

FVEAA NEWSLETTER
July 1995

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NEXT MEETING - July 21 at 7:30 PM
Will be in Room 1046 in the Student Resource Center at the College of DuPage,
southeast corner of 22nd Street & Lambert Road

DISCUSSION TOPIC - Gary Hendrickson from Argonne Lab will have a presentation on electric vehicle batteries. We will also discuss possible testing of the Ford Electrostar which will be available for a short while from ComEd.

MEMBERSHIP INFORMATION

Any person interested in electric cars is welcome to join the FVEAA. The cost for a full year's dues is \$15 which will entitle the member to receive our monthly Newsletter which contains useful information about electric car components, construction, policies, and events. Dues for new members joining in July will be \$ 5.00

FOX VALLEY ELECTRIC AUTO ASSOCIATION

308 South East Avenue
Oak Park, Illinois 60302

First Class



John Emde
6542 Fairmount Avenue
Downers Grove IL 60516 -2919

ADDRESS CORRECTION REQUESTED

PRESEZ

The meeting in July will include a speaker from Argonne National Laboratory, Gary Hendriksen one of the authors of a paper entitled "Development of Advanced Batteries for Electric Vehicles". This program should update our membership on progress being made on batteries. The American Vehicle Manufacturers Association contributed funds for a joint research and development project with the federal government.

Ken

Minutes of June 16th Meeting

The meeting at the College of DuPage was called to order by Vice President Shafer at 7:35PM. Sixteen members and three guests attended. Treasurer Corel reported no change in the checking and savings accounts.

Member Alcon is arranging a FVEAA appearance at the Downers Grove Heritage Fest on June 24th. Members, George Krajnovich and Ed Meyers will have cars at the exhibit opposite the Library from 9AM to 4PM. A Ford Ecostar from ComEd is also scheduled for display. Members were asked to show up to help set up and man the exhibit.

Member Brian Klosterman requested 25 items from the Newton inventory. Member Aarvold agreed to deliver these to him in Marion, IA. He also agreed to be the custodian of any remaining items. If any member wishes to buy any the these, contact Dave.

July Minutes - Continued

Member Ed Meyer reported that a 1990 Shelby Charger with a blown engine was scheduled for the car auction at Bolingbrook on June 24th. He was authorized to enter a bid not to exceed \$ 500 for the car that would become the vehicle for the coop project. (Editor's Note - The car never went to auction. It was advertised in the Sun-Times and sold prior to auction time).

Member Ray Oviyach inspected a VW convertible at an auto salvage yard. He reported that although the exterior condition was acceptable, it had serious structural rust and was rejected.

Member Barrett contacted Al Piemonte Ford Melrose Park. They seemed willing to sell or give the FVEAA a non-running car. He reported 3-4 of these vehicles are disposed of every Monday by the Dealer. Bob also briefly discussed the Ford Ranger "glider" program.

The membership approved proceeding with the coop program. An article in the next Newsletter will report progress and plans.

A new membership list will be published in December with phone, fax, and e-mail #s.

The Science article on lead emission from electric cars was discussed. Action on a reply was deferred until the next meeting.

Member Mock presented an update on his IGBT controller project.

The meeting was adjourned at 10:45.

Dave Aarvold

RECENT EV ARTICLES

Electric truck's price tag: \$ 30,000 - Chicago Tribune 6/13/95. Ford has chosen the electric conversion of its Ranger truck as the vehicle to be offered for the California ZEV mandate. It will be pitched to fleet buyers rather than retail customers in part because of the price tag. (Editor's note - There is little new technology involved. Ford could have offered a similar EV 20 years ago that would have about a 40-mile single charge range)

A faster, 'greener,' efficient future - Chicago Tribune 5/28/95 (From Journal of Commerce). A Hybrid car that uses conventional fuel for a tiny combustion engine coupled with an electric drive system with lead acid batteries would reduce emissions by 100 times in urban driven vehicles. Amory Lovens in a presentation to a Global Energy Future Conference stated these lightweight "hypercars" could leapfrog over other environmentally efficient cars. Compared with about 30 miles per gallon for present cars, the hypercar may be able to travel 150-400 miles on a gallon of fuel with electricity also providing energy. He recommends the hypercar start with an integrated platform built with composite materials. Some auto manufacturers have built experimental vehicles of this type.

