Fox Valley Electric Auto Association
1522 Clinton Place
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Address Correction Requested

David B Aarvold
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NEXT MEETING: Friday, September 17 at 7:30 PM at Ed Meyer's hangar, 216 Sunshine Drive in Bolingbrook. See location map in the July Newsletter

DISCUSSION TOPICS - 1. Status of our meeting room request at Triton. . Should the FVEAA become a sponsor of *Bad Amplitude?* 3. Web Page continued discussion. 4. *Performance - Part I*

MEMBERSHIP INFORMATION

Any person interested in electric cars is welcome to join the FVEAA. The cost for a full year's dues is $20 which will entitle the member to receive our monthly Newsletter that contains useful information about electric car components, construction, policies and events.

To obtain information about the FVEAA, you may contact either President Woods or Vice President Shafer:

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September, PRESSEZ

1. Ed Meyer will again roll his Beechcraft out of the hangar so we can have our September meeing at Bolingbrook. Bring your lawn chair, mosquito repellent, and enjoy the coffee.

2. . Ray Oviyach is working on a permanent meeting place at Triton college. Ray retired as head of automotive engineering at Triton.

3. We will continue discussion of possible sponsorship of the dragster. *Bad Amplitude.*

4. Bill will lead a discussion of Part I of the new series; *Putting Performance in your Electric Car* that is included with this Newsletter.

5. I regret the passing of member Vana and urge all members to check their prostates
KEN.

MINUTES OF AUGUST MEETING

The meeting in Ed Meyer's hangar was called to order by President Woods at 7:15. Twelve members and one guest, Arnold Zimmerman, attended.

There were two corrections to the July meeting. Ed Meyer's airplane is a twin **Beechcraft.** The final speed of the dragster was 180 mph, not 130. Minutes approved as corrected.

Treasurer Corel reported $ 2243.77 in the checking account and no change in the savings account. His report was accepted.

Arnie Zimmerman surprised Member Dana Mock by arriving in his experimental aircraft, a *Breezy*. The plane was inspected by members at the break.

The subject of FVEAA affiliation with the National EAA was considered. The members agreed that increasing annual dues to$ 39 was not acceptable. The portion rebated to the FVEAA is insufficient to sustain our monthly Newsletter.

Member John Emde, honorary crew chief for the dragster group, reported on the latest status. A trial run was made at the Joliet Drag Strip. The car had one battery pack, one Kostov motor and a Godzilla controller. During the run, the brush springs that carry about one-third of the motor current overheated and ejected a shower of sparks.

The motor was replaced and the second Kostov also failed. The motors are being rebuilt by Warfield Electric, a motor manufacturer in Frankfort, IL..

Bad Amplitude will not compete in other events until the bugs are worked out.

It was suggested the members could benefit from a meeting held at Warfield Electric where they could observe motor manufacturer. President Woods offered to ask George Hamstra if this could be arranged.

President Woods reported that Member Vana's medical condition was very poor. Editor's Note - Vana subsequently died. Services were held in St. Stanislaus Church on Tuesday.

There was a discussion about the FVEAA Web Page. It might be possible for the FVEAA to have its own Universal Resource Locator (URL). Work would be done by George Hamstra. Further discussion was postponed until George can be present to and provide additional information.

President Woods reported that the FVEAA could arrange to meet at the Lyons Township Hall in Countryside. It would require a letter to and approval by the Township Trustees.

Member Ray Oviyach, retired head of the Auto Technology Department at Triton College, offered to determine if Triton would be willing to provide a classroom there for our monthly meetings at no charge.. It was agreed that an FVEAA affiliation with a community college would be advantageous. A progress report will be given at the September meeting.

Member Ed Meyer offered the use of his hangar for the September meeting.

The meeting was cut short and adjourned at 9:30 PM during a mosquito attack.

From the notes of Bill Shafer

RECENT ARTICLES ABOUT ELECTRIC VEHICLES

The Corbin *Sparrow* was the subject of two articles in Chicago papers and also in Columbus (OH). They were probably written from a Corbin press release. The first mention of this one-person vehicle, a three-wheeler , classed as a motorcycle was published in the June 24 issue of the **Columbus Dispatch** and reviewed in the August FVEAA Newsletter. The second article appeared in the **Chicago Sun-Times** on June 28 and reviews in the July Newsletter. The **Chicago Tribune** on August 8 had an article entitled *Strange Bird.* There was also an article written by Matt Nauman that appeared in the **Knight-Ridder newspapers.** All these articles essentially say the same thing; refer to previous issues of FVEAA Newsletters.

The San Francisco Examiner (Date unknown) had an article on Honda who is expected to sell a 3-cylinder, 2-seater hybrid called the ***Insight.*** *The editor is skeptical about one of the statements made - that hybrids could maybe go one or two thousand miles between gasoline stops!*

Computer-operated cars aren't ready for fast land yet. Columbus Dispatch. This is an article about tests at Ohio State University on cars equipped with experimental electronics that will allow "drivers" to take their hands off the steering wheel when driving on specially-prepared roadways. There is still a long way to go.

