

NOTES FROM AN OUTSTANDING EVENT

THE STAR OF THE SHOW

JOHN WASYLINA

RENUALT 4DR. 4 PASS. 69.3

By far the biggest crowd seen at the September International Rally Sunnyvale Ca. was gathered around JOHN WASYLINA'S NEW RENAULT.

John is our most prolific member, having converted at least 10 cars completely. He lost count at 10, however, if you checked 2 out of 3 of the 40+ cars at the Rally you would find John's handiwork, at least connected with the machine work (motor mount). This in spite of the fact that John's expertise is Electrical.

John was a pioneer in the development of Silicon Valley. From 1935 to 1974 John owned and operated Excel Transformer Co., which was a major supplier of transformers to most of the manufactures in the area. John probably developed his machinist skills keeping all those winding machines running.

The 1983 Renault that John drove in the Rally was voted the best looking car and also won the efficiency award which John has won almost every Rally.

How can any of us say we're too old to start a new project when we have a role model like John who is 76+?

RECORD ATTENDANCE

VISITORS FROM FAR AWAY PLACES

Mike Deliso EEVA New Jersey
Max Clawiter Montana
D.J. MacLauchlan Alberta
Jim McCullough DEVC Colorado
Mr. Bouchard Quebec
Joe McCarthy Texas
Bob Aronson Florida
Bill Kuehl Nevada

Tony DeBellis Moraga Hi-School
Danville with 15 students

80 people attended our Brunch
60 took part in the Symposium

SPECIAL AWARDS

< MAN AND WOMAN OF THE YEAR:

AL AND PAT HARDAGE

AL AND PAT were responsible for our outstanding Awards Brunch and Saturday evening dinner.

< KEITH CROCK AWARD FOR TECHNICAL ACHIEVEMENT:

Saied Motaei

Electrolite Recirculation -Regeneration
with series motor including parallel
battery switching - Thermal management -
Individual battery monitoring of
temperature and voltage - Use of fiberglass
parts for weight reduction - High pressure
tires -

'86

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!!!!

BATTERY RESEARCH UPDATE

News from DOE & LLNL reported by Paul Brasch

Zink/Bromine testing is showing some long life indications although sometimes at lower energy efficiencies than lead/acid. First, a small 500 Watt-hour (Wh) battery is at better than 1100 cycles with stable performance at 68% efficiency. Larger 1.2 kWh and 3.5 kWh units are also being tested with 47 and 67% efficiencies respectively. But these are experiencing some problems with precipitates and pH. Just starting testing is a large 30kWh EV type battery which has successfully powered an AC drivetrain vehicle at Ford Motor Company.

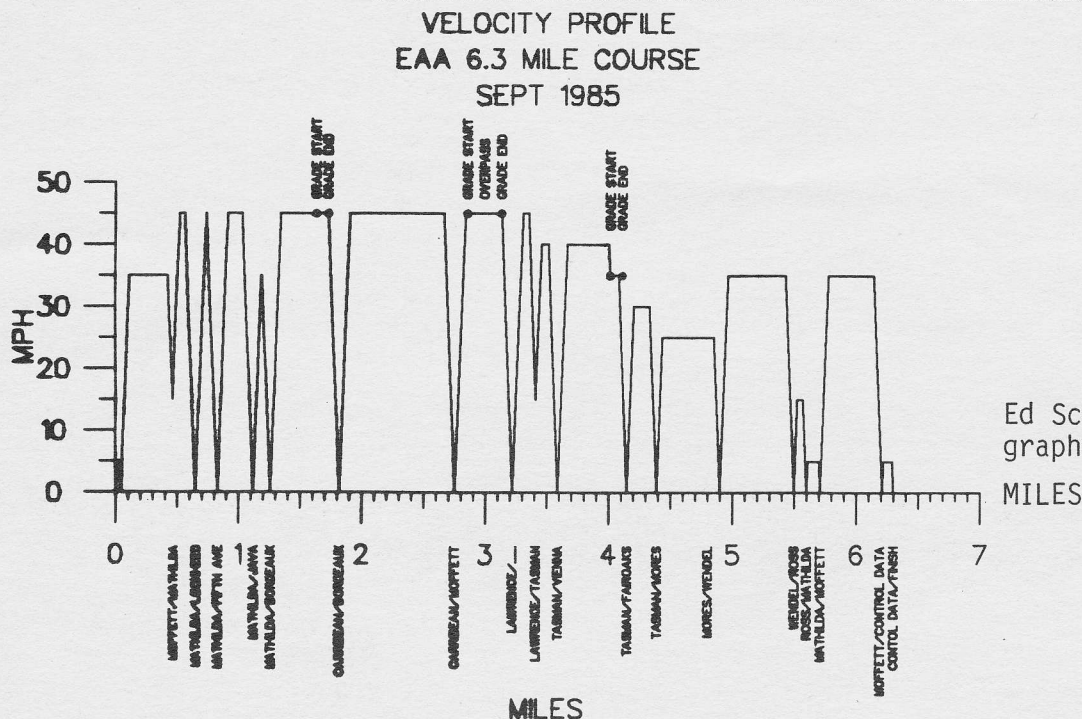
For high-temp "superbatteries" there is good and bad news. Four Ford Sodium Sulfur cells have so far lived through 343 to 674 cycles at slightly above their designed capacity. One cell even increased its capacity from 143 Ah to 160 Ah when constant current/constant voltage charging was tried. The bad news is that the very high energy Lithium/Iron Sulfide cell testing has stopped temporarily due to mechanical problems. The cells seem to bulge and break the bolts holding restraining plates.