Stempel's Revolution - Newsweek 7/15/95, page 41. The retired chairman of GM who launched development of the Impact is now associated with Ovonic Battery Company. While Chairman of GM, he became convinced that the Impact would be an essential product in GM's future. He observes that at the present, the government has rigged the auto market to favor electric cars by the 2% Zero Emission mandate in California. Nickel Metal Hydride batteries by Ovonics are likely to hit the market by 1997.

The auto electric - Chicago Tribune 7/8/95 (Reply to Chapman Letter on 5/28 - See June FVEAA Issue) In the reply, M William Brier from the Edison Electric Institute counters that the author is living in the past. He notes the Sunrise vehicle exhibited at the 1995 EV Symposium and Tor de Sol has a projected \$ 20,000 price tag, The Impact accelerates 0-60 in 8.5 seconds. He argues the car described by Author Chapman is not the car that today's technology can produce.

Electric Car Sets a Record: 238 miles Without a Charge - NY Times 4/27/95. The Sunrise, a 4-passenger EV with the interior space of a Taurus, a lightweight composite body, and equipped with an Ovonic battery travelled 238 miles in the 1995 Tour de Sol. Five other cars entered in the event exceeded a 100 mile range.

Tour de Sol Comes to This: Buses, Bikes and Composite Cars. NY Times 4 28/95. The event has been an annual showcase for EVs but the 1995 show featured a 22-foot electric bus that seats 14, electric scooter, and the Sunrise built by Solectria of Wilmington MA. The bus, entered by the University of Massachusetts in Lowell is use is on a 5-mile loop between campus and railroad station. The bus has a 35-mile range and a 27mph top speed. The scooter, entered by German engineer Helmut Schiller, is a prototype that can easily travel at 50 mph and a 100 mile range. The Sunrise energy efficiency is 150 watt-hours a mile and went 238 miles on a single charge.

AC Propulsion Civic (A silent power rocket) - A First Drive car test by Road & Track, 7/95 issue, page 69. The EV ranks somewhere between a Radio Flyer wagon and a moped on a performance scale for most car enthusiasts. Driving Al Cocconi's electric Honda CRX changes that impression. The drive system utilizes 28 Optima sealed lead-acid batteries, the AC motor-controller system produces 200 bhp @ 6-12000 rpm and has 165 lb-ft of torque from 0-5000 rpm. Acceleration from 0-60 was 6.2 seconds. Urban driving tested range was 118 miles. The powertrain is available now for \$ 40,000, but would drop to \$ 12,000 with production of 1000 units per year.

Electrified - Tom Sneva drives Formula/Lightning in Purdue Race - The Sagamore 6/9/95. Al Potvin, dean of the Purdue Engineering School in Indianapolis, two years ago initiated a student project to build an electric racing car. Sneva's observation - "It is amazing what this car can do. It surprised me how far technology has come."

California building code mandates electric car wiring for homes - CEE News, June 95, page 1. Sacramento County's building code now requires new homes to have an outlet for charging electric vehicle batteries. The Ordinance requires conduit and a two-outlet charging panel for all new single-family homes and residence garages. The charging circuit is rated 30-amps, 240-volts (Similar to a standard electric clothes dryer circuit). Estimated cost for the installation is \$ 40. Since the Ordinance took effect on Jan 1, circuits have been installed in 300-500 homes

RECENT EV ARTICLES - continued

Road Gets Bumpy for Electric Car, And Presidential Politics is Blamed - New York Times (National) 6/24/95, page 8. This article analyzes how the future mandate for electric cars may become embroiled in the next presidential election. The California Governor, Pete Wilson, who has become a candidate for the office, received letters from four Midwestern Governors, (Engler - MI, Edgar - IL, Thompson - WI, and Voynovich -OH) stating that "zero emission vehicle mandates would have little environmental benefit and would be so expensive that they would have to be subsidized by raising the cost of conventional automobiles. This will cost jobs in their states". They offer to organize an event in one of the Great Lakes states to announce your support for a national clean car (that exceeds present federal requirements). "Pete, your leadership can benefit the economy and the environment for all Americans", says the letter. The appeal was rejected but Gov Wilson called for an "audit" to determine whether the electric car program was practical. In California folks have invested over \$500-million in the effort with more spending likely within the next two years. (Editors note - more job loss for California to become an issue?)

