chief, said the Smart car received a positive reaction from a cross section of motorists in customer clinics in the U.S. "Most of those who saw the car loved the design," Tomforde said. "From the feedback we are getting there appears to be a viable market for the Smart in the United States." Though he said California, Florida and Michigan offered the best opportunities, he would not confirm the number of states Micro Compact is targeting.
(AUTOMOTIVE NEWS: 4/29)

Low-Cost EV to Be Produced in India

Low-cost EVs may be produced in Bangalore, India by California-based Amerigon Inc. and India-based Maini Group, according to an agreement in principle recently signed by both companies. Maini Group, which will provide vehicle assembly, distribution, sales and service for the EV joint venture, has already established a dealer distribution network in anticipation of strong consumer interest in the cars. The joint venture will have the capacity to produce about 6,000 vehicles annually over the next few years. The REVA will cost about $6,000 and is designed for city use, with a range of up to 60 miles and a maximum speed of 45 miles per hour, according to Amerigon. The car has two full seats in front and space in back for two children.
(BUSINESS WIRE: 4/29)

Honda EV Gets A+ in Market Savvy

The Green Car Journal recently gave Honda's EV an A+ for market savvy for its well-thought out design that provides a roomy interior and a low center of gravity. A two-door, four passenger hatchback, the Honda EV has nearly the same height, length, and width dimensions of the KiaSportage, yet weighs just 300 pounds more despite the batteries. It is equipped with dual airbags, automatic climate control, electric power-assist steering, two-way remote communicator,and power windows, locks and mirrors. The 49kW brushless DC motor is powered by 24 12v Ovonic NiMH battery modules which provide 0 to 60 mph acceleration in 18.7 seconds, a top speed of over 80 mph, and a range of 125 miles. Honda plans to lease the car to fleets and consumers.
(GREEN CAR JOURNAL: MAY 1996)

CA Utility Offers New Rate

Southern California Edison recently announced that Southern Californians could charge their EVs for the equivalent of 33 cents per gallon. The California Public Utilities Commission approved the new EV rate, which will be 4.1 cents per kilowatt hour (kWh) during off-peak hours and 32.5 cents per kWh during summertime peak hours. The off-peak period would be effective from 9 p.m. until noon the next day. Consumers would also need a separate meter to receive the rates. At these rates, charging an EV would cost 1.3 cents/mile, compared to 6 cents/mile for a gas-powered vehicle. An EV owner could save up to $56 each month, assuming the owner drove 1,200 miles/month and charged the EV during off-peak hours. To sign up for the new EV rate, contact Edison's EV Hotline at 1-800-366-7766.
(EDISON RELEASE: 5/8)

VA Power to Distribute Magne Charge

Delco Propulsion Systems and Virginia Power recently announced that the Richmond, VA-based utility would serve as the regional distributor for the Magne Charge inductive charging system. Virginia Power was selected by General Motors, which will use the Magne Charge system to recharge its EVs, including the EV1 scheduled to hit retail markets in California and Arizona later this year.

The utility will serve as the authorized EV charger service provider in the southeastern U.S., covering Virginia, Delaware, Maryland, West Virginia, North Carolina, South Carolina, Tennessee, Georgia, Florida and the District of Columbia. Under the agreement, Virginia Power has the right to sell, repair and offer warranty service on the charging system.

(VIRGINIA POWER RELEASE: 5/13)

Daimler-Benz Introduces Fuel Cell EV

Daimler-Benz A.G. recently unveiled its prototype fuel cell passenger vehicle in Berlin, Germany. NECAR II (New Electric Car), which is powered by Ballard Fuel Cells, is modeled after the Mercedes-Benz V Class mini-van. The Ballard Fuel Cell converts natural gas, methanol, or hydrogen fuel into electricity. Researchers from Ballard Power Systems and Daimler-Benz teamed up to develop the cell, which fits under the floor of the vehicle. So NECAR II has about the same interior space as its standard combustion engine counterpart. NECAR II can carry up to six passengers. It is capable of speeds of 110 kilometers per hour (nearly 70 miles-per-hour) and has a range of over 250 kilometers (over 150 miles) between fillups.