Talking about problems Nickel/Zinc still seems to be having them. With only 203 cycles, the capacity of a module under test was already down to 77% of rated when funding ran out.

However, testing of an Easle-Picher Nickel/Iron module has shown a 109 mile projected range using the SAE J227 aD/improved ETV-1 driving profile with regenerative braking. This is a 15% improvement and the first time Ni/FE has exceeded the 100 mile program goal.

The Aluminum/Air battery (fuel cell/) is still alive. Lawrence Livermore National Laboratory is still working on it, and so is a private company in Ohio. The Canadian Government has also been funding research on it. Art Maimoni of LLNL feels that a 100 cell system, if built, should do very well in a full size EV as their tests of the primary wearout mechanism has shown a projected cell life of greater than 2500 cycles.

The best news seems to be for Lead/Acid modules of the large load-leveling kind. One module has completed 605 equivalent 80% depth of discharge cycles while retaining 78% capacity. But more important, an Exide module running at 50 o C has completed 1523 cycles (a claimed 4246 equivalent cycles at 25 o C) with 115 % of its 5 hour 30 o C rating. That sounds like progress to me.



Ed Schanz made this beautiful graph of our rally course

THE SINCLAIR STORY:

Although the Sinclair C5 (as seen at the May Electrathon) has received some criticism regarding some of the claims made when the machine was presented to the public, and the production rate has been reduced to a tenth of the intended 100,000 per year, Sir Clive has at least made the U.K. general public aware of personal electric vehicles which in itself is no mean achievement.

Sir Clive Sinclair has now released his plans for more advanced vehicles, the C10 and, targeted for 1990, the C15.

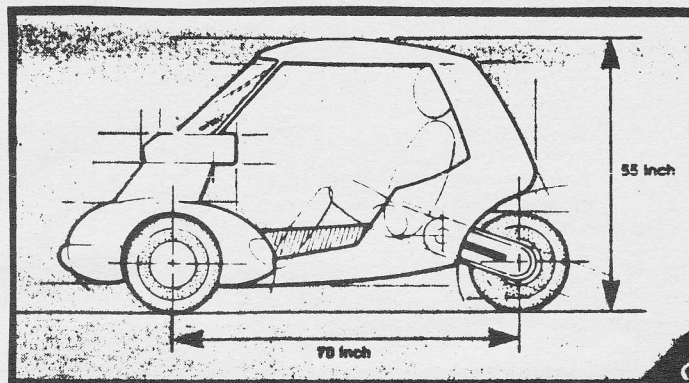
The C10 will appear before the C15 and will be a three wheeled two seater with two driven wheels at the front and a trailing rear wheel. Lead-acid batteries, drive motor and controls all appear to be housed within the front part of the car. The performance is stated as 25 to 30 M.P.H. (40 to 48 KPH) with a range of 40 miles (64 Km.)

The C15 is shown to be an aerodynamically styled four seater, four wheeler with a planned performance of 80 M.P.H. (128 KPH) and a range of "hundreds" of miles. This specification is beyond the capabilities of established designs and conventional batteries and Sir Clive hints at the use of "new technology". This suggests either the long awaited "breakthrough" in battery technology or some non-mechanical source of electric power, such as a fuel cell.