On-Road Vehicle Emissions: Regulations, Costs, and Benefit - Science 5/19/95 page 991-2 (Policy Forum). The six authors of this paper state that cost estimates for implementing the 1990 Amendment to the Clean Air Act are \$12-billion. It is important to analyze the scientific basis for the proposed programs. They point out the EPA model for analyzing State Implementation Plans has had little success in predicting urban, on-the-road vehicle emissions. On-road sensors measuring exhaust CO and HC emissions were placed at various urban locations in California and collected data on 66,053 vehicles. Fifty percent of this sample with the lowest emissions contributed less than 10% of the pollution: 7% of high-emission vehicles accounted for 50% of CO emissions and 10% accounted for 50% of HC emissions. About

5% of the vehicles were gross emitters of both CO and HC. At two locations, high-polluting vehicles were immediately pulled over and inspected. Forty one percent of these showed evidence of deliberate tampering with emission control equipment. The study indicates large differences between the majority of cars and the few gross polluters. The conclusions of the study are summarized in the accompanying Table 1.

Table 1. Estimated costs and benefits of various mobile-source HC and CO emission reduction strategies as applied to the California fleet measured in 1991.

Action	Millions of vehicles affected	Percent reduction		Estimated cost (billions of dollars)*	Percent reduction per billion dollars spent	
		HC	CO		HC	CO
Switch to reformulated fuels*	20 (100%)	17	11	1.5	11	7.3
Scrap pre-1980 vehicles	3.2 (16%)	33	42	2.2	15	19
Scrap pre-1988 vehicles	14.6 (73%)	44	67	17	2.6	3.9
Repair worst 20% of vehicles	4 (20%)	50	61	0.88	57	69
Repair worst 40% of vehicles	8 (40%)	68	83	1.76	39	47

*Reformulated fuels were estimated to cost consumers an extra \$0.15 per gallon or \$75 per year for a 20-mpg car driven 10,000 miles per year. Scrappage costs per vehicle were conservatively estimated at \$700 for pre-1980 cars and \$1000 to \$2000 for cars built from 1980 to 1988. Average repair costs were estimated at \$200 per vehicle.

FROM OTHER EVE NEWSLETTERS

AVEA (The Aussies) in their June issue notes that Hong Kong's taxi fleet may be converted to electric drive if tests now being conducted on a conversion of the standard taxi, a Toyota Crown, is successful. A 5-year old vehicle was stripped of the ICE components and replaced with electric drive. Conversion cost amounts to 25-30% of the car's original cost. About 1000 cars could be converted. They also list seven firms capable of producing electric buses. Part two of the story about conversion of an car is described. (See June issue for Part 1) His solution to the 20g restraint requirements was met by securing each individual battery to the floor of the vehicle and building an airtight, power ventilated box around the assembly. His conversion uses an Advanced DC, 10.6 kW, 120-volt motor.

EVAOSC, (The Southern CA group) in their June issue had an intelligent analysis of errors in the Carnegie-Mellon study on lead emissions. An article reporting on the Mitsubishi hybrid also appeared. This car is based on the 3100 pound EXPO wagon. The hybrid version weighs 4586 lbs. The 336 volt drive system batteries are below the passenger compartment in the center of the car. Two AC induction motors, one in each front wheel have a maximum speed of 9600 rpm and deliver a maximum of 30 kW to each motor. auxiliary power unit (APU) can generate 20 kW.

In their June issue, the rave reviews of Impact test drivers were listed. GM built 30 cars for the demonstration and allowed 40 customers to use the car for 2-4 weeks. Vehicle operating costs were 1.44 cents per mile off-peak and 3.75 cents for the standard residential. Money for an EV test project for the South Coast district is being financed by a \$4 surcharge on automobile registrations. The California Air Resources Board (CARB) that mandated the 2% ZEV held a public hearing on consumer acceptance of EVs. Auto manufacturers, including Toyota, were pessimistic. Several EV owners presented optimistic assessments.

EEVC (The Eastern EV group) in their May newsletter published an account of Ray Carr's trip across the country in his 1912 Baker electric. He is scheduled to leave Astoria OR on May 28 and travel at an average speed of 18mph during the trip to Atlantic City, NJ. Several conversions that included a Fiero, Porsche, 1919 Detroit Electric, and an Escort were exhibited during Earth Day. A critique of the US General Accounting Office report: *Electric Vehicles, Likely Consequences of U.S. and Other Nations' Programs and Policies*. The report considers six barriers to widespread EV use: battery limitations, infrastructure, safety, uncertain market potential, and high initial price. Each topic is addressed by EEVC in the newsletter.

