Electric Auto Association NEWS

NOVEMBER 1984 VOL. XVI NO. 11

'85 Calendar Coming Events

WE WOULD LIKE OUR JAN. ISSUE TO BE THE MOST COMPLETE CALANDAR OF EVents EVER PUBLISHED REGULAR HANG ON THE WALL CALANDER PLAN AND REPORT NOW !! NOW!!!!

Utilities Recharge Electric Vehicle Concept

By RICHARD FRASER

Excerpts from 6pg. artical

Imagine having not only your basic car, or cars, as you know and love them, but also having a companion runabout for short trips, like going to work, the store, or the post office. It's small. It's lighweight. It's whisper quiet and doesn't foul the air. It's more economical to own and operate than your present vehicle. And it's immune to oil embargos.

Your runabout runs on electricity. Many people have given the idea of electric vehicles (EVs) serious thought. Indeed EVs have been with us since the days of Thomas Edison and the debut of the "horseless carriage." But now a number of interested parties are uniting to move the idea beyond its latest dream state and into reality. Not just a few units here and there, but into the reality of commercial, large scale production.

In 1983, a consortium of some 30 electric utility companies joined together to fill a void in leadership in this fledgling industry. In a field where concers fostered by the energy crisis of the early '70s have waned, and with them, some of the support of government and major automobile manufactures, the electric utilities have assumed a leadership role under the banner of the Electric Vehicle Development Corporation.

Headquartered in a suburb of Milwaukee this non-profit corporation's goal is to, achieve quantity production of on-road electric cars and trucks by the end of the 1980s. The EVDC will not research develop or manufacture such vehicles but will act as a catalyst for developers at all levels.....

Whether the public is ready for electric vehicles a whole new industry is now at the threshold. Just out of public view, manufactures, research institutes, hobbyists, governmental agencies and other groups are busy developing the concept of electric transportation. For those involved, the question isn't so much whether the public accepts the idea as when.

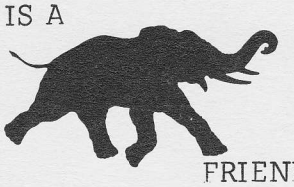
In test after test, and throughout its long history, the EV has proven to be a viable product. The real focus now is on commercial viability.

....Furthermore, a number of electric companies have plenty of capacity for expanding their markets. McLean explained that between the low-demand hours of 10 p.m. to 6 a.m. Milwaukee has the capacity to recharge 1000,000 cars, without any additional capital equipment.

....A survey conducted by ESB Ray-O-Vac in 1978 indicated that the average commuter traveled a distance of 23.5 miles. From the survey's results, it was concluded that the transportation needs of 80 percent of today's commuters could be met with EVs using state-of-the-art lead-acid batteries.

Cover Story Wisconsin Business Journal July 1984 by Richard Fraser

AN ELEPHANT IS A



FRIENDLY ANIMAL

By TED BENSON

All the combined talent, wisdom, and experience of the EAA could not have planned a better outcome for the White Elephant than what really happened.

The White Elephant is a 3 wheeled electric golf cart, that belonged to Leroy Larsen. He donated it to the Peninsula Chapter of EAA and they gave him a letter for the Internal Revenue Service, as a contribution to a non-profit organization. That made a good deduction on his Income Tax Return.

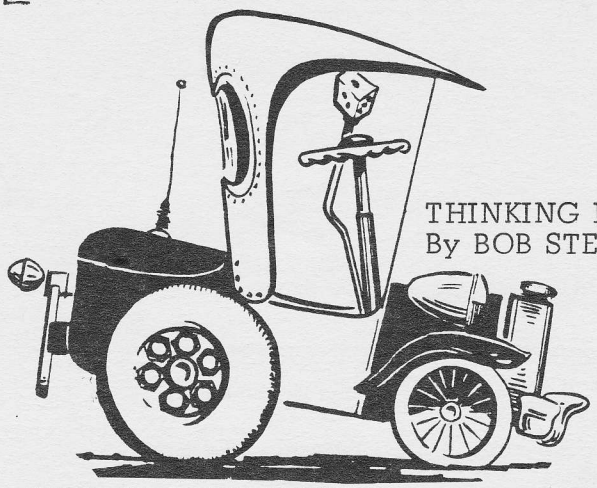
Gus Urbach helped Ted Bensen tow it to his home garage and get it running. John Newell donated some good batteries for it. Stan Skokan and Al Hardage donated a full bridge rectifier Ted used to keep the batteries charged up.

