Electric Auto Association NEWS

JUNE 1986 VOL. XVIII NO. 6

LAST CHANCE

NOW IS THE TIME!! WE MUST MAKE ARRANGEMENTS!! WE MUST KNOW WHO IS COMING NOW! NOW! CONTACT CLARENCE AT (408)248-2588 NOW!! WE HAVE 10 CARS SEMI-CONFIRMED FROM THE BAY AREA A TOTAL OF 20 USA. 8 VEHICLES FOR OUR CONVOY 4 GAS & 4 ELECTRIC. A FANTASTIC VACATION AND GREAT EV EXPERIENCE AWAITS, GO FOR IT.

Aug. 7: CONVOY OF TOWED & DRIVEN VEHICLES LEAVE FROM BAY AREA
Aug. 9: Cars to be trucked delivered to Fremont on or before
Aug.11: EAA INTERNATIONAL RALLY UNIV. WESTERN WASHINGTON
Aug.12: BC HYDRO RESEARCH CENTER
Aug.13: EVAC Rally Surrey to Skytrain
Aug.14: RALLY TO EXPO
Aug.15-16 & 17 EXPO Pacific Bowl

THE FIRST NORTH BAY CHAPTER RALLY

NOVATO

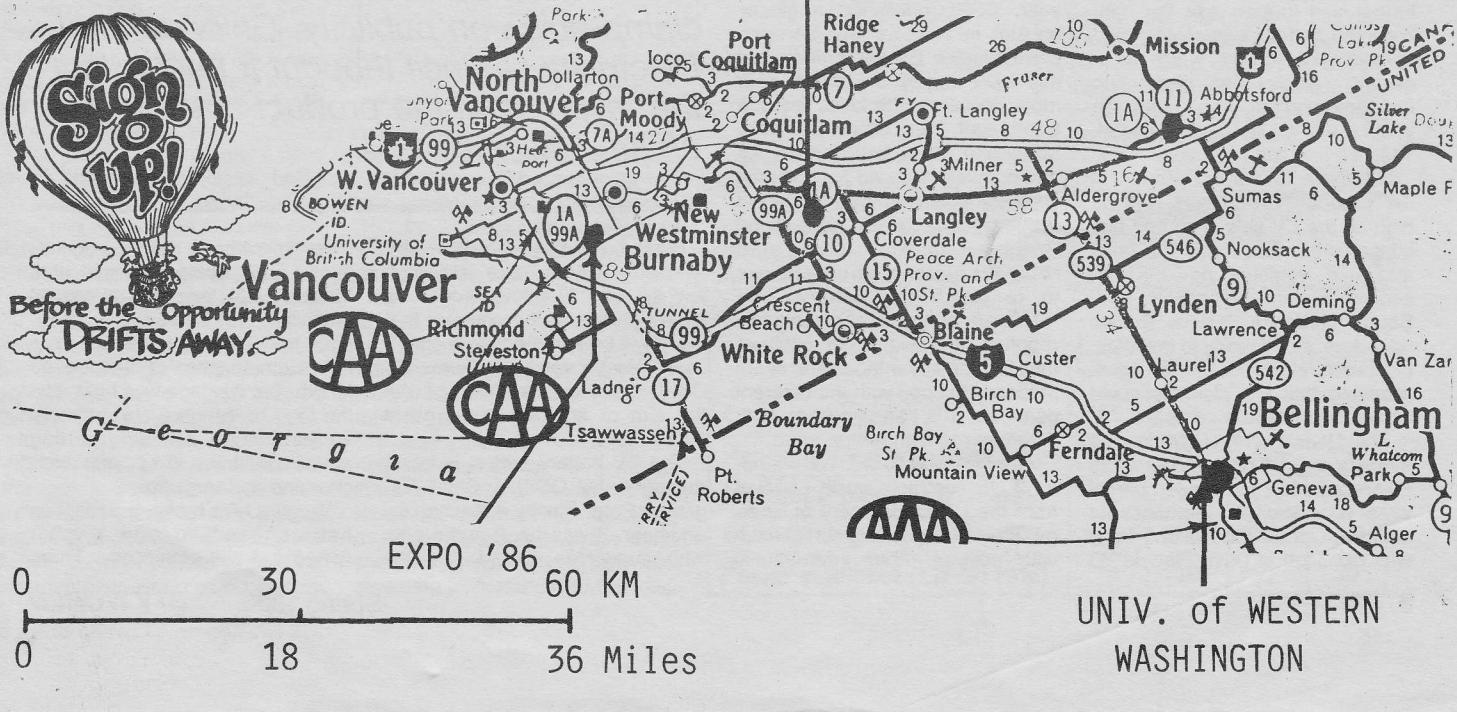
Date: June 21 Saturday
Place: South end of Novato Fair Shopping Center, deLong Ave. (West side of US 101) Novato
Time: 8-9:15am driver check in 9:30 morning run Noon-1:00 lunch
1-3:30pm afternoon rally run

Routes:
1. Innercity: 3 Miles per lap, 30mph max
2. Interurban: 6.5 miles per lap 45mph max
3. Freeway: 9.25 miles per lap with a 2.75 mile stretch of freeway.