Electric Grand Prix Corp. (Rochester NY) reports in the July-Sept issue that UPS is testing the Ford ECOSTAR for its use. They also report that EV articles are appearing now with regularity in Road & Track Magazine. Details of their tests on several EVs are reported. Development of a new EV plug device by TransTechnology, 8800 Allen Road in Peoria, IL 61615-1584 is covered. The contact drop is less than 5 millivolts at 400 amps. Experience with testing of EVs in France is reported. Paris now has 50 recharging stations and expects to add 150 more by the end of this year. Editor Paul Heany made a two-day presentation at SCIENCE EXPLORATION DAYS. Your personal subscription to this informative newsletter costs \$8. Send it to Electric Grand Prix Corp, 6 Gateway Circle, Rochester, NY 14624-4415.

Future Drive, The Argonne Lab Publication second issue has articles on EV safety, a technical description of Solelectria's Sunrise, a pre-event account of Chrysler's hybrid car competition that was held this month, and a description of the University of Maryland's second hybrid vehicle entered in that event.

The Maine Sun Summer newsletter contains a detailed description of the 1995 Tour e Sol event. Under the title "The Lead Herring", Dr Richard Komp writes a critique of the Carnegie-Mellon study. It was noted the study was funded for the most part by contributions from BP American, Exxon Research and Engineering, Mobil R&D, and Shell Development. Ford Motor also provided funding. They also reported on the Main Solar Blast, a series of events in Portland Me following the "Tour". Included were an Autocross, the Electrathon, and the Junior Solar Sprint Finals.

The 1995 Michigan High School Electrathon Competition final issue reported on the event. Thirty six schools were initially involved and nineteen were able to pass the rigorous inspections to compete. The winning car completed 96 laps (30 miles) in 60:27. All this on a 12-volt Pentad powered car with a DieHard battery from the teacher's camper.

FROM OTHER EV NEWSLETTERS - continued

This is the final issue of the newsletter from Michigan. We salute Paul Zellar for his effective management of this event and wish him well as he now seeks other employment and relegates GLEA to hobby status. If you want a copy of the full-color booklet on the event, send \$ 15 to GLEA, PO Box 224 Sparta MI 49345.

NESEA (Northeast Sustainable Energy Association) in June released the results of the Tour de Sol. Four dozen vehicles, electrics, solar-powered, and hybrids drove the 300 mile course. The reference car was 1995 Geo Metro sedan that achieved 45 mpg, which when adjusted for losses involved in refining gasoline was reduced to and equivalent 35.8 mpg. Solectria's converted Geo Metro recorded the equivalent of 65.2 mpg. The pre-production Sunrise got a record 70.7 mpg. Top efficiency went to the Schiller Erange electric motorcycle with 245 mpg. This was the first time for a head-to-head competition between gasoline and electric powered cars. The complete results may be found elsewhere in this newsletter. The FVEAA Librarian has a Tour de Sol program for those interested.

SEVA (The Sacramento Organization) in their June newsletter published statements on flaws in the Carnegie-Mellon study. In the July issue an article on electric boats was featured. There was a Tech Tip appearing on the Internet on finding battery ground faults. You can access it at jeremy@electriciti.com on the EV Discussion List.

VEVA (The Vancouver Group) in their June newsletter reported on the Elelctrathon competition held June 4. The event challenges a single seat electric powered vehicle fitted with 64 pounds max of lead-acid batteries to go the maximum range in a one hour time limit. The Tour de Sol race results were printed together with interesting comments by the author, Michael H. Bianchi.

World Electric Transportation (Clarence Eller's newsletter) printed a complete summary of the final scores in the 1995 Hybrid Electric Vehicle Challenge. Categories and winners of each were:

Ford Escort Class - University of Alberta with a score of 847.98 (out of a possible 1200)

Chrysler Neon Class - University of Tennessee with a score of 968.41.

GM Saturn Class - California State University at Fresno with a score of 851.68.

Energy Economy results were:

Escort - Wayne State University with 26.94 mpg

Neon - Texas Tech University with 24.00 mpg

Saturn - Ecole de Technologie Superieure with 42.74 mpg

Also published were the standings on the fifth day of Sunrayce 95. Leading at this point was MIT with a total elapsed time of 8:35:03 with an average speed of 38.18 mph.

