F.V.E.A.A. NEWSLETTER

MAY 1986

MEETING NOTICE

The next meeting will be friday MAY 23RD at *MID AMERICA FEDERAL SAVINGS* 250 E. Roosevelt Rd. Wheaton, Illinois. - Time - 7:30 P.M. sharp. Guests are welcome and need not be members to attend the meeting.

THE PRES SAYS

EXXON MONEY

No further word on allocation of Exxon money. According to the April 23d Tribune, the Feds have said the funds can't be used for a heating bill welfare program, which should be good news for our request. More discussion on this at the May meeting.

NEXT MEETING

Please note that the May meeting will be the 4TH FRIDAY, MAY 23 AT 7:30 pm. The bank has other needs for the meeting room on our regular meeting night.

The technical discussion will feature another tutorial paper which is a follow-on to April's. It will address factors such as rolling resistance and aerodynamics which affect design requirements and performance.

CONTINUED →

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

FIRST CLASS

ADDRESS CORRECTION
REQUESTED

RAFFLE CAR

Work on the FVEAA "RAFFLE CAR" is progressing well. Thanks to the efforts of John Stockberger, Ken Meyers, Everitt Mitchell, and others, the car is now complete except for a needed set of new batteries. Any ideas for raising the $700 these will cost? I have been unable to title the car with only a Xerox copy of the salvage title. Anyone have the original copy? Preliminary contact has been made with potential raffle partners.

APRIL MEETING

Two questions were raised about the assumptions used in the tutorial paper on acceleration during the April meeting discussion. A copy of the paper is enclosed for those who were unable to attend.

The first question concerned the need for a 4-second, 0-30 MPH capability. This is "pedal-to-the-metal" for conventional family sedans. Members felt it was unnecessarily demanding for the usual driving conditions. Members agreed to make acceleration observations from their everyday driving of conventional cars and report their findings at the May meeting. Those not present at the April discussion are requested to provide similar data.

The second question concerned the assumed 3200 pound weight for a converted EV. Most members thought this was at least 700 pounds too high. Members agreed to have their cars weighed and report curb weight and battery weight at the May meeting.

Member John Newton has skillfully summarized and covered performance calculations on a single sheet of paper which is included.

Bill

HAMFESTS 1986

June 8 — 29 ANNUAL HAMFEST SantaFe Park 91st & Wolf Rd
Hinsdale, Ill. 6:00 AM $3.00

July 12-13 — INDIANAPOLIS HAMFEST Marion County Fairgrounds
I-465 & 174 Indianapolis, Ind. 6:00 AM $5.00

July 13 — HAM & COMPUTERFEST American Legion Ogden & Saratoga
Downers Grove, Ill. 312 964-5529 8:00 AM $3.00

July 27 — BELVIDERE HAMFEST Boone County Fairgrounds
Belvidere, Ill. 8:00 AM $3.00

August 24 — COMMODORE COMPUTERFEST Kane Co. Fairgrounds Randall Rd
St Charles Ill. 898-3066 8:00 AM $5.00

Sept. 14 — B.A.R.S. HAMFEST, SantaFe Park 91st & Wolf Rd.
Hinsdale, Ill. 312 985-0527 8:00 AM $3.00

Sept. 20-21 — SUPERFEST 86 Expo Gardens W. Northmoor Rd.
Peoria, Ill. P.O.Box 3461 Zip 61614 $4.00

Sept. 27-28 — RADIO EXPO Lake County Fairgrounds Rt 45 & 120.
Grayslake, Ill. 6:00 AM $4.00

Oct. 12 — SWAPFEST Waukesha County Expo Ctr. Hwys. FT & J
Waukesha, Wisc. 8:00 AM $3.00

Oct. 18-19 — CONVENTION/HAMFEST Norris Sports Center
St. Charles, Ill. 8:00 AM $4.00

Nov. 2 — HAMFEST Lake Co. Fairgrounds Rts 45 & 120
Grayslake, Ill. 7:00 AM $3.00

Times are when gates open to the public. Prices are 'at gate' prices and may or may not include both days on two day events. Some advance ticket sales may be discounted.

0 to 30 M.P.H.