(BALLARD RELEASE: 5/14)

Sunrise Breaks Another Record

The Solectria Sunrise broke its own record in the 1996 American Tour de Sol race. The Sunrise, powered by Ovonic NiMH batteries, set a new distance record of 375 miles on a charge on the third day of racing. That's more than a 50% improvement over last year's record-breaking run of 238 miles. A Solectria Force powered by Ovonic NiMH batteries achieved a record 244 miles on a charge, outdistancing all other production competitors. The NiMH battery pack provided the Sunrise with 32 kilowatt hours of power at 252 volts and the Force 23 kilowatts at 196 volts. According to Ovonic's parent company, Energy Conversion Devices, Inc., the battery packs performed well in the race.

(ECD RELEASE: 5/15)

BAT Converts Postal Vehicles

Battery Automated Transportation (BAT) has received the first of 10 Post Office vehicles to be converted to electricity under a contract awarded to the company last year by the U.S. Postal Service. Five of the vehicles will serve the Phoenix, AZ area and the other five the Atlanta, GA area. The first BAT-converted EV will be delivered two weeks prior to the opening of the Olympic Games in July, according to BAT. The cars will use BAT's drive train, Horizon and Optima batteries, Lockheed-Martin charging systems, and other state-of-the-art equipment. The postal service's fleet of more than 100,000 long-life vehicles will require engine replacement starting in 1999.

(BAT RELEASE: 5/15)

Impact Comes to Canada

General Motors of Canada (GM) and the Province of British Columbia recently announced the arrival of the Impact this summer as part of the GM PrEView Drive Program. As the first test drive program for EVs in Canada, it will elicit customer response to vehicle performance and capabilities. Twenty drivers will be selected to use one of five Impacts for a two-week period between July and November, which also includes the use of a 220-volt home charging unit and a portable 110-volt charger. "This data from the 'real world laboratory' will help us to understand how electric vehicle technology performs in our climate and will help us to evaluate the needs and expectations of potential electric vehicle customers," said Tayce A. Wakefield, vice president of corporate affairs for GM of Canada.

(GM CANADA RELEASE: APRIL 1996)

Kids Show EV Works for Families

From: "Will Beckett (via RadioMail)" <beckettw@RADIOMAIL.NET>

4th Grade Class Data

The following is the data collected by students in a fourth grade class at Hoover Elementary School in Palo Alto, California.

I visited the class two weeks ago to talk about electric cars and to show them my car. This sample seems to follow national averages with over 75% driving less than 40 miles per day.

Mileage Results

Miles Driven	Days
0 (Zero)	13
0 to 10	40
10 to 20	82
20 to 30	90
30 to 40	50
40 to 50	28
50 to 60	15
60 to 70	9
70 to 80	8
80 to 90	8
90 to 100	9

Forwarded Message from Lucinda Surber <surber@hoover.palo-alto.ca.us>

Dear Will,

Here are our mileage results. (See Table.) Twenty-five kids collected data the first week and 27 the second week for a total of 364 days.

The class total for gas for the two weeks was $1,087.76, which seemed a lot of money to us. Half the class found their longest distances occurred on the weekends and half had longer drives during the work week.

Your electric car would work for almost all families!

Thanks again for coming to visit.

Cheers, Lucinda

Lucinda Surber ... surber@hoover.palo-alto.ca.us

Best Regards,Will Beckett

BeckettW@radiomail.net

Kids and electric vehicles (EVs) are a good mix.

They're at it again!

I just was approached by the local electrical inspector for the city, who saw my "electric vehicle" sign on the back of my EV. He wanted to see the permit for my charging system.

I tried to explain that I just plug into any 110v outlet, and let it charge overnight. (K&W onboard charger) He insisted that he just got back from a building officials seminar, and they told him that everybody that has an EV must apply for a permit for the charging outlet within 3 days of purchasing it !