Events

August 7-10 - SAE Future Transportation Technology Conference at the Red Lion Hotel in Costa Mesa, CA. For info call the SAE at (412) 772-7178. Fax (776) 0210.

August 17 - Electricore Formula lightning Race in Indianapolis. Call Jim Hunnicutt at (317) 278-1673 for info.

November 13-15 - NESEA S/EV Symposium at Rhode Island Convention Center in Providence, RI. This is the 7th annual renewal of this event that features electric car development discussions, workshops, and exhibits. Over 1000 people are expected to attend. For information, call NESEA, 50 Miles Street, Greenfield MA 01301, phone (413) 774-6051, Fax (413) 774-6053.

NEDEA'S 1993 AMERICAN TOUR DE SPI

* see "notes to results"

PRODUCTION CATEGORY	DOE NESEA Standing ¹ Prizes ²	student Range Prizes ³ miles ⁴	Efficiency ⁵ Challenge ⁶ miles/kwh	Energy Challenge ⁷ Miles ⁸	Tour Total ⁹	VEHICLE # and NAME	TEAM NAME	TOWN, STATE	Description: Car type / Battery mtg / chemistry	
										175**a
2	C*	163**b	na	58.7*c	520	55	Ford Ecostar	Northeast Utilities	Hartford CT	Ford Ecostar van / ABB / Sodium Sulphur
3	B*	129	9.10**g	47.4	450	7	Nordic Challenger	EVERMONI/NAVAC	Waterbury VT	1984 Solectria Force / Sonnenschein / lead acid
4		129	8.16	57.6	439	50	Solectria/Horizon	Connecticut EV/NAVAC	Hartford CT	'95 Solectria Force / Electrosource Horizon / lead acid
5		102	8.05	42.3	415	51	'95 Solectria Force	CONN EV / Ethel Walker	Hartford CT	'95 Solectria Force / Interstate / wet lead acid
6	D*	111	4.62	23.5	390	62	Solectria E-10	NAVAC / BECO / Hanscom AFB	Boston MA	1994 Chevy S-10 / GNB / lead acid
7	F*	75	na	242.7	366	90	ZAP Powered Rotator	ZAP Rotator Racing	Forestville CA	Electrified mountain bike
8	E*	75	2.34**k	na	170	54	US Electric Shuttle	New England Power Service	Westboro MA	U.S. Electricar Bus / lead acid
DISCOVERY CHANNEL COMPUTER CATEGORY										
1	G*	238**c	9.30**n	70.7**b	587	63	Solectria Sunrise	Boston Edison / NAVAC	Boston MA	Pre-production prototype / Ovonic / Nickel Metal Hydride
2	H*	143**d	5.59**p	63	481	61	Solar Bolt	Bolton High School	Bolton CT	1974 Fiat sedan / Trojan / lead acid
3	I*	105	4.00**q	44.0	384	66	Genesis I	Genesis Team	Saginaw MI	Dodge D-50 pick-up / Trojan / lead acid
4		89	3.73	45.8	358	64	Kineticar II	CSERT-NVCTC	Waterbury CT	Chevy S-10 pick-up / Trojan / lead acid
5		104	5.92	43.5	353	78	Softx Sedan	Softx Design	Nagoya 464 Japan	Nissan / Yuasa / Nickel Zinc
6		97	4.33	41.9	344	81	Sparky	Wooster's Charge	Danbury CT	Saab sedan / Trojan / lead acid
7		97	3.41	29.3	337	80	Millenium Falcon	Bare Sky Club	Greenwich CT	VW sedan / Trojan / lead acid
8		76	3.73	na	315	74	Lightning Volt	Parkland HSL/High Co VTS	Orefield PA	Chevy S-10 truck / Trojan / lead acid
9		91	4.66	39.1	311	70	SUN-BUNNY	Fall Mountain TDS Team	Alstead NH	VW Rabbit / Trojan / lead acid
10		73	9.58	37.6	295	72	Sungo	NHTI Solar Car Team	Concord NH	Purpose-built 2-seater / Sears / lead acid
11		81	2.23	21.1	294	80	Brock Electruck	Thousand Islands Sec. School	Brockville, Ontario CAN	GMC truck / lead acid
12		73	4.99	na	258	53	Elfa Electra (Skoda) EV	Elfa Electra Automotive	Jamestown NY	Elfa converted Skoda Favorit van / Crown / lead acid
13		97	3.95	43	240	76	RHAM Rod	RHAM Science & Tech	Hebron CT	1985 Nissan Pulsar / Trojan / lead acid
14		81	4.06	na	221**h	60	Fulmine	Angelo Esposito	Staten Island NY	conversion / DeKa Dominator / lead acid
15		81	5.53	31.8	208	65	Electric Hare	Falmouth Waitsmen	Falmouth ME	VW Rabbit / US Battery / lead acid
16		63	na	32.2	134	71	S-15 Truck	Minuteman Science-Technology	Lexington MA	Chevy S-15 truck / Trojan / lead acid
17		69	5.55	73.4	65	75	KA1000	Polytech Chargers	Farmingdale NY	Hatch back / Trojan / lead acid
18		51	5.76	na	-121	67	ZeeVee88	GLEAA & GLEAN	Westerville OH	Purpose-built (EV Motor Sports) / lead acid
19		59	4.69	na	-336	73	Electric Fiero	Orr Electric Racing Team	Cincinnati OH	Fiero / GNB / lead acid
20		59	9.26	na	-339	79	1959 Berkeley	Team New England	Nahant MA	1958 Berkeley roadster / lead acid
21		na	na	na	-480	82	Gray Ghost	Yankee Ingenuity	Marlborough CT	1929 Mercedes replica / GNB / lead acid
22		na	na	na	-485	88	Solar Flair I	Greenwich Solar Flair	Greenwich CT	VW Rabbit / Trojan / lead acid