Acceleration times in seconds. 10 trips - 11.5 miles per trip. Normal rush hour morn. & eve. traffic - suburban driving - speed limits of 30 to 45 MPH. Vehicle - Chev Van V8 gasoline.

21.22	14.31	10.81	11.87	15.22	9.19	9.25	7.12
9.97	11.96	11.03	11.72	8.56	7.63	9.79	6.50
11.91	10.87	8.62	11.69	14.47	9.59	12.35	9.06
16.69	9.35	8.87	11.34	12.53	12.69	14.60	8.63
7.69	8.94	9.97	10.31	12.43	11.75	13.88	12.38
9.78	12.88	6.88	10.81	13.59	9.75	12.44	11.63
10.28	9.28	9.26	12.19	14.87	9.87	10.16	13.63
17.97	11.13	9.43	10.66	18.06	11.34	7.78	9.85
10.84	10.47	12.22	9.03	11.41	13.03	11.75	10.10
7.75	11.44	12.81	8.19	13.88	13.72	10.03	10.47
9.09	10.90	12.03	11.66	14.75	8.10	17.78	13.75
14.56	20.12	15.25	12.59	15.15	10.22	12.81	11.69
11.90	13.66	12.37	18.69	13.79	10.97	10.12	13.66
4.66	11.75	11.82	11.25	10.91	11.19	15.31	13.06
5.65	15.06	12.87	12.81	11.47	13.06	10.91	9.41
4.75	9.87	10.97	22.03	18.10	10.53	5.69	12.78
							13.62

[illegible].56 seconds/129 startups = 11.65 average seconds for 0 - 30 MPH.

PUTTING PERFORMANCE IN YOUR ELECTRIC CAR

April 25, 1986

Most EVs are conversions of conventional cars in which a "surplus" motor, batteries and controller replace the gasoline-related components. The motors that have been used typically operate at 36-48 volts and are limited to 400 amps by the controller capability. The 14-20 Kw of power this combination provides may produce an unsatisfactory accelerating capability. Our past president, Dana Mok, said it succinctly, "I'm tired of people honking at me when the stoplight changes to green". A car salesman will tell your that a vehicle's performance in the first few seconds of driving is an important consideration in a customer's car buying decision.

The purpose of this session is to review the basic factors which relate to acceleration and to determine what is required to provide satisfactory performance. It is based on (Issac) Newton's Law of Motion:

$$\text{Acceleration} = \frac{\text{Force}}{\text{Mass}}$$

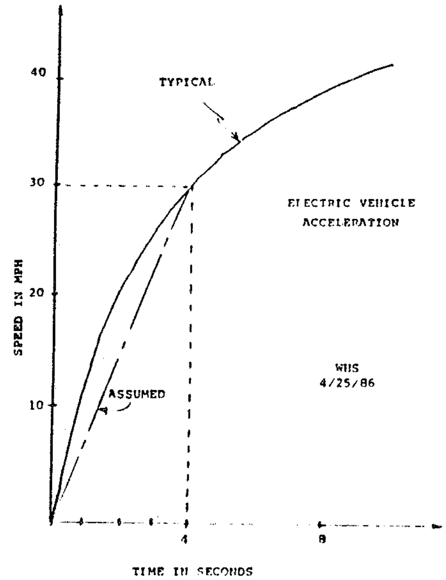
The first parameter to define is the desired acceleration. Zero to X in how many seconds? The electric should be able to match the acceleration of traffic, even if it will not beat the high-performance cars. The time required to go from zero to thirty is a test value used by Popular Science in their monthly car testing program. A listing of some recent values follows:

Car Make Model	Pounds	Seconds Required to Go 0-30	0-40	0-50	0-60
Buick LeSabre	3172	3.59	5.25	7.51	10-70
Mercury Marquis	3818	3.89	5.90	8.55	12.00
Olds Delta 88	3190	3.65	5.37	7.88	11.20
Ford Taurus	3109	3.8	5.7	8.6	11.8
Chevy Celbrity (Eurosport)	2719	3.4	5.2	7.7	10.6
Ford Escort	2080				13.5
Dodge Omni	2094				13.7

From the table and other data, it appears that the electric which is primarily used in urban traffic should be able to go from zero to thirty in about four seconds. This, however, only gives one part of the story. The distance traveled during the acceleration period is another useful value.