Then the White Elephant seemed to be a burden to everyone, Ted had to make room for another electric vehicle he bought for himself. So Bruce McCaskie came to the rescue and stored the vehicle until Annual Rally Sale. Bob Wilson, Technical Manager for GTE Corporation, bought it as a present for a friend.

The Peninsula Chapter had donated money to the Santa Clara Chapter to help with their Rally expenses. The sale of the White Elephant reimbursed the Peninsula Treasury for the exact amount of their donation.

But here is the heart touching part of this account. Bob bought it for a friend who is handicapped with multiple sclerosis. She works just five blocks from where she lives, and has to walk to and from work on crutches. Now what was a White Elephant for the Peninsula Chapter has turned into a God Send for the friend. She can just pile into "OLD Whitey" and scoot off to work, no strain.

The strange part of this entire affair is, not a thing was planned, and Ted believes that everyone has benefitted and has a good feeling about the happy ending of the White Elephant.



THINKING IT OUT
By BOB STEINFELD

IDEAS TO THINK ABOUT IF YOUR BUILDING A CAR

1. How is the car going to be used?
2. What kind of terrain do you plan to drive in?
3. Rate your skills at tackling this project and plan to take classes, read books, and seek technical help from the Club.
4. Figure out and set aside the expenses for the project.
5. Do you have a place to work on the car?
6. Don't overestimate the range and top speed of the car. Choose your maximum range and divide it by 2 for every day travel. Plan this estimate around the speed you plan to travel and if it's over 50 cut your estimate in half again. It's much better to under estimate the performance than to be disappointed when you complete the car.
7. Distribute the battery weight evenly front to back and side to side. The car will handle better and be much safer.
8. Don't exceed the maximum rated suspension weight, otherwise you will have to beef up the suspension and brakes.
9. Design in an excess of safety features and emergency cut-off devices.
10. Decide early on the following:
    a. Conversion or from the ground up.
    b. Number of batteries
    c. Type of motor.
    d. Type of transmission
    e. If a clutch is going to be used.
    f. Type of control system.
    g. Number of passengers you plan to carry.
11. Don't do a conversion on an inexpensive car that has not been registered for a number of years.

I have been using a simple equation for calculating the mileage of EVs:

$$\text{miles} = \frac{\text{Energy}}{\text{wh/mile}} = \frac{(75)(\text{min.})(\text{nr. of batt.})(\text{batt. voltage})}{(60)(\text{weight}/100)(5.25)}$$

HANS KOSKI

This assumes that all losses vary directly with weight and at rally speeds

WIN AN EV

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THE ALUMINUM AIR POWER CELL --CON'T FROM OCTOBER

BACKGROUND

Study of aluminum as a possible electrochemical energy source for electric vehicle applications began at LLNL in 1979. The essentials of the battery are shown schematically in Fig. 1. The over-all energy producing reaction

$$Al + 3/2\ H_2O + 3/4\ O_2 + NaOH = NaAl(OH)_4 \qquad (1)$$

takes place in the cells, where aluminum dissolves in sodium hydroxide electrolyte to form sodium aluminate and oxygen from the air reacts with electrolyte in the air cathode. The standard, reversible cell potential for the above reaction is 2.73 v; however, the processes at the electrodes are complex and the actual electrochemical energy efficiency of the cell is about 50%. What gives the aluminum air system the potential for rapid refueling and extended range is the aluminate decomposition reaction

$$NaAl(OH)_4 = Al(OH)_3 + NaOH \qquad (2)$$

which takes place in the crystallizer. This reaction regenerates the NaOH electrolyte and separates aluminum as the hydroxide, a raw material of the aluminum industry.

In 1980 the initial test cells were scaled to 1000 cm^2 size and were operated jointly with a crystallizer, thus establishing the compatibility of the cell and crystallization processes. The main program emphasis at LLNL has been the development of a rapidly refuelable cell with efficient utilization of the aluminum, and development of a crystallizer design scaleable to vehicle sizes. The most recent cell configuration - a wedge shaped cell - allows full consumption of the aluminum fuel and simple recharge without disturbing the elctrodes.

Work under contract has led to improvements in the performance of the air electrode and the aluminum alloy.

CON'T ON Pg 5

CUT UR LOSSES

MEASURING EV PERFORMANCE

by Gary Jackson

One problem which every EVer faces sooner or later is how to improve the range and speed of his EV. Basically there are 2 approaches: Add batteries (the brute force approach) or improve the efficiency of the EV. One problem with improving EV efficiency is how to measure what you have done. In other words, how do you know that you've done any good? No one wants to drive around for hours until his batteries run down, only to discover that the "improvement" he made had no effect on overall performance. The method discussed here allows a straightforward method of evaluating power losses in the EV vehicle.