MORE OVER

THE COOP PROJECT

Comments from Bob Munroe- Project Manager

I was encouraged with the members response in seeking a suitable car for the project. There are several members who found possible sources. Member Ray Oviyach has been authorized to inspect and buy a car he deems suitable and meets our guidelines.

When a car is located, the Project will get underway. I ask members who were waiting for a proceed decision by the members before adding their support to buy a participation share. Send your contribution to Treasurer Corel.

We have many members that have a strong interest in getting a first-hand look at what is involved in a conversion. This is their opportunity to get hands-on experience with guidance from members who have gone through the process.

The club has yet to decide what will be the disposition of the completed car. There are two alternatives at the moment:

1. Sell the car to a FVEAA member and return participation share funds advanced.
2. Raise the annual dues in November from \$15 to \$ 20 and hold a drawing to award the car to a FVEAA member.

Bob

TechniCorner: Upgrading voltage for more performance

This is Part II of Ken Koch's remarks. Ken is owner of KTA Services, a supplier of EV components in Upland, CA. It was published in an EVAOSC newsletter. Part I appeared in the FVEAA June issue.

Last month's TechniCorner indicated that the Curtis-PMC 1221 B motor controller eventually would be replaced by the 1221C. This has come to pass." The 1221B is no longer manufactured, and now we'd like to expand on using the new, more powerful 1231C-8601 controller to upgrade your Ev's performance.

Five to seven years ago, the average EV had a Prestolite or GE 20hp (1-hour thermal rating) series motor, a Curtis or Russco or GE motor controller, and a 96-volt battery pack made up of 16 golf cart batteries. Chargers were either Lester or home-brew. Typical performance would be a top speed of 65 mph, 0-50 acceleration in 18-20 seconds, and a 35-50 mile maximum range.

Just 3-4 years ago, the average on-road EV had either a 7 or 9-inch Advanced DC motor, a Curtis 1221B-7401 controller, and a K&W BC-20 charger. The battery was 108 volts, made up of 18 golf cart batteries. The top speed was 75mph, acceleration remained at 18-20 seconds, and the working range was 40-60 miles. Overall performance seemed to range from "not bad" to "OK for most folks", although one could sense that EVers preferred to have more.

A year or two ago most EVs were being built with the larger 9-inch motor. The 1221B was still the controller of choice, while the K&W BC-20 charger with a LB-20 booster was in widespread use. Battery packs were up to 120 volts. Heavier-duty vehicles, (pickup truck conversions) were the only ones capable of carrying 20 batteries (1200 lbs); others used ten 12-volt batteries (Trojan 5SHP or U.S. Battery 1450 weighing 850 pounds. Top speed was now up to 80 mph, but range and acceleration depended on battery performance. Performance? Somewhere between "so-so" and "are you sure that's all?"