Watch out! They will do anything for a permit fee! (read "tax")

Bob Taylor (Old Grey Hare'd Guy)
wascalbun@aol.com

http://members.aol.com/wascalbun/bob/bob.html (my home page)

http://members.aol.com/hrsoc/index.html (OCHRS Web Page)

More EV Rate & Building Code Comments

This inspector seems to be going a bit overboard. We expect that you would only have to be inspected and permitted if you apply for a dedicated EV service to take advantage of a utility's special EV rate, if they have one. If you are going to keep your status quo, then you should be fine. It would be like an inspector coming to your house after new rules about air conditioner circuits went into the Code and trying to say that now you are not in compliance, just because he was driving by and happened to see that you had an air conditioner. Hopefully, this will be an isolated case, but if not we'd like to hear about it.

Thanks for the opportunity to respond.

Tues, 21 May 1996 07:48:00 PDT. From: "Lacy, Scott" <lacysr@RESEARCH.SCE.COM>

Spyder Juices Annapolis Acceleration

by Sparkz

Al Simpler's MendoMotive Porsche Spyder (#31) used its 216 V pack of GNB's to Osterize even the gas-car competition in the Tour de Sol performance test. At Sandy Point State Park near Annapolis, MD, Spyder laid down a standing eighth mile time of 11.02 sec, even with batteries that were 95% discharged. After a short charge, Spyder then wrapped the Tour de Sol autocross, with a 36.27 sec.run. The Neon was second with a standing eighth of 11.158.

According to InnEvation's Gary Flo, in an EV Discussion List post, the Spyder was no slouch in the distance department either, doing a miles per charge of 117.

The *GNB G2* batteries weren't full when they started, or we might have gotten the lead-acid triple crown." A new battery equalizer also helped, according to Gary.

About the Spyder's Controller

So far Larry Howes 240V/600A IGBT unit has been "bullet-proof" for us... It has had the crap beat out of it for almost two years including overcurrent, & repeated pedal mashing. Cooked our brushes at Phoenix and didn't even get warm."

Michael Bianchi described the course in his 5/17 Internet post. "[It] consisted of a short acceleration run into a slalom, right turn, 3 off-set gates, a hard right turn, 1 1/2 revolutions around a skid-pad circle (counter-clockwise), another hard right turn, and then a short run to a dead stop. Each team had up to 4 attempts at the autocross, not necessarily with the same driver each time." He also noted that credit was not only due to the vehicles alone "(Driver skill and experience in autocross racing has a lot to do with the autocross results.)"

The Sandy Point autocross was set up and run by the Washington Area Sports Car Clubs. Acceleration and performance testing was done by Argonne National Labs. — S

TOP TEN TdS AUTOCROSSERS

No.	Car Name	Team	Autocross	Accel.
9	Spyder Juice		35.673	11.002
31	Neon Control car	Solar Electric Spyder Juice	36.270	11.158
84	The Paradigm	Team Paradigm	36.875	
46	Utility EV	PETC	37.426	11.302
???	GM Impact	prEView	37.559	
32	Porsche 914	Electric Bull Shadow Mountain	37.685	14.965
63	SolectriaSunrise	NAVC / BECO / Solectria	38.270	13.197
17	Ford Ecostar	Allegheny Power	38.371	12.785
72	Sungo	NHTI Electric Car Team	39.223	15.421
33	Solar Bus	Bridgewater Solar Works	39.395	16.403
4	Solectria Force NMH	Solectria	14.034	39.660

Keep it Simpler — Autocrosser Spyder Juice from Simpler Solar and MendoMotive (Gary Flo).

An Autocrossing Bus? Yet, and it was in the Top 10. Entry #33 proves that an old classic can learn new (elec) tricks.

How-To Video: Advanced Moldmaking

May 1996 09:20:54 -0600 - Bill Dube' <bdube@BOULDER.NIST.GOV>

The "Advanced Moldmaking and Plug Construction" video may be obtained from: Fibre Glast Developments Corperation, 1944 Neva Drive, Dayton, OH 45414. (800) 821-3283

This 35 minute video gives a very good step-by-step demonstration of making a plug and then a mold for a small composite car body. I recomend it for those who have a basic understanding of how to use fiberglass, but have never made a plug or mold.

