F.V.E.A.A. NEWSLETTER

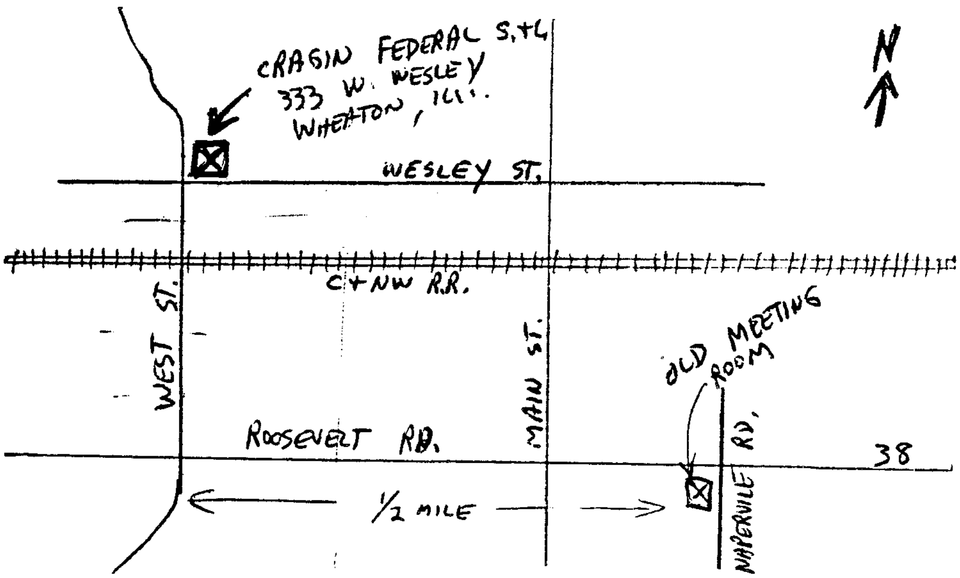
JULY 1986

MEETING NOTICE

The next meeting will be friday **JULY 18TH**, at *CRAGIN FEDERAL SAVINGS & LOAN* 333 W. Wesley St. Wheaton, Illinois. (see map) - Time - 7:30 P.M. *sharp*. Guests are welcome and need not be members to attend the meeting.

NOTE: NEW MEETING PLACE

PARK IN LOT IN BACK OF BUILDING



F.V.E.A.A.

FOX VALLEY ELECTRIC
AUTO ASSOCIATION
624 PERSHING ST. WHEATON, ILL. 60187

FIRST CLAS:

ADDRESS CORRECTION
REQUESTED

FVEAA CLUB ITEMS FOR SALE

BATTERIES

2	6 volt	7" x 12"	wet	$5.00 ea.	
1	6 volt	7" x 12"	dry	$10.00	(new)
1	6 volt	7" x 16"	wet	$5.00	
1	12 volt	7" x 10"	wet	$5.00	
1	12 volt	6" x 10"	wet	$10.00 ea.	(new)
~~2~~	~~12 volt~~	~~9" x 20"~~	~~wet~~	~~$10.00 ea.~~	~~(heavy)~~

Unless otherwise stated, these batteries are slightly used (if at all) and are not E.V. (golf cart) type. These are what is left. If you want one or more, let me know before the meeting and I will bring your order to the meeting. Those who have picked up their batteries, should make payment to the club treasurer.

OTHER STUFF

Solid brass battery connectors #00 & 000 pos. or neg.	$ .75 ea.
Steel laminated choke core for shunt motors.	$5.00 ea
Black heat shrink tubing 3/4" shrinks to approx. 1/2"	$ .50 foot
200 Amp relay 24-28 volt coil Only 2 left.	$15.00 ea.
400 Amp relay 12 volt coil Limited supply.	$45.00 ea.

Above items may be purchased at the meetings or place your order with me to ship U.P.S.