The Coasting method described here is very simple. As a coasting car slowsdown, its kinetic energy, which is related to speed, decreases because this energy is being used to overcome losses such as wind, bearing friction, tire rolling resistance, etc. By measuring the time it takes to slowdown 5 mph, one can calculate te total power losses of the vehicle which the motor and drivetrain must overcome.

Unfortunately, as with many simple ideas, the implementation isen't always so straightforward. In order to obtain an accurate measurement of vehicle losses, certain precautions must be taken. First, unless you have access to an airport runway or speedway at 6 a.m., there is usually a wind and an incline to introduce error in the measurement. Second, in order to obtain reproducible results, the test conditions must not vary. This means that the EV should be properly warmed up each time a series of runs is made. Also, no significant changes should be made to the EV during the runs, i.e. don't add a passenger, change tire pressure, etc. during a run.

With the cautions mentioned above, here's how the methodworks.

1. Select a reasonably flat road with plenty of space at either end to get up to speed. Runs are made in both directions to eliminate any error due to incline or wind.

2. Select a time of day when any wind is either small or constant. This assures that the wind factor will cancel in the calculations.

3. Warm up the car for each series of runs. This is important to assure reproducible results.

4. Select a point to start coasting. Run the car up to the desired speed, put it in neutral (if desired), and start timing at the selected coast point.

5. Measure the time it takes for the car to lose 5 mph. Repeat this test in the opposite direction, trying to end that coast at about the same point where the original coast started.

After the desired data has been obtained, the power losses can be calculated by this formula:

$$P_{loss\ watts} = .0454 \times W \times S_{av} \times S_{inc} \times \left(\frac{1}{t_{up}} + \frac{1}{t_{down}} \right)$$

W = Total weight in pounds of car, driver, passenger,

S_{av} = Average speed in mph = $\frac{1}{2}(S_{initial} + S_{final})$

S_{inc} = Speed loss in mph = $S_{initial} - S_{final}$

t_{up} = Time in seconds to go from $S_{initial}$ to S_{final} "up" incline

t_{down} = Time in the opposite(down) direction.

By repeating this test at serveral speeds, you can obtain a graph similar to that shown in Fig. 1

How can this data be used? First of all, it can be used to evaluate improvements that you make in your car. For instance, from Fig. 1 I determined that my car was much too inefficient. Consequently I changed to radial tires, added 30W oil to the manual transmission, and carefully realigned the front end. The results, which I could now quantify, are shown in Fig. 1. I had improved losses by approximately 25%. The second use of this data is that you can calculate the efficiency of your motor/drivetrain. EVs are idealy suited for this because input power can easily measured using a voltmeter and ampmeter. Thus the efficiency of the EV at any speed can be determined by:

$$Eff = 100 \times \frac{P_{loss}(watts)}{V_{motor} \times I_{motor}} \quad \%$$

Let's illustrate the method with an example. Suppose it takes a car and driver, weighing 2000lbs total, 10 seconds going East on Lovelorn Ave. Going West and again coasting from 30mph to 25mph it takes him 15 seconds. The power loss, which the motor and drivetrain must overcome, is calculated to be:

$$P_{loss} = .0454 \times 2000 \times 27.5 \times 5 \times \left(\frac{1}{10} + \frac{1}{15} \right)$$

$$= 2081 \text{ watts}$$

PERFORMANCE CON'T

Now, this dedicated EV'er wants the efficiency of his motor under dynamic conditions. He again drives east on Lovelorn Ave. at 27.5mph without coasting and measures 46V and 65A. He repeats this test going West and measures 46V and 55A. Hence his efficiency is:

$$\text{Eff} = 100 \times \frac{2081 \text{ watts}}{46 \times \frac{1}{2}(55+65)} = 75\ \%$$

By using the coasting method to determine EV losses, the EV'er has at his hands a versatile method to characterize his vehicle. It should be noted that large laboratories obtain the same data, albeit more accurately, by much more eleborate means using expensive apparatus such as wind tunnels, scale models, dynomometers, and test tracks.