For purposes of simplification, we will assume that acceleration is constant from 0-30. This is not quite the case, especially with an electric drive, but using this assumption will avoid using calculus to get an elegant solution.

The velocity-time curve will be:



The distance traveled is the area under the curve which we can calculate by using the familiar triangular area formula:

Distance=0.5 X time X final velocity
= (0.5) (4 seconds) (30 Mph)
= (0.5) (4 seconds) (44 feet per second)
= 88 feet

Zero to thirty in the length of one lot! Can an electric do it?

Next, we will convert the velocity-time curve into an acceleration. This is pretty straightforward because we assumed a constant acceleration over the four seconds. The acceleration is the slope of the velocity-time curve:

$$\text{Average Acceleration} = \frac{\text{final velocity}}{\text{final time}} = \frac{\text{44 feet per second}}{\text{4 seconds}}$$

$$= \text{11 feet per sec-sec}$$

The second parameter to define is the vehicle weight. Most of the car conversions have about 10 batteries, each weighing about 70 pounds. That's a total of 700 pounds of batteries. The battery weight typically makes up 20-25% of the total curb weight of the car. The car weight would be 2800-3500 pounds. Let's assume the conversion weights 3200 pounds.

Referring to the Table on Page 1, we see that the electric has the handicap of pushing around as much weight as the Olds. This makes the job of getting satisfactory acceleration out of an electric hard for all the electrical components; the battery, the controller, and the motor.

Before we can plug the car weight into Newton's equation, we must get it into the proper units. Dividing the weight in pounds by the acceleration of gravity (32 feet per second per second) will give the car's mass which is:

$$\text{Mass} = \frac{3200}{32}\ \frac{\text{pounds}}{\text{feet per sec-sec}}$$

$$= \frac{\text{100 pounds, sec-sec}}{\text{foot}}$$

We can now calculate the force required:

$$\text{Force} = \text{mass X acceleration}$$

$$= \frac{\text{100 pounds, sec-sec}}{\text{foot}} \times \frac{\text{11 feet}}{\text{sec-sec}}$$

$$= \text{1100 pounds}$$

The electric drive system must shove the car with over a half-ton of force to produce the desired acceleration.

Lets now carry this process one step further and calculate the Kw power level required for the acceleration. The 1100 lb. force is applied for 4 seconds, over a distance of 88 feet. Combining these factors, we find:

$$P = \frac{\text{(1100 lb.) (88 feet)}}{\text{4 seconds}} = \frac{\text{24,200 ft.-lbs.}}{\text{sec}}$$

Since one horsepower = 550 ft.-lbs. per second, the power required at the wheels for acceleration is:

$$P = \frac{24,200}{550} = \text{44 horsepower}$$

Also, one horsepower equals 746 watts, so:

$$P = \text{44 horsepower} = (44)(0.746)$$
$$= \text{33 Kw}$$

This is the peak rating of the electric system, neglecting losses, for the acceleration desired.

Compare this with the 14-20 Kw delivered by the usual EV conversion system and you can see why the sluggish acceleration and horn-honking. Incidentally, at 48 volts, the current is 688 amps for 33 Kw.

Next month we will introduce the losses caused by various drive train components that increase the peak rating developed in this session.

W. H. Shafer
4/25/1986

FUNDAMENTALS for the POWERING of a PASSENGER VEHICLE

Six factors are involved in fixing the performance of passenger vehicles--weight, rolling resistance, air resistance, acceleration, gradients from the horizontal and of course propulsive effort of the power source and its transmission. To simplify the calculations involved I have assumed a unit weight of 1000 pounds and have reduced the power unit to force only as the horsepower required weight, resistances due to friction, air, gradients and acceleration are a function only of force and velocity. Simply HORSEPOWER is FORCE X M P H /375. For direct current power supply HORSEPOWER is VOLTS X AMPERES X EFFICIENCY/746. Efficiency of direct current motors and transmissions varies greatly, depending upon the percentage of designed output in volts and amperes and temperature conditions, with an operating range in the general area of 60% for light loads and as high as 90% for the most favorable conditions. Efficiencies can be calculated with an accuracy of 99% for any specific condition.