John Emde 968-2692
Temporary keeper of the club stuff

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FOR SALE Old oscilliscope Heavy tube type. It works $25.00
Bill Palmer
969-1176

****

FOR SALE Elcar parts or whole. 10 Trojan batteries. Lester 12 & 48 volt charger. Lambert 48 volt transistor controller. 6 H.P. GE series motor. Best offer.
Don Kubick
437-0453

PUTTING PERFORMANCE IN YOUR ELECTRIC CAR-PART III

Discussions by members at the last two meetings, and operating data they provided, indicate the assumptions used in Parts I and II should be revised as follows:

Item	Original	Revised
Acceleration 0-30 (sec)	4	6
Distance traveled (ft)	88	132
Average (ft per sec-sec)	11	7.3
Battery Weight (lbs)	800	825
Fraction (%)	25	33
Curb weight (lbs)	3200	2500
Mass (poundals)	100	78
Acceleration force (pounds)	1100	570
Power (HP)	44	34
Power (Kw)	33	25.5
Road load (lbs)	48	36
Hill climbing		
Angle (degrees)	30	17
Force (lbs)	1600	720

As the above table shows, the revised assumptions are much-less demanding of the propulsion system.

When the FVEAA has exhibited cars at public events, two frequently-asked questions are:

How fast will it go?

How far will it go?

To answer these questions for our conversion kit, energy use and efficiency must be analyzed in addition to the revised assumption factors. Several elements require consideration.

1. Road load power required.
2. Battery output power.
3. Component efficiency
   a. Controller
   b. Motor
   c. Transmission
4. Auxiliary power use

To calculate road load power, a top speed selection must be made. Even though the present national limit is 55 mph, a top speed capability of 60 mph will be used. Using our assumptions, overcoming rolling resistance requires:

$$\frac{88 \text{ ft.}}{\text{sec}} \times 36 \text{ lbs} \times \frac{1 \text{ HP-Sec.}}{550 \text{ ft-lbs}} = 5.76 \text{ HP}$$

And to overcome aerodynamic drag at 60 mph requires:

$$\frac{88 \times 108}{550} = 17.24 \text{ HP}$$

Adding these, we find 23 HP required.

To allow a little margin, a 25 Hp motor will be used. This is equivalent to 18.7 Kw. A motor with this continuous rating will keep the car rolling at 60 mph.

Referring back to the table, we see that an 18.7 Kw motor will provide a 17 degree slope hill-climbing ability at:

$$25 \text{ HP} \times \frac{550}{750+36} \times \frac{60}{88} = 11.9 \text{ mph}$$

This brings us to the second element, battery output power. At 48 volts, the current for a 25 HP motor would be 390 amps, an unrealistic requirement for the usual deep-cycle battery rated at a 75 amp continuous discharge current.

Battery current can be reduced by parallel-connected battery strings. Our assumed 825 lb battery, if made up of 12-volt units, could be connected as two strings of six units each, a total of 12 units. Twelve units each weighing 69 lbs is within our weight limit. Six units, each providing 12 volts, give a nominal 72-volt battery system with a cruise current of 130 amps from each string. We could attain the same result by connecting all 12 units in series and use a 144-volt system, but this will have an effect on motor and controller design. The current is still almost twice the continuous rating and will reduce the range, but is about the best compromise we can achieve.

For accelerating, the motor must develop 25.5 Kw (34 HP) and would draw 177 amps from each parallel string for six seconds to meet the acceleration criteria we have established.

We can now answer the first question. A conversion kit with a 19 Kw (25 HP) motor will move a 2500 lb car at over 60 mph and climb a 17° slope at 11 mph. By using the motor's short-time overload ability to develop 26 Kw (34 HP), we can meet the 0-30 acceleration criteria.

The second question requires an examination of component efficiency. The transmission will be considered first. The usual transaxle used on a front-wheel drive car has an efficiency of 85-95%, depending on design and lubrication. It varies slightly with speed.