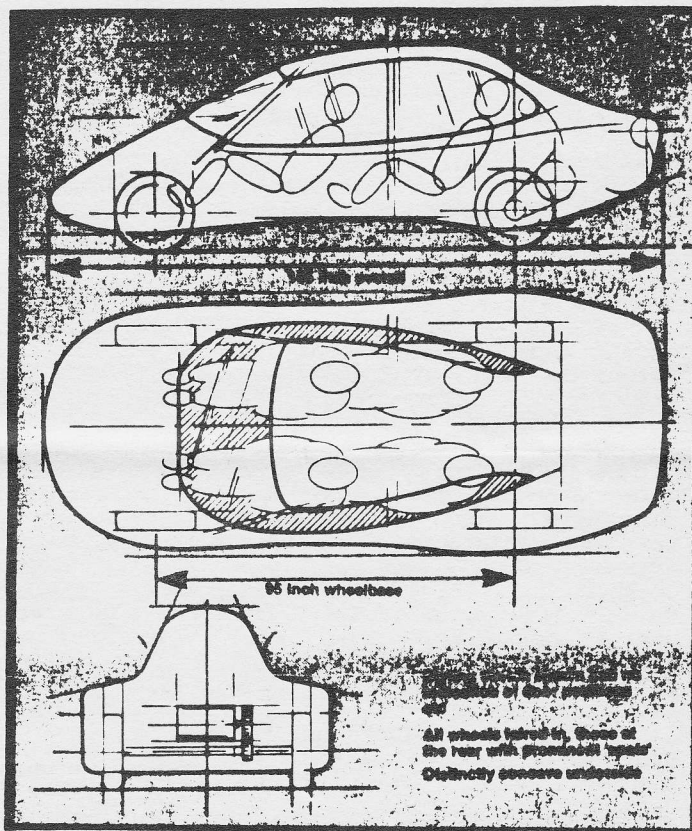
The E.V. industry is all too used to optimistic claims for new proposals but, on past achievements, if anyone is going to make a breakthrough, Sir Clive Sinclair is the one most likely to succeed - and we don't have all that long to wait.

Jim Pryor

AEVA-AUSTRALIA NEWSLETTER



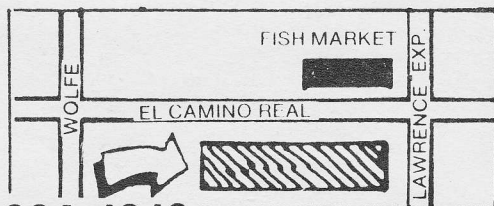
A dumpy two-seater: Sinclair showed only 'exploratory styling sketches'.



The design sketch Sir Clive Sinclair fleetingly showed made one thing very clear: the C15 will be a highly aerodynamic vehicle.

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This is the latest Swiss-built electric Carville. It now has a four-speed gear box from Citroen, and both motor and battery box are located between the rear wheels. Top speed is said to be 80 km/h, and range 100 km. It is a luxury model, costing about \$17,500 in Switzerland.

COMPUTER PROGRAM FOR CALCULATING ELECTRIC CAR PERFORMANCE

by Bill Palmer

Do you wish you could predict the performance of your electric car before you build it or before you actually make changes you may be planning? I did. I wanted to change the differential ratio and the number of batteries in my Vega. I hoped to increase motor speed in each gear to increase torque multiplication through the gears and decrease motor current. So, I put the car data and performance formulas into a spreadsheet program on my computer. The printout on the next page shows the Vega performance after the changes. The values before the change show slower motor speeds, less acceleration and more current. The shaded areas require motor speeds higher than the maximum, so the car will not operate on its own power at those speeds in those gears. Negative accelerations on grades mean the car speed will decrease under those conditions.

The input data are listed in the upper left corner. The values on the rest of the sheet are calculated by using the input data in the formulas shown for each set of calculations. So, calculating the effects on performance of any changes in a car that change the basic data can be done extremely easily and quickly - once you know all the necessary data. All you need to do is change one or more input data values and the program automatically recalculates all of the resultant values.

Most of the data values are easily determined such as weight, frontal area, wheel diameter, gear ratios and maximum battery voltage. The rest of the data values may require some research or work or both. Maximum motor armature current probably is limited by the speed controller. The rolling resistance factor (KRR) can be measured by towing the car at low speed in both directions (to cancel out wind and grade effects) on as smooth and level a road as you can find. With a spring scale in the tow line, measure the force necessary to keep the car moving at a constant speed. Then divide the average force by the car's weight.

The aerodynamic drag factor (KAD) can be determined by towing the car in a similar manner but at various speeds. Subtract the rolling resistance force from the total force

measured at each speed and divide the remainder by the frontal area times the speed squared to get the aerodynamic drag factor.

Motor torque per ampere (TA) and speed per volt (SV) can be determined from the speed/torque / voltage/current curves for your motor, such as the one shown below. They are available from the motor manufacturer. Pick a few torque and speed values and divide each respectively by its corresponding current and voltage value. Use the averages for the values of TA and SV. Note that the values vary slightly with speed and load.