No entrance fee.
Awards for each route.
Generous minimum and maximum times for each lap.
INFO: Mike Callahan (707)584-5909
John Williams (415)383-0745

GO FOR IT!!

INTERNATIONAL ELECTRIC car rally



Don Gribble, EVA Director, recently visited Chloride Silent Power's Runcorn base and now emphatically reports –

Yes – the sodium-sulphur battery is coming!

Suddenly it's summer for sodium-sulphur. The battery which for 15 years has held out the promise to revolutionise electric vehicle performance is on the move again. Ten years of heart-ache and five years of virtual news blackout have ended with a decision, not to ditch the project, but to move towards the marketplace. The 3 sponsors, Chloride, Electricity Council and the UK Department of Trade and Industry are visibly pleased.

And you do not need to be misled by recent talk of it being used primarily for peak-lopping at power stations. The British sponsors still see the biggest market as very much being for electric vehicles and electric industrial trucks.

Fourteen years ago I was privileged to drive a Bedford van powered by the world's first practical sodium-sulphur battery. It had been constructed at the Electricity Council's Capenhurst Research Centre. The team there was led by Dr Wynn Jones who is now the General Manager of Chloride Silent Power Limited (CSPL).

10 years away

That same van was also driven by the Minister of Transport, Ernie Marples, who was destined to become President of the Electric Vehicle Association for several years until he cycled over to France to look after his vineyards. He thus relinquished the Presidency long before the battery became a commercial reality. Indeed, as the 1970's rolled past, prospects for the wonder battery retreated further and further over the horizon. The battery was always said to be '10 years away', which led to electric vehicle men concluding that any product which was ten years away would never succeed. Talk like this can now stop.

In the late 1970's, enthusiasm in the Chloride Group was running high on the EV side. Van and bus consortiums were formed to build and use vehicles powered by sodium-sulphur. Manchester and South Yorkshire PTE's, 2 bus operators, stood ready to test electric buses alongside diesel ones, believing that the electrics could win on cost per mile comparisons.

The Department of Trade and Industry gave Chloride Technical £0.5m to build 2 high-speed parcel vans specifically to demonstrate sodium-sulphur. One of the vans was exhibited at Drive Electric '80 at Wembley, but it was relegated to spend its life whistling around Wynne Avenue in Manchester as a test bed for advanced lead acid batteries. At that time it was no good whistling for sodium-sulphur. It had hit a bout of intractable problems.

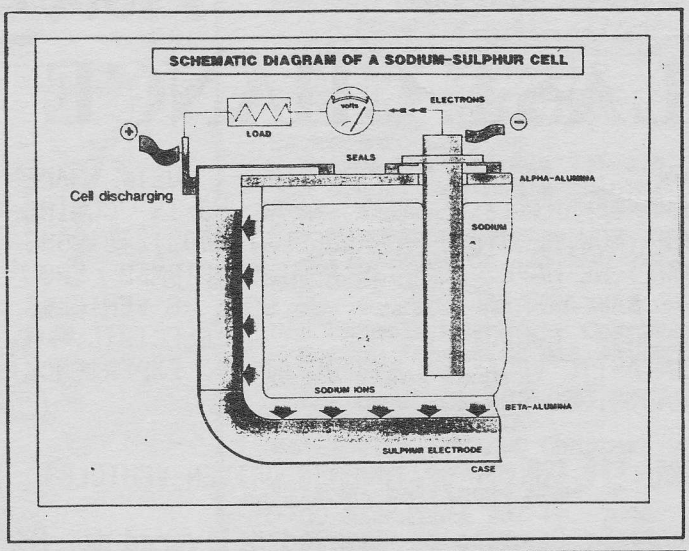
Since then, there has been a self-imposed clamp-down on publicity. Chloride and Electricity Council thought it best to cut the 'hype' until the product could shake off its difficulties.

That time has now come, and the prospects look most promising. CSPL will be cooperating with Lucas Chloride EV Systems to demonstrate a workable battery on an electric Bedford van in early 1987. Dr Wynn Jones is predicting that commercial production should follow in 4 or 5 years time with manufacturers and fleet users gradually being involved in field trials.

Industry view

A recent interview with staff of CSPL made it clear that the difficult technical problems have mostly been solved. In October last year, CSPL published a glossy booklet in time for the Sorrento Drive Electric EV conference, but this went largely unnoticed. At a more down-to-earth level, 2 of the CSPL staff, Peter Bindin and Mike McNamee have produced an AV presentation intended for potential customers and they have started systematically taking this round British industrial truck, and road vehicle manufacturers to re-launch the battery. The response of those companies is reported to have been positive: they like the advantages and seem prepared to cope with the different demands of a battery whose core is running at high temperature.

As to finance, CSPL have landed 2 US contracts worth £10.9 m from the US Department of Energy. These were won in competition with several other international companies like Ford Aerospace who are also developing sodium-sulphur batteries, thus reinforcing the statement that CSPL are leading the world.



▲ *How a sodium-sulphur cell works.*

Part of this American money is directed towards building a huge demonstration sodium-sulphur battery for peak-lopping. It will have an output measured in megawatts and the battery will be the size of a house.

". . . There has been a self-imposed clamp-down on publicity. Chloride and Electricity Council thought it best to cut the 'hype' until the product could shake off its difficulties . . ."