Efficiency of the motor is an important consideration. Any motor is most-efficient at rated current, voltage and speed. It is least-efficient at low speeds. The table lists measured values for a 15 Kw, 96 volt, 175 amp, 5000 rpm shunt-wound motor used for the ETV-1:

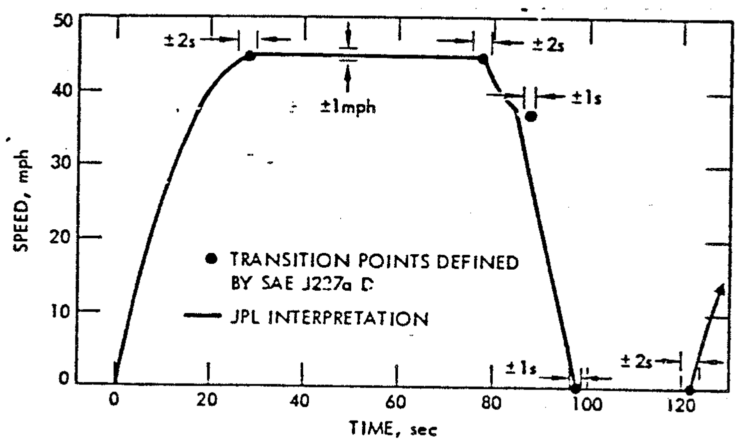
ETV-1 Component Efficiency

(Efficiency %)

Speed-mph	Transaxle	Motor	Controller
25	88	68	92
35	89	86	97
45	92	89	99
55	92	90	99
J-227aD Cycle	92	84	99

Efficiency of the ETV-1 controller remains above 90%.

The cycle driving in the table refers to a standard established by the SAE for testing electric cars. It was developed to represent a typical urban driving situation. REquirements are shown by this speed-time graph.



Next month, we will examine battery supply of the energy required for urban driving and effect on range.

W. H. Shafer
June 20, 1986

IN RESPONSE TO YOUR REQUEST
NASA TECH BRIEF VOL. 9 NO. 2, ITEM 83

COSMIC PROGRAM ABSTRACT

LEW-13927

HEAVY - HYBRID AND ELECTRIC ADVANCED VEHICLE SYSTEMS SIMULATION
(Boeing Computer Services & NASA Lewis Research Center)

The Hybrid and Electric Advanced Vehicle Systems Simulation program, HEAVY, was developed as a flexible tool for evaluating the performance and costs of proposed propulsion systems; HEAVY provides the capability to quickly, conveniently, and economically configure and test a proposed propulsion system at a preliminary level of detail without requiring the user to be a simulation expert. An expandable library of standard components provides the designer with building blocks of prime movers, transmissions, controllers, and other basic components. HEAVY uses the designer specified model to generate a FORTRAN program tailored to the drive train being simulated. The user may enhance a HEAVY generated model by adding FORTRAN statements as desired. A user-oriented simulation capability exercises the user defined model. HEAVY is a design tool that is intended for use early in the design process for concept evaluation, alternative comparison, preliminary design, control and management strategy development, component sizing, and sensitivity studies.

HEAVY models only those characteristics which have a significant impact upon the vehicle's general performance. Propulsion system components are modeled by their steady-state performance, either by algebraic equations or by measured performance maps. Differential equations in the model represent long-term dynamics such as vehicle speed and drive train shaft speed, rather than transients such as drive shaft flexing. This type of simulation consists of a sequence of closely spaced steady-state conditions rather than a true dynamic simulation. Transients are modeled in terms of duration, energy loss, and energy transfer. At each step of simulated time, HEAVY establishes a physically reasonable operating point from which to predict vehicle response during the next time step. Thus, HEAVY is capable of estimating vehicle acceleration and predicting performance under conditions of limited resources such as battery charge or electric motor torque.

The HEAVY standard component library is a collection of predefined and pretested subroutines intended to free the HEAVY user from the necessity of building models of individual vehicle components. The models in the component library contain sufficient detail to be useful in predicting the performance of an electric or hybrid vehicle. They are intended to be used as detailed design tools for a specific component, but represent generic devices. New components may be added to the library and existing components may be modified to add more detail or to reflect improved mathematical models. The capabilities of HEAVY are defined by the contents of the component library and are not constrained by model generation or simulation.

This program is written in FORTRAN IV for batch execution and has been implemented on a CDC CYBER 170 series computer operating under NOS with a central memory requirement of approximately 55K (octal) of 60 bit words. HEAVY was developed in 1981.