The trend is clear: People building newer Evs expected better "performance" while some of the older Evs were being upgraded in terms of more batteries or bigger motors. Of course, the lead-acid batteries didn't gain anything in energy density so a better top speed or quicker acceleration always meant reducing range if driven to peak capacity. Since 65-75 mph top speed is plenty for most drivers, one can only conclude that the insatiable desire for more "performance" mainly meant better acceleration.

Acceleration is affected by the weight of the vehicle and the torque developed by the motor. Motor torque is proportional to motor current while motor speed is proportional to motor voltage. In other words, acceleration can be improved primarily by lightning the vehicle and/or developing more motor torque through a higher-current controller. Increasing voltage can increase acceleration, but only with no added weight.

TechniCorner - continued

The Upgrade

Thanks to the newly available 1231C controller, higher motor current and higher battery pack voltages are now possible. The 1231C is rated at 96-144 volts and 500 amps current limit. If a vehicle already has a 9-inch motor, its in a perfect position for an upgrade because this unit is rated up to 144 volts. Upgrading from a 1221B rated at 400 amps increases the maximum torque from 86 to 113 ft-lbs, a gain of 31%.

While the Advanced 8-inch motor is rated only to 120 volts, it can be used at 144 - **but with caution**. Since the 8-inch has the highest RPM-per volt characteristic, it runs the highest risk of overspeed if unloaded. It should never be used above 120 volts without a speed-limiting device such as the K&W TD-100 Tach Drive/Rev Limiter. Upgrading from 400-500 amps increases the 8-inch motor's maximum torque from 64 to 85 ft lbs, a 33% increase.

What about the 144-volt battery pack? Six volt units would be a crushing 1560 lbs. Adding two units to a 12-volt pack holds some promise, if there is room. But the slickest 144-volt upgrade is made possible by Trojan's new T-875 battery that is rated at 8-volts, 165 amp-hrs at the 20 hour rate, weighs 63 lbs, and is in a GC-2 case, exactly the same size as 6-volt units.

Eighteen 8-volt batteries provide 144 volts, the number of units usually found in existing EVs. No modification of the battery trays is necessary. An EV with 20 batteries can downsize to 18 to shed some weight. Those with 16 units can usually upsize with only minor modifications.

Performance Results

Top speed will increase to 90 mph with a 144-volt upgrade. Going 0-50 will drop to 13-15 seconds.

But what about range? Replacing 18 Trojan T-105 units with T-875s will produce about the same range. Energy density for T-875 is 30.75 wathours per pound. U.S. Battery 2200 is 31.4, not significantly different.

To illustrate further, a typical 108-volt car requires about 125 amps @ 108 volts, or 13.5 kW to sustain 55 mph on level ground. At 144 volts, 94 amps is required for a 13.5 kW power level. When examining the discharge curves of each battery type, we see that

T105s can sustain 125 amps for 60 minutes; the T875 can sustain 94 amps for 55 minutes. At a steady 55 mph, range would be reduced by 4, from 55 to 51 miles, with the 8-volt units, hardly significant.

Battery Charging

What about charging the batteries? The reliable K&W BC-20 with its programmability feature has enjoyed wide popularity (More than 500 are in use, some with the LB-20 booster. The BC-20 is usable up to 144 volts with a new booster transformer and programming resistor. The new booster carries a LB120/144 designation. It has about twice the power rating of the LB-20. Thus, from a 120-volt AC line rated at 15, 20, or 30 amps, charging currents of 8, 10 or 15 amps DC is available to charge a 144-volt pack. A 30-amp branch circuit is the standard electric clothes dryer outlet. Minimum wire gage is # 10.

A big thanks is due to Trojan for making the T-875 unit available to conversion hobbyists. It isn't available, however, to golf cart manufacturers other than Club Car, for whom it was originally designed. Price per battery is about \$ 90 from Wil-Power, F.O.B. its warehouse after the end of May this year. You can also check with a local Trojan distributor. Other upgrade components are available from KTA.

Testing the Ford Ecostar Van

President Woods received a call from ComEd indicating their willingness to assign one of their ECOSTAR vans to the FVEAA for a limited test period of about 10 days. Ken plans to give first preference to members who already have an EV so the van can be compared with their car.

Our original proposal to ComEd planned each assignment would last 3-4 days to allow a reasonable evaluation time. Ken is negotiating to add more assignment periods around the ComEd schedule for car use already planned.

The testing schedule and program may be a discussion item during the July meeting.