They have a several videos on how to make things out of composites.They have a video called "The Seven Steps of Molding Fiberglass" that I have not viewed, but they recommend for folks that are new to the basic fiberglass process.

I have also viewed and recomend "Vacuum Bagging and Sandwich Core Construction." This gives a step-by-step demonstration of a wet lay-up carbon fiber / honeycomb car body in the mold produced in the advanced moldmaking video.

Keep in mind that the videos show just one technique of many that are available. What I liked about the demonstration and the process chosen is that is uses no exotic equipment other than that which is nearly essential. The only air tool used was a small cut-off wheel. The job is easier using tools like an air file, a DA sander, an orbital sander, a chopped-fiberglass gun, etc. These tools are not available to the average person working in their garage. A minimum of expensive tools are used in the demos. The power tools used were: air compressor, small electric belt sander, cut-off wheel, spray gun, and cup gun.

A Welsh vacuum pump is used in the vacuum bagging video. The vacuum pump shown cost about $2000 new. You may be able to dig something up surplus much, much cheaper. The ultimate vacuum needed is much less than the pump shown would normally achieve. A pump that is way too worn for many purposes might be just fine for bagging composites. Change the oil frequently (after each job) if you any regard for the pump. The volatiles and particulates in the epoxy tear up a pump if allowed to accumulate in the oil. An ordinary shop vac does NOT have enough uumph to do the job, but I have heard of folks using a high-speed industrial centrifugal pump.

Bill Dube - bdube@boulder.nist.gov

EVent Calendar

by Author

August 5-6

Edison Electric Vehicle Conference in Troy, MI. Contact Rick Temchin at Edison Electric Institute (202) 508-5588 or Sherry Craig at (202) 508-5561.

August 5-13

Sun Sprint of the Rockies - Aspen CO to Maob UT/. Call Curt Grinner at (970) 527-4493 or email hhs@wic.net or call Zach Keele (412) 847-6963.

August 10

East Bay Chapter's North Berkely BART Rally in Berkely CA. Call Lou for booth space and charging reservations by July 30. (510) 525-3636.

September 16-18

NESEA Sustainable Transportation and S/EV96. Symposium and trade show. Contact NESEA at (413) 774-6051 or Fax: (413) 774-6053.

October 17-20

Monte Carlo Rendez-Vouz in the port of Monaco. Accepting 50 teams to participate in rally 30 km long. They want EV companies to show their products. More than 5000 visitors are expected. For information, call 92 16 03 76 or Fax: 93 15 03 13, or write to Editions and Promotions Internationales, 11 Blvd., Albert ler MC 98000, Monaco. Deadline for registration is July 26, 1996.

December 11-13

North American EV and Infrastructure Conference in San Diego, CA. Call Pam Turner at (415) 372-0978 or visit their website at http://www/evaa/org.

Please call calendar items in to Anna Cornell at (510) 685-7580, or email to the the editor at CE96ed@AOL.com.

Helios the Heron at this year's Tour De Sol.

FOR EAA MEMBERS ONLY

EV Want Ads

For Sale

For Sale: Black Magic needs a home! First Volts Porsche, 1976 Porsche 914 converted with the Electro Automotive "VoltsPorsche Kit". 20 6V US 2300's, 9" Advanced DC, Curtis 1221 B. on-board K&W charger. Performed 83 miles on charge in recent EAA rally. Ultra-clean professional conversion. Well-maintained. Has log book and manual. Asking $13K/or negotiate lease arrangement. Fax inquires to Clare @ (408) 469-9185.