Prices in effect through December 31, 1985

LANGUAGE: FORTRAN IV

MACHINE REQUIREMENTS: CDC CYBER 170 Series

PROGRAM SIZE: Approximately 15,400 Source Statements

DISTRIBUTION MEDIA: 9 Track 800 BPI ASCII Card Image Format Magnetic Tape

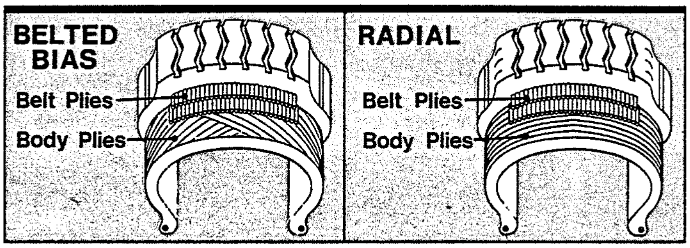
PROGRAM NUMBER: LEW-13927

DOCUMENTATION PRICE: $45.50 PROGRAM PRICE: $2,000.00

TIRES
How to Buy 'em Right and Make 'em Last

Jim Schefter

Can you *read* your tires? Do your eyes glaze over when a sales rep suggests new 60 series tires, perhaps a P225/60R14 instead of your old F78-14?



Is your tire pressure really important, or just another nit in a world already loaded with too many things to think about?

If you answered "No," "Yes," "I don't know," you're a typical driver. And you're putting yourself at unnecessary risk every time you drive your car.

Your tires are one of the most important—and least understood—parts of your car. Yet a few minutes devoted to tire basics now and another few minutes each month spent checking your tires will save you hundreds of dollars, improve your car's ride and handling, and perhaps prevent a nasty accident.

Understanding tire types

There are three kinds of tires—bias, bias belted, and radial. The terms refer to how various layers, or plies, of material are stacked inside the tire. A ***bias tire*** (the cheapest) has two or four layers of material such as polyester, with cords running diagonally across the tire. A ***belted bias tire*** has an extra belt of fabric running completely around the tire under the tread layer. Belted bias tires are often mid-priced and have better wear and traction qualities than bias—and are usually a better buy in the long run.

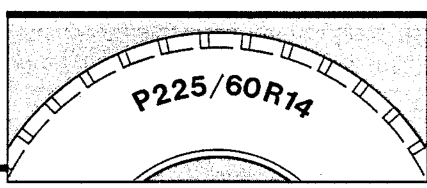
Radial tires are quite different. The body plies of a radial run at a 90-degree angle across the tire. Then from one to three belts, usually made of a steel cord, wrap the tire. A steel belt doesn't make the tire flat-proof, but does make the tread more rigid, which reduces wiggle and increases mileage. Radials also improve your car's handling. They usually are more costly, but last longer.

Although it's best to have all four tires the same, you can have radials on the rear wheels and bias or bias belted on the front. Never mix types on the same axle (except for a temporary spare) or put radials on the front only; that causes odd handling and can lead to an accident.

Snow and all-weather tires come in all three types. They have the words "mud and snow" or "m/s" on the sidewall and have a special tread. All-weather tires generally will get you through all but the heaviest snow and muck and can be used year-round.

Tire care

- Check air pressure frequently, preferably when tires are cool.
- Get new valve stems along with new tires. Old stems can crack and leak.
- Make sure that valve caps are in place. If one is missing, replace it now.
- Inspect tires for cuts, nails, worn spots, and uneven wear.
- If you feel a new shimmy or vibration, check your tires immediately. Even if the problem isn't the tires, it's going to affect them. See a mechanic.



DECODING THE CODES

The confusing code molded into the side of a tire tells a little of what's inside. An important number is the series, which is a percentage called the "aspect ratio." This ratio is determined by dividing the tire's height by its width. The lower the number, the wider the tire's footprint on the road, and the wider the better. That's because traction, acceleration, braking, and handling all improve if there's more tire actually touching the road. Series 50 or 60 tires are intended for high-performance cars or aggressive drivers. Series 70 to 80 are perfect for normal driving and are standard equipment on most new cars.