But the rest of the money will be directed towards 'core' research and it is openly acknowledged by all the parties to the contract that much will be spent on the technology of electric vehicle batteries. So CSPL are busy interviewing, with the aim of doubling the present staff.

The EV battery project is being managed by CSPL's Chief Engineer, Peter Bindin, a mechanical engineer. It was he, 3 years ago, who suddenly realised that the design philosophy of building bigger and bigger cells was creating more problems than it was solving.

At that time it was the cell seal and the problem of preventing cracks from developing in the beta alumina tubes inside the cells which were giving most trouble. Not only were the seals bulky, but they were expensive to a point which led to the philosophy that the larger the cells, the fewer seals there would be to spoil the economics. Cell designs grew until 800mm total length was proved practical. CSPL creditably managed to find a way to manufacture beta alumina tubes of the required length. But wastage was high, and the long tubes were always more vulnerable to cracking during abuse conditions, like severe overcharging and freezing.

When a tube broke, the reaction between sodium and sulphur ruined the cell electrically. There

were fears of putting such batteries in the hands of ordinary mortals who might poke the forks of a lift truck through a battery.

Things haven't changed. At least, not in the sense that CSPL know that someone, somewhere will undoubtedly still push a metal bar through a battery or will crumple it flat in a crash. But CSPL no longer fear for the consequences. Their tests on the 1986 vintage of cell show that damage is localised and containable. They believe that no chain reaction between cells will occur. The philosopy now is to let broken cells go out of circuit and make no attempt to replace them during the life of the battery.

Small is beautiful

What has wrought this change?

It came from Peter Bindin's realisation that 'small is beautiful'. This in turn was made possible by the discovery of cheap container materials and a cheap, reliable seal which works well on small cells.

The new electric vehicle cell is small and lends itself to mass production. It is slightly larger in size than a U2 torch battery and has been labelled the PB cell after its designer. The PB cell is 45mm in diameter, is 45mm tall over the centre electrode, weighs 100 grams and holds 20Wh of rechargeable energy. Energy density is therefore 200Wh/kg (at the 3-hour rate) which is 5-6 times better than most advanced lead-acid batteries used on vehicles today.

At the time of our interview, cells had performed without failure for 800 continuous charge/discharge cycles based on a 3-hour discharge followed by a 5-hour recharge. Larger cells based on similar materials have apparently survived 2 500 cycles, and Peter Bindin is confident that the eventual failure pattern of the small cells which are much more robust will lie between 3 000 and 5 000 deep discharge cycles.

For years, EV promoters have joked about their vehicles being driven by hundreds of U2 batteries. They will now have to live with that joke because a vehicle like the 1-tonne Bedford will be powered by literally thousands of the small PB cells. This could bring with it reliability problems: there are more bits to go wrong. However, CSPL solved this by a most elegant concept for connecting them up.

It all depends on making PB cells up into strings. At present the unit string contains 4 cells in series, but Peter Bindin envisages that it might one day be reduced to 3. The concept stands or falls on what happens when cells begin to fail in those strings, and more will be said about this later.

Vehicles and trucks

Each string of 4 cells is therefore rated at 8 Volts and the Wh capacity equates to 10Ah. Strings are connected into banks of 30 or more in parallel giving a capacity for each bank of 8V and 300Ah. This is now recognisable as similar to a standard lead-acid traction building block. For a fork lift truck, 9 blocks might be connected in series to give 72V 300Ah, whilst for a road vehicle 27 blocks might be connected to give 216V 300Ah.

At a conference on materials handling being held alongside the IHSE this March, Mike McNamee of CSPL will be presenting a paper in which he outlines a sodium-sulphur battery for an AGV. It is rated at 24V 500Ah, achieved with 600 PB cells. The cells are each connected in strings of 4 and there are 50 parallel strings. Such a battery would be made up into one stainless steel box measuring 350 by 375mm with a height of 600mm. The complete weight is estimated at 100kg, giving a useable energy density of 120Wh/kg at the 3-hour rate. It therefore stores 4 times the energy of a traction monobloc for the same weight and does so in one-third of the volume.

Similar calculations can be carried out on batteries for a vehicle like the Bedford CF. Indeed, Peter Bindin did so for a most absorbing paper he presented to the Intersociety Energy Conversion Engineering Conference in Miami last August. Copies of this are available from EVA on request.

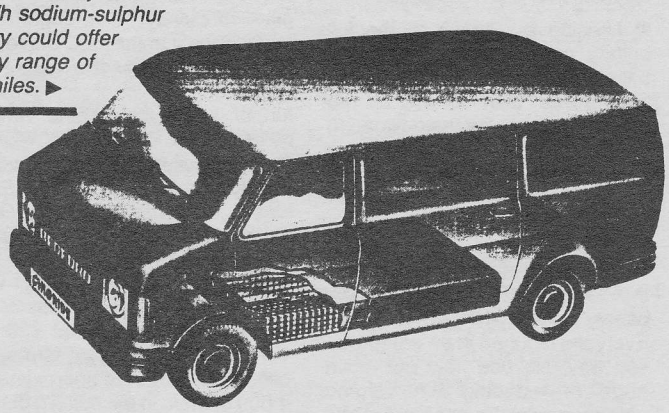
He set out to see how much energy could be stored in the present lead-acid battery compartment of the Bedford and concluded that it could be raised from 40kWh to 85kWh by building 4 battery units each containing 1 000 cells. There would be 40 parallel strings. The performance this would give the Bedford is summarised in the table reproduced from his paper. It also examines 2 other possible battery configurations. The first is designed to equal the lead-acid battery but at a much lower weight. The second is an intermediate battery storing 60kWh.