If you can't get curves for your motor you can make the measurements yourself. To measure torque clamp the motor to a bench, so it cannot move, and clamp an arm a little more than a foot long radially to the shaft. Couple a spring scale, rated at least 50 lbs, at a right angle to the arm exactly 12 inches from the shaft center and anchor the other end of the scale. Measure torque at several values of armature current up to the maximum your car's electrical system can supply. Divide each torque reading by the corresponding current value and average the results to get a pound-foot per ampere rating for your motor. For shunt motors, be sure all measurements are made with rated current flowing in the field.

You can measure motor speed vs. voltage (SV) by applying various voltages up to full battery voltage and measuring speed at each voltage. Again, shunt-field current should be at rated. Be sure a series motor is loaded. If you don't have a tachometer, drive the car at various speeds and carefully record the voltage and gear at each speed. Calculate motor shaft speed from speedometer readings using wheel size and gear ratios. Divide each speed by the voltage that produced it and average the results for a representative RPM per volt (SV) rating for your motor.

If any of you are interested in the same kind of calculations for your car, I will run them for the first ten people who send me the data on their cars. If any of you have computers with "Supercalc" and want to run the program yourself, I will send a program listing to the first ten who request it. Please send a long, stamped, self addressed envelope. If you would like the program on a diskette, tell me what computer and operating system you have and I will format a disk for your system (if it's one of the 25 or so that "MediaMaster" covers), copy the program to it and send it to you for \$10.00. My address is 44 Dior Terrace, Los Altos, CA 94022.

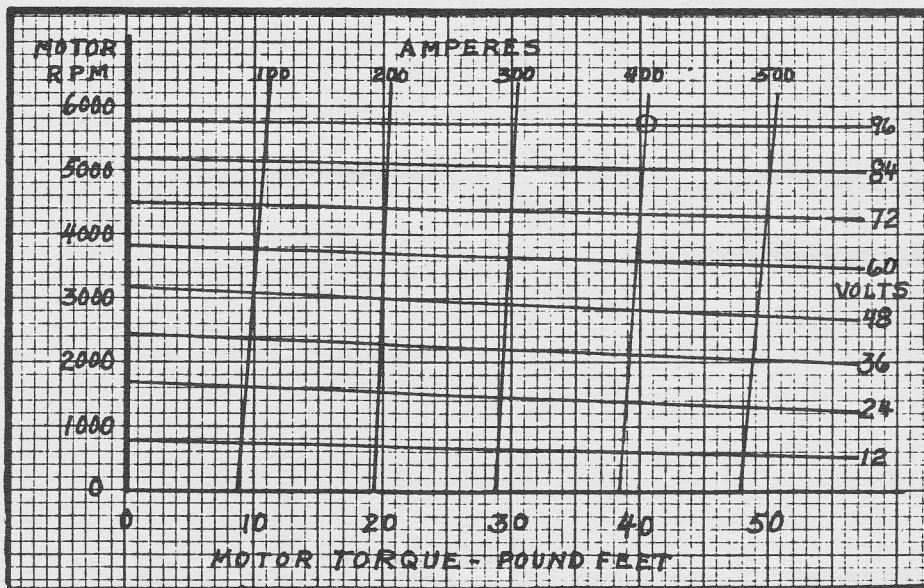


FIGURE 2. MOTOR SPEED-TORQUE-VOLTAGE-CURRENT CHARACTERISTICS

ELECTRIC VEHICLE PERFORMANCE

-----DATA-----

Vehicle owner: PALMER
 Vehicle make: VEGA-2
 Weight, pounds (WT): 3280
 Frontal area, sq.ft. (FA): 20
 Wheel diam., ft. (WD): 1.854
 Differential ratio (DR): 4.1111
 Gear ratios (GR1): 3.4167
 (GR2): 2.0167
 (GR3): 1.3333
 (GR4): 1
 (GR5): 0
 Rolling Res. Fctr. (KRR): .015
 Aero.Drag Fctr. (KAD): .0015
 Max.Motor Current (IM): 400
 Max. Voltage (VM): 96
 Motor lb.ft./amp. (TA): .1
 Motor rpm/volt (SV): 60

RETARDING FORCES:

ROLLING RESISTANCE: $RR=WT \times KRR=$ 49.20 pounds
 AERODYNAMIC DRAG at several speeds:
 $AD = FA \times SPD^2 \times KAD$ pounds
 MPH: 20.00 30.00 40.00 50.00 60.00
 AD pounds 12.00 27.00 48.00 75.00 108.00