Several different coding systems are used depending on when the tire was manufactured, with two most common.

Your tire might be coded "F78-14." The beginning letter is an industry rating of the tire's load-carrying ability. "A" is smallest and "F" is midrange; for passenger cars the code goes up to H, which designates tires for use on station wagons. The aspect ratio is designated by the "78," and "14" is the diameter in inches of the wheel the tire is mounted on. This code is being phased out.

The new code adopted by the American tire industry and the one you'll see most provides more data. Under this system a tire might be coded P225/60R14. This code tells us that "P" is a passenger car tire; its width is 225 millimeters. Series is 60. "R" is a radial tire (this letter would be "B" for belted bias and "D" for bias, or diagonal) for a 14-inch wheel.

Such information is important when buying tires. It helps you judge tire performance more accurately. A good sales representative will explain the codes and options for your car, perhaps consulting one or more reference volumes.

Alphabetical Listing By Product Category

BATTERIES, traction

AB Tudor
Accumulatorenfabriken Wilhelm Hagen AG
Accumulatorenwerk Hoppecke-C. Zoellner
Akkumulatorenfabrik-Dr. L. Jungfer
Alco Battery Co.
Allied Electric Vehicle Group
Chloride Group Limited
Chloride Technical
Conde Barao, SARL
Delco-Remy Division
Roberto Diener y CIA, S.A.
Douglas Battery Mfg.
Dunlop Batteries Australia
Eagle-Picher Industries
Electrona S.A.
Energy Development Associates
Exide Battery
Exide Canada Inc.
FIAMM SpA
Fulmen (UK) Ltd.
GNB Batteries
General Battery Corp.
Globe Battery Division
Gottfried Hagen
Hydrocap Corp.
Hi-Tech Batteries Ltd.
Imatra-Paristo OY
Japan Storage Battery
Lucas Chloride EV Systems Ltd.
Oldham Batteries Ltd.
Rolls Battery Engineering
S.A.F.T.
Simon Battery & Research Corp.
Sociedad Espanola del Acumulador Tudor
Surrette Storage Battery Co.
Trojan Battery Co.
VARTA Batteries AG.

BATTERY SEPARATORS

Accumulatorenfabriken Wilhelm Hagen AG
Akkumulatorenfabrik-Dr. L. Jungfer
Amerace Corp.
Celanese Fibers Marketing Co.
Chloride Technical
Evans Products Co.
Facile Technologies, Inc.
W.R. Grace & Co.
National Standard Co.
Oldham Batteries Limited
Texon, Inc.

BIKES, 2 and 3-wheel, scooters

Commuter Vehicles Inc.
Lyman Electric Products
Palmer Industries
Pandora Electric Cycles
Pedalpower
Ragonot

BUSES, 10 or more passengers

Chloride Technical
Daihatsu Motor Co.
Daimier-Benz AG
Hybrid Vehicles
Talbot Motor Co. Ltd.

CARS, passenger

Commuter Vehicles Inc.
Daihatsu Motor Co.
Electric Vehicle Industries
Evelec S.A.
FIAT
Gurgel Industria e Commercio de Vehiculos
HIL Electric Ltd.
Lectra-Matic Automobile Corp.
Lyman Electric Products
Mercury Electric Ltd.
Mini "T" Electric Motor Car Co.
Nissan Motor Co.
Progetti Gestioni Ecologiche
Ragnot
Toyo Kogyo Co.
Unique Mobility
Viniegra Vehiculos Electricos

CHARGERS

C-Cor Electronics Inc.
Hobart Brothers Co.
Lester Electrical of Nebraska
Rolls Battery Engineering