You can see from the table that the sodium-sulphur battery transforms the capabilities of the van.

- If a 40kWh battery is fitted, it saves three-quarters of the battery weight. So, with 1-tonne payload, the range is increased from 50 to 70 miles per charge. Alternatively, the payload may be increased from 1.0 to 1.9 tonnes still retaining the same 50 mile range.

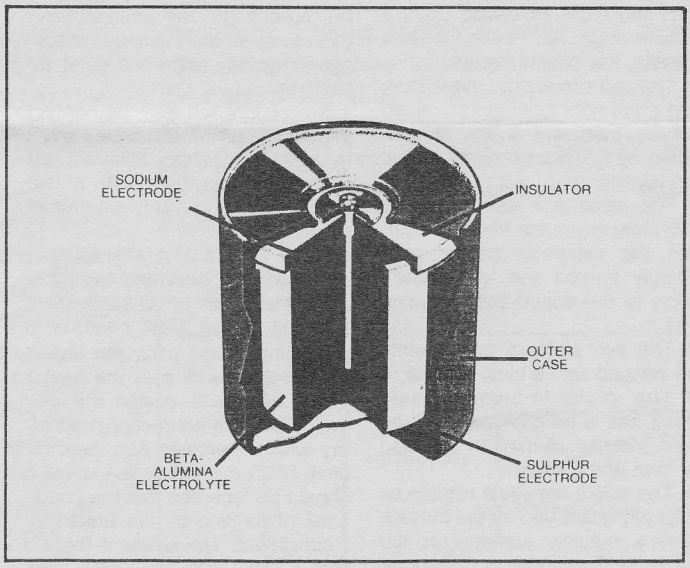
Continued on page 10

A Bedford 1-tonne van powered by an 85kWh sodium-sulphur battery could offer a daily range of 150 miles. ▶



". . . For years, EV promoters have joked about vehicles being driven by hundreds of U2 batteries. They will now have to live with that joke because a vehicle like the 1-tonne Bedford will be powered by thousands of small cells . . ."

A sodium-sulphur cell, packaged neatly in an outer case of mild steel. ▼



The table shows expected sodium-sulphur vehicle performance ▼

	Lead acid	Sodium-Sulphur		
Battery energy (kWh)	40	40	60	85
Range (miles) with 1t payload	52	70	105	150
Maximum payload (tonnes)	1.0	1.9	1.8	1.7
Battery weight (kg)	1250	330	424	580
Power available (kW-2h rate)	19	19	27	39

Continued from page 9

● Utilising the space of the full battery compartment, an 85kWh battery triples the daily range to 150 miles with a 1.0 tonne payload, or enables the payload to be increased to 1.7 tonnes for the same GVW. By any standards, those improvements are major ones.

Harking back to those days in 1972 when Ernie Marples drove the Electricity Council van, the battery took up all the cargo space. Everyone laughed in an embarrassed way. No one held out much hope of reducing the volume efficiency, only the energy density. So when logical minds said that the whole point of developing sodium-sulphur would be to put more fuel (kWh) on board, it seemed that a pantechnicon would be needed to accommodate the battery.

But the PB cell design enables the battery to be extremely compact.

Price

Those same logical minds asked what would happen about price. What would the bigger battery cost? If it could only be sold at the same price per kWh installed capacity as lead-acid traction, the cost of a bigger installed battery could be a killer.

Today the Bedford CF is fitted with an advanced lead-acid battery costing about £3 500 or £85 per kWh. The list price of full traction cells is now about £125 per kWh so claims that sodium-sulphur will be offered at lead-acid traction prices need scrutiny.

Dr Wynn Jones says that market pricing depends on the attitude adopted by whichever battery company takes on a licence. If it thinks in terms of mature mass production, then his vision and hope is that it can be sold for £35 per kWh of installed capacity, and be thoroughly profitable at that.

Doing your sums on this projection leads to some very interesting figures. At £35 per kWh:

● An 85kWh battery capable of driving the Bedford for 150 miles per charge would cost £2 975

● If it conservatively lasted 1 250 cycles over 5 years, averaging 80 miles per charge, the battery would last for 100 000 miles and cost 3p per mile

● If energy consumption were to remain at below 1.0kWh per mile (which is readily achieved with lead-acid) the electricity might typically add 3p per mile

● The combined cost of 6p per mile for battery and electricity would then be equivalent to 30 miles per gallon at £1.80 per gallon. This would enable electrics to hold their own against all the ongoing improvements in i.c. engine efficiency, a thought that might appeal to the EEC and other Government agencies who are wondering whether to provide further funds for electric vehicle development

● A 6p per mile fuel cost would enable vehicle promoters like Bedford to demonstrate a very clear reason for buying electric vans.