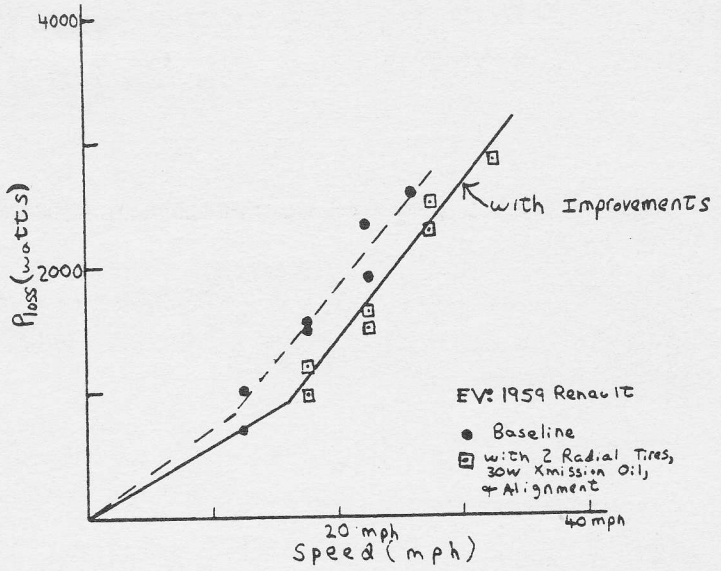

Fig. 1 P_{loss} as a Function of Speed

THE ALUMINUM AIR POWER CELL-CON'T FROM OCTOBER

The air cathode is a specialized structure containing a catalyst deposited on high surface area activated carbon. The carbon particles are mixed with a wet-proofing agent, such as Teflon, and pressed onto a metal current collection screen. The structure has to remain porous to allow diffusion of oxygen and electrolyte. A new catalyst was discovered (cobalt tetra methoxy phenyl porphyryn) which is more effective and has a longer operating life than the platinum being used previously. Improvements in the fabrication processes have produced samples with an operating life of 1400 cycles, equivalent to about two year life in vehicle application.

The initial experiments were performed using high purity aluminum and a torpedo alloy manufactured from high purity aluminum. Work at Reynolds Metals indicated that the high power density performance of the torpedo alloy could be retained in a much lower purity alloy, capable of manufacture in conventional Hall cells at a small cost increase over commercial grade aluminum.

In spite of the above improvements in cell design, anode and cathode performance, much work remains to be done before the initial engineering design of a complete system can be accomplished, and before an aluminum powered vehicle can be made competitive with an internal combustion engine powered by synthetic fuels.

INDUSTRIAL SUPPORT

Our prime industrial contract, cost shared, is with Eltech Systems Corp; they formed a consortium with Alcan, SRI and Case-Western Reserve University. The goal for the two year study contract was to have the initial complete engineering design of a vehicle system done by March 1986. However, our reduced FY85 budget will delay the schedule.

The emphasis of the work at Eltech is in the development of improved air cathode materials and fabrication processes, improved aluminum alloys and over-all system integration. Alcan (in cooperation with LLNL) is developing the data base to design a full size vehicle crystallizer for the aluminum hydroxide reaction product, and will perform a study of the fuel cycle, i.e. recycling of aluminum hydroxide. SRI is studying the electrochemistry of aluminum alloys and Case-Western Reserve University improved catalyst systems for the air cathode.

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2 Jet 600 Electravans (Subaru minivans)
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2 Jet 007 Sedans (Omni 024)
2 Jet 1000 Vans (Dodge Van)
1 Jet 1400 Van (Large Dodge Van)

All vehicles are in running condition, but may require battery replacement. If you are interested please contact Stan Skokan, Electric Vehicles Inc., 2736 Winfield Drive, Mountain View, CA [illegible]0, phone (415) 964 3974. Do not delay your call!

ANDY ST AMANT ESTATE SALE

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FOR SALE: 69 Renault sedan with Westinghouse motor controller, meters, and electric controls. Good shape $500 takes all. Orville E. Smith, P.O. Box 5035, Salton City, CA 92275

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WHATS HAP'N

Peninsula

ENERGY FROM WIND & OCEAN

November 3rd. Sat. San Bruno Library 10AM to 12.

We are fortanate to have Mr. JOHN McKINNEY from P.G.& E. Speaking on two of our oldest energy sources rediscovered ENERGY FROM THE WIND & ENERGY FROM OUR OCEANS !!!

There will be SLIDES. No one should miss this one.

CALL: Lydia (415) 591-6698

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ALL CLUBS, ASSO,. ANY GROUP INTERESTED IN ELECTRIC VEHICLES. PLEASE REPORT NOW!! NOW !! ANY EVENTS FOR '85 WE WOULD LIKE TO HAVE EVERY EV ACTIVITY INTHE WORLD LISTED IN OUR 1985

CALENDAR

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Call the contact person for meeting times and places.

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Electric Auto Association NEWS

NOVEMBER 1984

1249 Lane St.
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