COMPONENTS

AB Tudor
Accumulatorenfabriken Wilhelm Hagen AG
Akkutechnik Ladegerate GmbH & Co.
Allied Electric Vehicle Group
Baldor Electric Co.
F.W. Bell Inc.
Brown Boveri & Cie
Cabelform Ltd.
Chloride Technical
Commuter Vehicles Inc.
Conde Barao SARL
Curtis Instruments Inc.
Curtis Instruments (UK) Ltd.
Daihatsu Motor Co. Ltd.
Dana Corp.
Electric Vehicles Inc.
Electro Automotive
Electrona S.A.
Ellenberger & Poensgen GmbH
Espar Products Inc.
Exide Battery
Flight Systems Inc.
Flight Systems Ltd.
Fulman (UK) Ltd.
GNB Batteries
General Battery Corp.
Germanium Power Devices Corp.
Gottfried Hagen AG
Hydrocap Corp.
Lansing Bagnall (Canada)
Lansing Bagnall Ltd.
Lucas Chloride EV Systems Ltd.
Lyman Electric Products
Mercury Electric Ltd.
Mercury Products
NDC Netzler & Dahlgren Co. AB
PMC
Penta Engineering Co.
Power Functions Engineering Inc.
Progetti Gestioni Ecologiche
Propel Inc.
Ragonot
Reliance Electric
S.A.F.T.
Sevcon
Siemens AG
Sociedad Espanola del Acumulador Tudor S.A.
Ward Leonard Electric Co. Inc.
Westinghouse Electric Corp.

ENGINEERING, RESEARCH & CONSULTANTS

Electric Transportation Management Inc.
Electric Vehicle Consultants
Electric Vehicles, Inc.
GES mbH
William David Lawry
Penta Engineering Co.
Propel, Inc.
Victor Wouk Associates

GOLF CARS

Club Car
Daihatsu Motor Co., Ltd.
Industrias Murrell, S.A.
Mercury Electric Ltd.
Nordco Electric Vehicle
Palmer Sales & Service
Polaris E-Z-GO
Taylor-Dunn
Toyo Kogyo Co., Ltd.

MAINTENANCE EVs, industrial/commercial type

Harbilt Electric Vehicles Ltd.
Lansing Bagnall (Canada)
Lansing Bagnall, Ltd.
Nordco Electric Vehicle
S.I.T.A.
Smith's Electric Vehicles Ltd.
W.&E. Vehicles

TRUCKS, burden carriers, in-plant

Cushman-Outboard Marine Corp.
Daihatsu Motor Co., Ltd.
Harbilt Electric Vehicles Ltd.
Industrias Murrell, S.A.
Kalamazoo Manufacturing Co.
Lansing Bagnall (Canada)
Lansing Bagnall, Ltd.
Lyman Electric Products
Nordco Electric Vehicle
Ransomes Sims & Jefferies Lt
Smith's Electric Vehicles Ltd.
Taylor-Dunn
Toyo Kogyo Co., Ltd.
W.& E. Vehicles

TRUCKS, fork lift

Baker Material Handling Corp.
Conde Barao, SARL
Eaton Corp.
Hyster Co.
Industrias Murrell, S.A.
Lansing Bagnall (Canada)
Lansing Bagnall, Ltd.

TRUCKS, on-the-road

Chloride Technical
Daihatsu Motor Co., Ltd.
Electric Vehicle Industries
FIAT
Grumman Allied Industries
Gurgel Industria e Commercio de Vehiculos
HIL Electric Ltd.
Hybrid Vehicles
Nissan Motor Co. Ltd.
Progetti Gestioni Ecologiche
Rocaboy-Kirchner
Smith's Electric Vehicles Ltd.
Talbot Motor Co. Ltd.
Toyo Kogyo Co., Ltd.
W.&E. Vehicles

VANS, passenger/cargo

Commuter Vehicles
Daihatsu Motor Co., Ltd.
Gurgel Industria e Commercio de Vehiculos
Hybrid Vehicles
Rocaboy-Kirchner
Talbot Motor Co. Ltd.
Unique Mobility

GOLF CART BATTERIES

According to the *BATTERY COUNCIL INTERNATIONAL REPORT*, 95341 golf cart batteries were shipped in October 1985 for replacement and an additional 30882 were shipped for new equipment. This quantity would be adequate to equip about 10,000 *electric cars*.