For Sale: '78 Fiat X1-9. 108V, 6" Advanced DC, PMC controller, Sevcon DC/DC, K&W charger, 60 mph, 40-50 mile range, $4200/obo. Call (206) 631-1280. (Seattle)

For Sale: 81 Jet Electrica (Escort). 15,000 miles. PMC controller, USB 2300 battery, on-board charger. $5995. Call (415) 964-3974. (California)

For Sale: '80 Omni Jet 007. 120V, EV-1 controller, 5800 mi, white, 220v on-board charger. $5,000/obo. Call between 7-9pm EDT. (201) 998-4435. (New Jersey)

For Sale: '81 Renault Le Car. 72V system, Curtis PMC controller, tow bar, range 30-50 miles, 7,000 miles, $4,300. Call (503) 899-1127 evenings (Oregon)

For Sale: Electrthon/Scooter motor. Powered champ at Phoenix. 3 HP peak, 1 HP continuous, 24 volt. Several new @ 265. Call or fax for specs. (714) 965-3016. (Anaheim, California)

For Sale: Lester Charger for 108V pack. (25 amp) with 12 volt auxiliary. 110 or 220 volt input. New $375.. Call (714) 965-3016. (Anaheim, California)

For Sale: 'Lester Charger for 108V pack. 48V, 40 mph. Great learners car; with chargers/spares. Daily driver. $1200/obo. Gary Warren Seiss, 139 Richards Avenue, Dover, New Jersey 07801. (201) 366-2894. (New Jersey)

For Sale: 81 Bradley Electric Car. CA licensed for highway use. $3,000 miles. Mint condition. Needs home. Ferrari style. Gull wing doors, Trojan batteries, GE electronics. $10,000/obo. Call (619) 721-2454. (Oceanside, CA)

WANTED: Tropica, Dune Buggy or Roadster/Convertible. Write to Bob May, 1902 East Karen Drive, Phoenix, AZ 85022.

Member Want Ads

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.

$10 for the first 35 words. Each additional word, 25 cents. Want Ads are available to EAA members for the sale of electric vehicles, equipment and parts only.

If you want to run your ad in more than one issue, please specify and include payment for each issue requested.

For corrections or updates, please send a written note or fax to EAA Want Ads @ 408.374.8750.

Photographs of your vehicles may be submitted with your ad. If room is available, we run one photo each issue. These photos will not be returned.

Send your Member Want Ad request and check made 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:

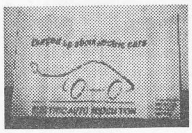
Electric Auto Association
18297 Baylor Avenue
Saratoga, CA 95070

CE ADVERTISERS

d B Associates 22
EcoElectric 11
EIN, Inc. 17
Electro Automotive 15
EV of America, Inc 15
Kaylor 20
KTA Services 24
Westberg Mfg. inc. 11

EAA **Reprint** Order Form

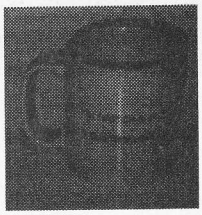
100% Cotton Cap
Forest Green
'Charging into the Future' EAA Logo
CAP001.....$7.50



Auto SunShade
SS001.....$8.00

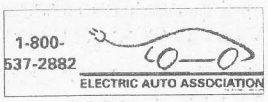
T w/EAA Logo
(adult small only)
TS001....$14.50

Thermal Auto Mug
MUG02...$6.00

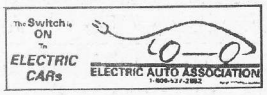


Porcelain Mug with
'Charging into....Future'
MUG003.....$5.00

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
BG1996	1996 Buyer's Guide to Electric Vehicles (Feb 96 issue CE)	$ 5.00
BG1995	1995 Buyer's Guide to Electric Vehicles (Feb 95 issue CE)	$ 5.00
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

PN001	Ball point pen with "EAA, 800 phone # & Charging....Future"	$ 1.00
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

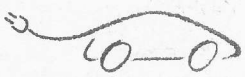
Name_____
Address_____
City,St,Zip_____

Item#	Size	Quantity	Item Description	Unit Cost	Amount

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

Subtotal	
Postage (10% of subtotal, for USA*)	
Handling	$2.00
Total	

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



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1996 04 04

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

• Address Correction Requested •

EBAY
996

• Time Dated Material - Please Do Not Hold •