Whilst it is easy to slip into calculations like this and get very excited about the prospects, it should be realised what £35 per kWh means as a target for the PB cell. Since there are approximately 4 000 of them in the 85kWh battery costing £2 975, it can be deduced that each would have to be manufactured for about 50p, leaving 25p for connectors and packaging. This is an ambitious target, and it will depend very much on how much the manufacturing is sold for and what sort of marketing margin the manufacturer will expect.

What grounds are there for optimism on cell prices? In the end it comes down to the cost of materials.

Along the development trail, exotic materials were proposed for cans and seals. However, CSPL's breakthrough has been to find suitable, low-cost materials.

● The cell can is now made from mild steel with a chromium-based surface treatment which is described by CSPL as proprietary but inexpensive

● The separator tube and top seal plate are made from alumina, with the separator (rather confusingly termed the 'electrolyte') being of the doped beta alumina type

● The two alumina components are bonded with a simple glass

● The metal-to-alumina seal which has to be gas-tight is made from metallic aluminium, bonded by heat and pressure

● The active materials remain as originally conceived for the battery, namely metallic sodium on the inside and sulphur in the outer cylindrical space. Both of these cost only about £100 when bought in bulk

● The protective atmosphere inside the cells is industrial argon.

Heat management

An equally important area which adds to the cost is the heat management system. The battery packs being proposed by CSPL for fork lift trucks and road vehicles envisage the strings of cells being tight-packed with corrugated spacers. Above and below the cells are heat conducting plates of aluminium to conduct heat. These have 4 functions:

● To even out temperature variations during normal running

● To act as a heat-sink when a cell fails

● To provide a path for injection of heat into a battery to raise the cells from ambient to 350°C

● To allow heat to be removed to keep it within working limits of 270-410°C.

A black box

The whole pack of cells and plates is encased in a Thermos-type container. This is made from double-skin stainless steel with glass-fibre boarding in between. The cavity is evacuated and sealed. Any heating or cooling pipes and the electrical connections have to be brought out through the container walls. But once manufactured, CSPL envisage the battery as a black box with terminals which never needs topping up or maintenance.

CSPL are confident that this type of container does not provide any major technical problem only one which needs sound engineering development. Undoubtedly, though, this is one reason why sodium-sulphur batteries cannot be hurried to the marketplace. Field trials on the thermal management system will take time to perform.

Investment will also be needed in cell production techniques and it is unlikely that any licensee will miss the opportunity to mass-produce cells on highly automated machinery.

CSPL have a pilot plant capable of making PB cells and expect to have their own small-scale plant installed during 1987 capable of producing 1 000 cells per week. Part of their work over the next 2 years will be to design the elements of mass-production machinery which licensees can then exploit. (With this talk of licensees, it should be recorded that the conditions of funding by the Electricity Council and Government means that CSPL can only offer non-exclusive licences. Although it is highly likely that Chloride Group will set up a company to be the first licensee, it should be possible for other intending battery manufacturers to obtain a licence).

To understand and appraise the technology further means asking a lot of technical questions. In the short time available, EVA threw as many as possible at Peter Bindin and his replies are summarised on page 14.

Once you have got to grips with these technicalities, it makes sense to ask how the truck and vehicle customers have reacted to date about what they have been told. Peter Bindin summarises their comments as follows:

● They liked the prospect of a truly maintenance-free battery

● They liked the high electrical recharge efficiencies which are much superior to lead-acid

● They understood and applauded the philosophy of the new small cell and using it in a series/parallel array

● They were suprised to learn that the battery container would only run 5 degrees or so above ambient and that the battery would work with equal efficiency in cold stores or on the equator

● Based on what CSPL claimed, they stopped having worries about safety

● They welcomed the prospect of recharging safely in 5 hours or less

● They thought it would not be impossible to market a battery which needed regular daily use to keep it hot, and they accepted the assurance given by CSPL that the small cells could withstand being frozen over several hours at least 20 times and thawed out in 20 minutes without loss of performance

● They were all very excited by the enormous storage capacity and thought it would create new markets for electric vehicles.

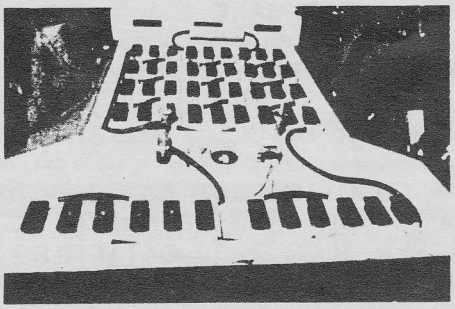
Peter Bindin says that a really big plus of sodium-sulphur is that the discharge voltage remains flat during the first 75% of the discharge. If this is so, the writer would like to make his own observation. It is this. Not only does sodium-sulphur promise to treble daily range, but the performance will not drop off. For the first time in history, a practical battery will behave like a fuel tank. This will have a tremendous impact on customers and drivers, since they will not be aware of any falling off in performance until the last few miles of daily service.

Tremendous strides

EVA concludes by congratulating Dr Wynn Jones, Peter Bindin and the other dedicated workers at CSPL for making such tremendous strides during the last couple of years.