Call of the Road: Socket to Me. People Magazine, 8/9/99. Michael Weiss, the star of the TV show *Pretender,* says his Toyota RAV-4EV is a great date-magnet. This vehicle is not yet publicly available. The article notes that California has registered 2465 electric vehicles.

Travel. BC of IL LifeTimes August, 1999. In an article discussion future transportation in Illinois, they note that only about 200 electric vehicles were sold last year out of a total of six million. In the long run, at least a decade, they look forward to fuel cell cars.

Promise of Neighborhood Electric Vehicles is Alluring. Wall Street Journal, June 1, 1999, Page B2. Celebration, Florida may be showing a way to the future of communities. There small electric vehicles, running on restricted-speed special streets, serve most transportation needs of the residents. Vehicles include Global Electric Motors (GEM) of Fargo, North Dakota that sells a model for $ 6000. Neighborhood Electric Vehicles of Vancouver, Canada sells their model for $ 7500. The $ 12,500 Sparrow may be another candidate. Celebration is a planned community near Orlando planned and being built by Disney.

Outside of their protected area, owner's of NEV's do not drive their golf cars and slow-speed electric cars because they don't safely mix with regular traffic.

Supercars: Around the Corner or Running on Empty? Science, July 1999, Page 285. The government-industry *Partnership for a New Generation of Vehicles* (PNGV) has so far spent $ 2-billion since 1993 in development of super-high mileage cars. The objective is to develop vehicles that will get triple the present gas mileage and to reduce energy use and pollution.

RECENT ARTICLES ABOUT ELECTRIC VEHICLES - Concluded

Program critics claim PNGV is on the wrong track by emphasizing direct-injection diesel engines instead of fuel cells. Other say industry, in its own interest, should be doing the job without federal support. Program supporters say it has a better chance of achieving desired goals than increase regulation mandating higher mileage.

Batteries are at the heart of hybrid developments. Varied air flow over a battery may heat up some cells in a battery pack while cooling others. Current battery designs are unlikely to meet requirements according to a report released in April (www.nap.edu/catalog/6485.html)

A following story on Page 682 analyzes fuel cell developments.

An August 1 Press Release from, the Northeast Sustainable Energy Association (NESEA) announces a November 5 workshop on building a Successful EV Program in your School.

FVEAA Web surfers may enjoy visiting the **Volo Auto Museum** web page and look over their collection of antique cars. www.volocars.com. They also note that visitors to the Route 66 dragstrip can sign up for the raffle of a 1970 Olds 42 W30 or $ 50,000 cash to be given away at the end of the racing season. A good reason to go see ***Bad Amplitude.***

FROM OTHER EV NEWSLETTERS

Again this month only two EV Newsletters arrived by deadline date.

EEVC, the Eastern Group in Valley Forge had an article about fuel cell work. Of particular interest was another article about the proposed new automobile electrical standard that will increase the system voltage from 12 to 42 volts. This system is designed to handle 3-5 kw kilowatts of power. Air conditioners and other accessories now driven by a serpentine belt will instead be electrically driven and better controlled. They also had articles about a new theromoacoustic Stiring engine that may achieve a 30% efficiency.

EV News, now Larry Gulick's publication, in the August Executive edition, notes the Postal Service had approve purchase of 500 EV's but needs addition funding authorization for projected purchases in the future of 1000 units in the second year, 1500 in the third, and 3000 in the fourth year. They have also approved purchase of 11,275 flexible fuel vehicles (ffv). Target price for EV's is $ 20,600, the same amount they pay for ffv's.

They report that a NiMH-equipped Ford Ranger ran for 115 miles @ 45 mph on a test track. It has a rated 82.5 miles on the urban driving cycle.

Lockheed-Martin has a patent on a charging system. Voltage measurements of each module are taken by an on-board device during driving. Batteries identified as having low voltage are preferentially charged during regenerative braking. They expect this will lengthen battery life.

PUTTING PERFORMANCE IN YOUR ELECTRIC CAR

INTRODUCTION

Starting torque sells cars. Almost every driver is favorably impressed during a test drive of a new car he is considering purchasing when the gas pedal is floored and he is pressed rearward in the seat. A wimpy acceleration will usually kill a deal.

Acceleration must be able to match that of conventional cars if the driver of an electric car is going to keep up with traffic, Early hobbyists who converted cars used available, economic, hunt-wound aircraft-surplus type starter-generators. Their cars were plagued with slow acceleration and horn-honking by drivers following them.

Electric car range and acceleration will be covered in this Series of Essays. Part I will start off with an overview of range considerations where the fundamentals for powering a passenger vehicle will be presented. We will deal with drag forces that reduce range. Next will come the fundamentals affecting acceleration. In Part II sample calculations will be applied to various components. This will be continued in Part IV Part V will consider battery characteristics. Part VI will examine battery chargers. Part VII will take a look at currently available components for conversion work.