PERFORMANCE:

WHEEL RPM per MPH: $WS=5280/WD \times 3.1416/60=$ 15.11
 MAXIMUM MOTOR RPM (powered): $MS = VM \times SV =$ 5760.00
 MOTOR RPM vs CAR SPEED in each gear:
 $MS = DR \times GR \times WS \times MPH =$ MOTOR RPM
 MPH: 20.00 30.00 40.00 50.00 60.00
 1 4244.41 6366.61 8488.81 10611.02 12733.22
 2 2505.25 3757.88 5010.50 6263.13 7515.76
 GEAR: 3 1656.30 2484.44 3312.59 4140.74 4968.89
 4 1242.25 1863.38 2484.51 3105.63 3726.76
 5 .00 .00 .00 .00 .00

MAXIMUM CAR SPEED IN EACH GEAR:

$SM = VM \times SV / DR / GR / WS$ MPH
 GEAR: 1 2 3 4 5
 MPH: 27.14 45.98 69.55 92.73 .00

ACCELERATING CAPABILITY, on level road, in each gear and speed at maximum current:

$A = IM \times TA \times DR \times GR \times WD/2 - RR - AD / WT \times 32.2$ MPH per SEC.
 MPH: 20.00 30.00 40.00 50.00 60.00
 1 4.51 4.37 4.16 3.89 3.57
 2 2.42 2.27 2.06 1.80 1.47
 GEAR: 3 1.39 1.25 1.04 .78 .45
 4 .90 .75 .54 .28 -.05
 5 .00 .00 .00 .00 .00

HILL CLIMBING ABILITY: acceleration in each gear and speed for several grades: $AG = A - \% \text{ GRADE} \times 32.2$ MPH PER SEC.

GRADE= 5%
 MPH: 20.00 30.00 40.00 50.00 60.00
 1 2.90 2.76 2.55 2.28 1.96
 2 .81 .66 .45 .19 -.14
 GEAR: 3 -.22 -.36 -.57 -.83 -1.16
 4 -.71 -.86 -1.07 -1.33 -1.66
 5 .00 .00 .00 .00 .00

GRADE= 10%
 1 1.29 1.15 .94 .67 .35
 2 -.80 -.95 -1.16 -1.42 -1.75
 GEAR: 3 -1.83 -1.97 -2.18 -2.44 -2.77
 4 -2.32 -2.47 -2.68 -2.94 -3.27
 5 .00 .00 .00 .00 .00

CRUISING CURRENT (level): $I=(RR+AD)/TA \times DR \times GR \times WD/2$ AMPERES

MPH: 20.00 30.00 40.00 50.00 60.00
 1 47.00 58.52 74.65 95.38 120.73
 2 79.63 99.15 126.47 161.60 204.54
 GEAR: 3 120.44 149.96 191.29 244.43 309.38
 4 160.59 199.95 255.05 325.90 412.49
 5 .00 .00 .00 .00 .00

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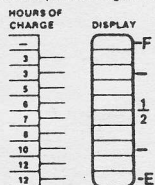
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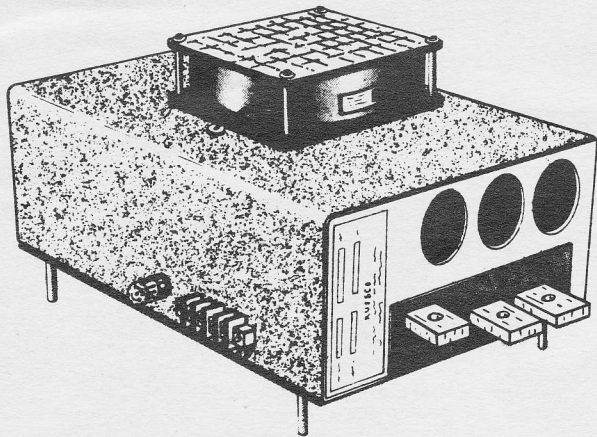


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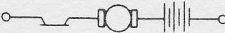
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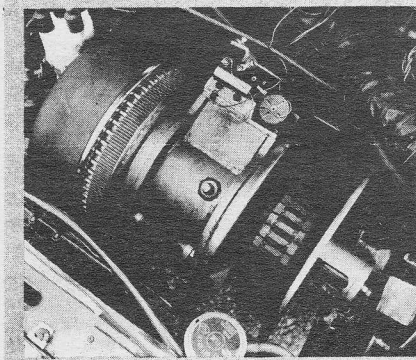
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