Without wishing to hurry things along, we earnestly hope that intending licensees will be allowed to evaluate the progress at the earliest possible opportunity. Some of them have a great knowledge of mass-production machinery and it might help to have them in on the act as soon as possible.

With oil prices slumping, the survival and future of the traditional electric vehicle market is exciting, but uncertain. With sodium-sulphur, the whole future of the industry is transformed. Please Sir Michael (of Chloride) and Philip Jones (of the Electricity Council), make things happen as quickly as you can.



This battery compartment in a modified Volkswagen Rabbit holds 13 batteries. Future batteries will provide more energy per unit of volume, allowing a decrease in the size of the compartment for short-range vehicles.

EV Research

There has been considerable government and private EV research, development, and demonstration over the past several years. The most extensive program is the one established by the Department of Energy (DOE) in response to the Electric and Hybrid Vehicle Research and Development Act of 1976.

The DOE program originally authorized $160 million for a number of projects designed to strike a balance between early commercialization of near-term EV technology and long-term development and utilization of advanced designs and technology. In the past, DOE has supported such projects as demonstrations of state-of-the-art vehicles and components, and development of advanced-design vehicles and advanced battery systems. However, current DOE plans call for an emphasis on advanced components and vehicles, such as the hybrid (combination electric- and gasoline-powered) vehicle.

The U.S. Postal Service is running a test program to assess EVs in mail delivery service. Seven hundred EVs are in use and plans are to have 3,000 to 5,000 in service by 1990.

General Motors Corporation is conducting an electric van development and production program and has established an Electric Passenger Car Project Center that may market a small battery-powered car in the late 1980s. Gulf+Western Industries is developing a high-performance, long-range, extended-cycle-life zinc-chloride energy storage system; limited production of this "electric engine" for use in delivery vans is scheduled for 1983.

General Electric is building a prototype of a hybrid car that is designed to use gasoline on the highway, electricity in town, and combined electricity and gasoline for quick starts and climbing hills.

Extensive research is also under way in Great Britain, Japan, and West Germany. Thousands of battery-powered trucks are in routine use in Britain, and major Japanese firms are cooperating to develop a cost-effective electric passenger car.

Research by EPRI

The Electric Power Research Institute (EPRI) is working to advance research and development of electric transportation in accordance with a strategy established in 1979. In particular, EPRI wants to ensure that plans for the development and public use of EVs take into account the needs and capabilities of the electric utilities.

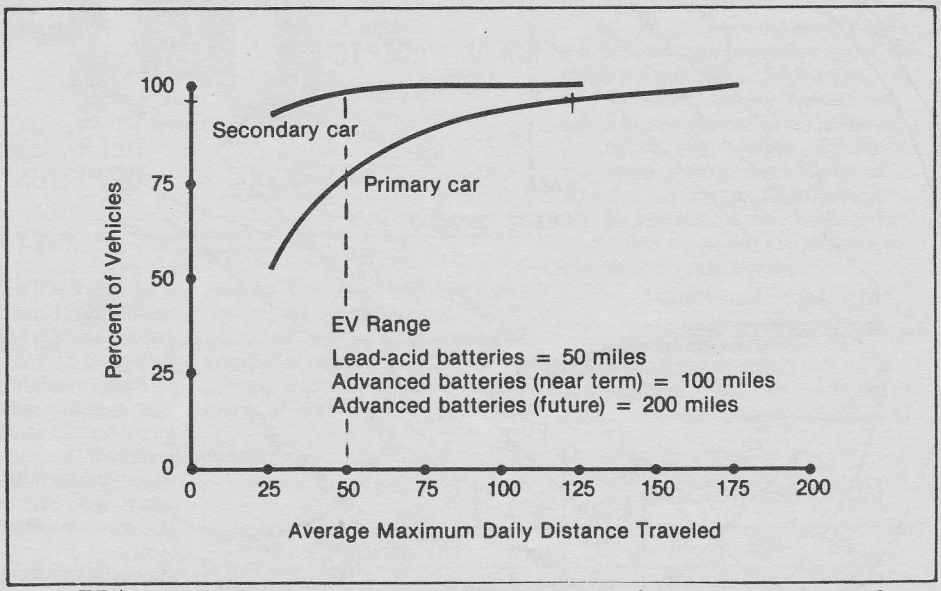
Because there is a direct interface between the utility and the EV at the EV charger, the effect of widespread use of EVs on electric power generation, transmission, and distribution must be considered. Utilities and EV manufacturers must cooperate to ensure that EV systems and utility-distributed power are compatible and that proposed recharging systems make maximum use of idle generating capacity during off-peak hours.

EPRI's research plan defines three principal areas: (1) vehicle testing and evaluation, (2) EV component evaluation and improvement, and (3) assessment of EV impacts and introduction of EVs by utilities.

An EPRI electric vehicle field testing project is being conducted by the Tennessee Valley Authority at its EV test facility in Chattanooga, Tennessee. Ten Volkswagen Transporters are being tested: five as delivery vehicles and five as passenger vans. These field evaluations include testing (on the Transporters) of improved battery systems. A variety of other EVs will also be tested, including electric conversions of the VW pickup and the Ford Escort.