FOR A 1000 POUND VEHICLE

Rolling Resistance ½ to 2 %	Force = 5 to 20 pounds
Gradient Resistance 1 to 10 %	Force = 10 to 100 pounds
Acceleration MPH PER SEC/SEC from 1 to 10	Force = 11.5 to 115 pounds

FOR OTHER WEIGHTS THESE FORCES ARE DIRECTLY PROPORTIONAL

Air Resistance Varies as the square of the Speed. For a compact assume four horsepower at 40 MPH. Force = 37.5 pounds

EXAMPLE CAR WEIGHT 2500 Pounds

		MPH 40	60	80
Rolling resistance @ 1 %		25 lb	25 lb	25 lb
Air Resistance		37.5 lb	84.5 lb	150 lb
Total		62.5	109.5	175
HORSEPOWER AT WHEELS	=	6.7	17.5	39.5
AT 72 volts, Amperes with 85% eff	=	82	214	482
At 200 Amperes ACCELERATION in MPH/ HR / SEC	=	3.4	0	
AT 200 Amperes Gradient Climbing Ability	=	3½ %	0	

JSN 4/24/86

J. Hampton Barnett reported on TVA's electric vehicle test program at the recent American Power Conference in Chicago. The Electric Power Research Institute established an EV Test Facility in Chattanooga in 1981. Since then, 57 vehicles of 18 different types have been tested. The following tables list vehicle and performance characteristics for 5 different EV's:

TABLE I
SELECTED TEST VEHICLE CHARACTERISTICS

Vehicle	Kubvan	Pickup	Electrica	Transporter	Griffon
Manufacturer	Grumman-Olson	South Coast Technology	Jet Industries	Volkswagen	GM/Bedford
Type	Van	Pickup Truck	Sedan	Bus	Van
Gross Vehicle Weight (lb)	3,200	4,100	3,790	6,779	7,718
Max Payload (lb)	435	760	650	1,744	1,898
Cargo Volume (ft^3)	69	33	16	43	208
Number Passengers	2	2	4	8	3
Motor Rating (hp)	18	24	20	23	54
Battery Model	Exide XPV23-3	Exide XPV23-3	Alco 2200	Hoppecke 3x5PE193	LCEVS EV-5T
System Voltage	84	108	96	144	216
Battery Weight Fraction	0.29	0.29	0.27	0.24	0.32
Regenerative Braking	No	Yes	No	Yes	Yes

TABLE II
SELECTED VEHICLE PERFORMANCE CHARACTERISTICS

	Kubvan	Pickup	Electrica	Transporter	Griffon
Max Speed (mi/h)	53	61	64	44	52
Constant 35 mi/h Range (mi)	32.8	65.3	48.6	46.2	93.4
SAE J227a C Cycle Range (mi)	26.6	28.5	28.5	24.8	64.9
TVA Urban Route Range (mi)	26.6	n/a	21.0	27.0	54.8
Constant 35 mi/h dc Energy Consumption (kWh/mi)	0.28	0.22	0.22	0.31	0.33
SAE J227a C Cycle dc Energy Consumption (kWh/mi)	0.35	0.40	0.32	0.48	0.43
Acceleration Time 0 to 30 mi/h (S)	13.1	12.1	12.6	13.0	11.4

F.V.E.A.A.

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
2	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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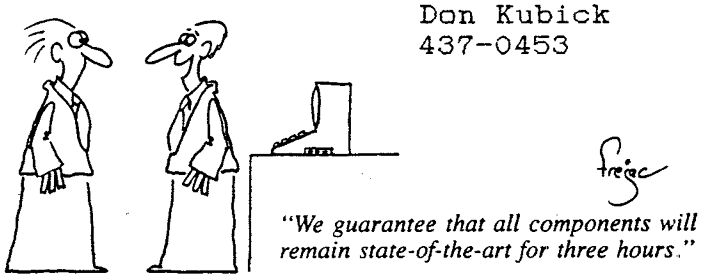
FOR SALE Old oscilliscope Heavy tube type. It works $25.00
Bill Palmer
969-1176

****

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



"We guarantee that all components will remain state-of-the-art for three hours."