EPRI's component evaluation and improvement program includes laboratory testing of improved lead-acid batteries and testing and development of EV battery chargers as well as other equipment that interfaces with utility power systems. EPRI is also working with utilities to develop the analytic tools that will help delineate the role of the utilities as EV energy suppliers. For example, a computer-based model is available to utilities for forecasting the EV-related electricity load and for planning generating capacity.

Finally, about 100 electric utilities have bought or plan to buy EVs. EPRI assists these utilities by establishing



About 75% of the primary vehicles travel less than 50 miles a day. Essentially 100% of the secondary vehicles travel less than 50 miles per day. Note that for converted cars the motor weight removed is equivalent to the battery weight added for 50 mile range.
Above 50 mile required range one must add 8.6# of lead acid battery for each mile required or 864# if range needed is 150 miles.

sodium-sulphur

Dr. Charles Levine, a consultant for Dow Chemical Co. told the East Bay Chapter about the potentials of the Na S (Sodium Sulphur) batteries now being produced. The expected life is ten years, but there is no way short of actual testing to prove this, like an elevated temperature test. the external battery compartment will be only slightly higher than ambient. The internal temperature of the battery is 300° C. (Approx. 600° F)
This battery provides 124 Watt-Hr./Kg. and will cost you $100/KW. Hr. the overall efficiency is 90% as the result of extremely low internal resistance. Ideal for electric vehicles.
Dr. Levine explined that the Dow battery is different than the normal Na S battery which uses Beta-Alumina as the electrolyte. Their Na S uses a special glass (D4-06) in the form of small glass tubes 4 Mils in Diameter and 1/2 Mil wall thickness.

Reported By John Newell

A SODIUM-SULPHUR POWERED VAN
WILL BE ON DISPLAY AT EXPO 86

FOR SALE

EIGHT CARS ARE TOO MANY FOR ME TO DRIVE.

THEREFORE I OFFER TO SELL THE FOLLOWING:

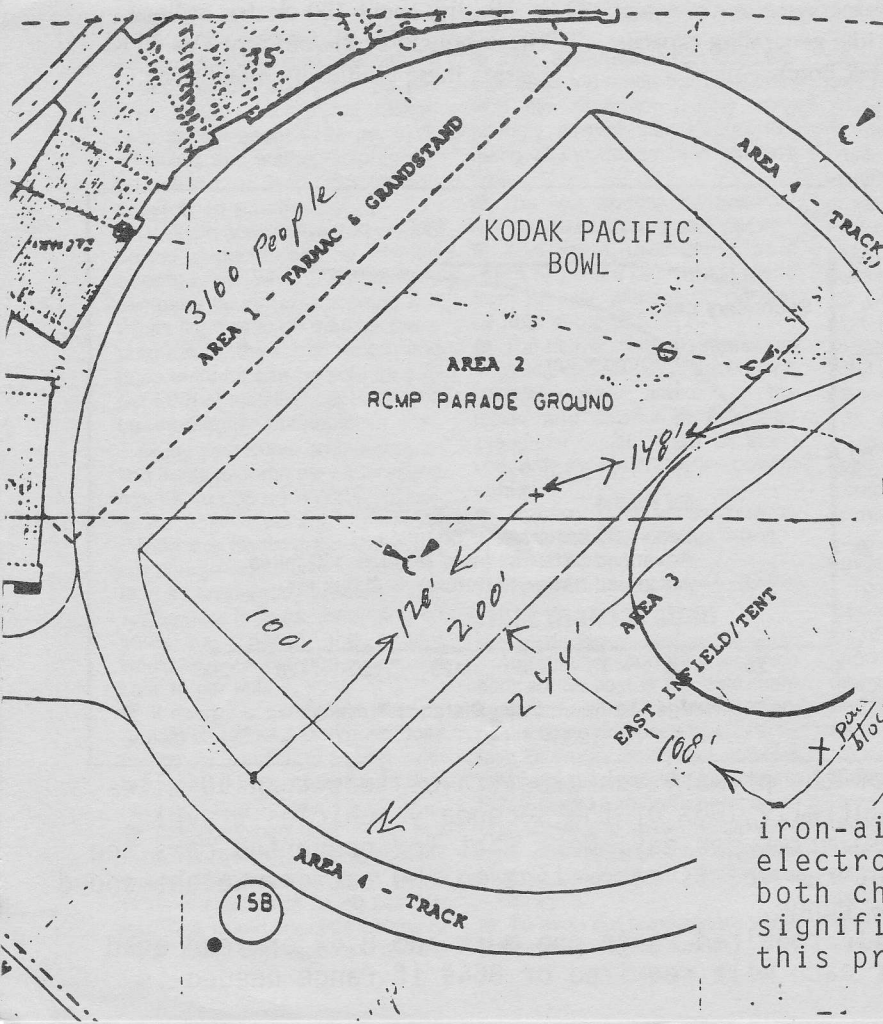
**THE NO.2 PRODUCTION JET 007 ELECTRICA
120 VOLTS,400 AMPS GE MOTOR
NEARLY NEW ALCO 2200 BATTERIES
REINFORCED FRAME/ORIGINAL INVOICE
AM/FM RADIO, SPORT ACCESSORIES
ROTARY DC-DC CONV. FOR AUX.BATTERY
TRAILER HITCH & HYBRID WIRING
STREET LEGAL - 1MCT390 -
LESTER CHARGER FOR ABOVE

WILL REDUCE THE PRICE UNTIL IT SELLS:

MAR 86 - $2400
MAY 86 - $1800
JUL 86 - $1200
SEP 86 - $ 600
THEN SCRAP OUT FOR PARTS

TERMS: CASH SEE IT AT OUR SHOP
EASY DELIVERY TO S.D AREA OR BAY AREA
ALL PARTS WARRANTEED FOR 90 DAYS

ERV ULBRICH - 213-696-4886 - HOME
213-942-4097 - WORK



EXPO 86
VANCOUVER

HELP US TAKE FULL ADVANTAGE OF OUR OPPORTUNITY AT CANADA'S WORLD EXPOSITION !!
WE NEED FUNDS
For a $100 donation we will send you three EV manuals written and donated by EAA members

GUIDE TO ELECTRIC AUTO CONVERSION
By Bill Williams
ELECTRIC AUTO MANUAL
By Walter Laski
ELECTRIC CAR CONVERSION MANUAL
By Clarence Ellers

Please add to DOE report Pg. 2
MAY

iron-air cells built using bifunctional air electrodes (same air electrode used for both charge and discharge) and represent a significant advance in the development of this promising technology. -PB-

EV Marketplace

FOR SALE: Prestolite 20 HP-96V motor with custom cast adaptor for VW trans-axel and PMC 96V controller W/Fan, all brand new for $1450. CALL: Peter eves. 5-8 at 1-(916) 482-0248. 923 5179

+ + + + + + + + + + +

FOR SALE: Baldor 8HP-72V DC motor, brand new never used for $450. CALL: Pete after 5PM at 1(916)482-0248.

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FOR SALE: Like new-MAKE AN OFFER-Assemb. Willey 8 Electronic Controller; Reb. GE3487R 400A. & GE 2CM63 200A. Aircraft Gen's & Mtg. Pcs.; Lester Mod. 9807 48V. Charger; 8-220A. Remy 9GCA EV Batteries.;+Misc. Pcs. CALL: 1(414)691-0052, Russel Kramer Route 3, Hwy. S, Kau Kauna, WI 54130.

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FOR SALE: BALDOR 96V DC Motor for $350, Custom adapter for VW Transaxle $100, Ray Mensing (415)493-8220.

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SPECIAL PRE-SUMMER SALE

Batteries, new ALCO 2400, 6 volt, 138 minute, extras from conversion, only quan. 8, $10.00 each. MOTORS: new Prestolite MTC-4001 series, 96 volt 20HP @ 185 amps one hour rating. Developes 50HP at 96 volts and a whopping 84 ft. lbs. torque using Russco HV-500 Controller. 8.5" Dia. X 16.3" length, with 1.125" shaft, 105 lbs. of the finest motor money can buy. Quan. 4 @ $795 each. Controller; Russco HV-650, 650 amps of sizzling power, guaranteed to blow the doors off Vettes & Porches, Seat belt required. Up to 120 volt systems, one only $795. All prices FOB Santa Rosa, CA Russco Electro-Mechanical Engineering, PO Box 3761, Santa Rosa, CA 95402. (707)542-4151. Established 1976.

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GAS CARS FOR SALE

79 Brat 4X4-Front Winch,Tires Warr. $3000.
Chev. Citation 1980, 4 Door, Air, Cruise, Tire Warr. $3000.
82 Honda 110 Trail Bike, Buddy seat,& Helmets. Al & Pat Hardage CALL: (408)734-8385

ADS must be received with payment by the 10th of the month, for the following month's issue. AD rate is min. 1 to 5 lines $5.00. 1/4 Pg. $15, Full Pg. $50.00, Full Pg. 2 sides $80.00, Wanted Trade, For Sale, etc. Mail to EAA 1249 Lane St. Belmont, CA 94002

WHATS HAP'N

EAST BAY:

June 14, 1986 PG&E Service Center
4801 Oakport St. Oakland
Mike Brown from Electro Auto-motive will be our guest speaker.

NORTH BAY:

JUNE 21 Sat.

EAA CHAPTERS
Call the contact person for meeting times and places.

ARIZONA: Phoenix Chapter
Greg Whitney 602 978-3380
ARKANSAS: Little Rock Chapter
B.S. Boykin 501 562-0252
CALIFORNIA:
Bakersfield Chapter
James Peters 805 393-1749
Concord: Contra Costa Chapter
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Los Angeles: Burbank Chapter
Il. Weiss 213 849-7632
Oakland: East Bay Chapter
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David Parez 414 481-9655

EDITORS: - Walter Laski - John Newell - Bill Palmer - Paul Brasch - COMPILED AND PUBLISHED By Clarence Ellers. SEND IN YOUR PERSONAL AND CLUB NEWS AND COMING EVENTS. ARTICLES _ COMMENTS etc. all correspondence to address below.

Electric Auto Association NEWS

JUNE 1986

1249 Lane St.
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94002

Address Correction Requested

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HELP !!

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$25 "RALLY" DONATION
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