RANGE

Over twenty years of experience has been accumulated with lead-acid batteries and substitutes that included nickel-iron, nickel metal hydride, sodium-sulfur, nickel-cadmium, and a host of other electrochemical combination. These substitutes can store 2-3 times the energy of a lead-acid battery but are many times more expensive.

No battery can approach the energy-storage capability of gasoline. A pound of gasoline stores 115,000 BTU of energy that is used by an engine with an efficiency of about 10%. That leaves 11,500 BTU to move the car. A pound of lead in a battery stores about 1000 BTU available to move the car. The usual range for a converted car using a lead-acid battery pack and driving in the usual urban traffic is less than 50 miles. There have been "tests" that report longer distances, but they are driven at a constant speed, usually 25-40 mph, on a test track. **Be skeptical of range claims and find out what were the test conditions.**

The Federal government and private industry has spent millions of dollars trying to produce an electric car with a range equivalent to a gasoline car. Forget it; an examination of the electrochemical series of candidate battery materials will show this is a quixotic quest.

Persons who have converted cars to electric drive have learned to use them within their range limitation. Car manufacturers don't believe this approach will be acceptable to the public. What is needed is a good public relations campaign, ala the original VW Beetle ads, informing the public that an electric car makes environmental and economic sense.

PERFORMANCE FACTORS

Six factors are involved in fixing the performance of a passenger car. They are; weight, rolling resistance, air resistance, road gradient from horizontal, and propulsive effort from the power source and transmission.

Weight

The most important factor defining vehicle performance is vehicle weight. Most conversions use 12-15 batteries. These can be six, eight, or twelve volt modules, each weighing about 70 pounds. Twelve batteries weigh 840 pounds, fifteen will weigh a half-ton. Battery weight makes up a maximum of 30% of total converted vehicle weight. The curb weight of a typical conversion vehicle will be 2800 to 3500 pounds. For convenience, 3200 pounds will be used for illustration purposes. The ideal weight distribution is a 50-50 split between front and rear wheels.

The following Table on the gives weights for vehicles owned by FVEAA members:

Year	Mfg - Model	Allowed	Converted	L. Front	R. Front	L. Rear	R. Rear
98	Ford Ranger *	5467	4816	1239	1178	1189	1205
86	Dodge Omni	3284	2212	752	655	383	422
90	Nissan Sentra	3117	2971	639	613	877	842
80	Mazda RX-7	3000	2859	715	714	716	714
	Unique Electrek		2650				
	MI Towncar		2700				
	Citicar *		1580				

* As-manufactured. Others are conversions or modified.

Road Load

This is the name given to the rolling resistance caused by friction in bearings and gears plus tires. The flexing of tires under load is the principal element of road load. Road Load is independent of velocity and directly proportional to weight. It typically ranges from 0.5-2% of weight. One way to measure road load is by coast down. In this, the car is allowed to coast in neutral at low speeds on a smooth, level surface. Observe the initial speed, the final speed, and elapsed coast-down time. The Road Load coefficient can then be calculated:

$$Kr = \frac{\text{Initial Speed - Final Speed}}{\text{(Gravity Acceleration)(Elapsed time in Seconds)}} \quad \text{(Feet per Second)}$$

For illustration a 3200 pound car will be assumed. It coasts from 20 to 10 mph (29.3 to 14.7 feet per second) in 30 seconds

$$Kr = \frac{29.3 - 14.7}{(32)(30)} = \frac{14.6}{96} = 0.015$$

The Road Load Force (Fr) for the car is (Kr)(Car Weight) = (0.015)(3200) = 48 pounds

Aerodynamic Drag

The drag is caused when a car is pushed thru the air. It increases as frontal area becomes larger and as the square of velocity. The cars shape in an important factor The easiest way to determine this is to get it from manufacturer's literature. You can also attach a spring scale to a tow line and tow it at various speeds on a smooth, level surface. The force is read from the spring scale at various speeds. Subtracting Road Load will yield drag force.

Drag force isn't much of a factor at usual urban speeds up to about 30 mph as the following table for a 3200 pound car having a frontal area of 10 square feet shows:

	Speed in Miles per Hour				
	20	30	40	50	60
Fd in Pounds	12	27	48	75	180

Hill Climbing

Around Chicago this is not an important factor. There are occasions, however, when it must be considered. Assume our car is on a parking garage ramp with a 30 degree slope. The force required to move the car up the slope can be calculated:

Fh in Pounds = (Car weight)(Sine of Inclination Angle) = 3200 Sine 30 = (3200)(0.5) = 1600

For a 2 % maximum grade on the Interstate System, the hill climbing force would be 112 pounds.

The sum of all forces at the wheel surface for our typical car travelling at a constant 30 mph would be:

$$Fr + Fd = Fh = 48 + 48 + 112 = 208 \text{ pounds}$$

Acceleration

Acceleration is defined by Newton's Second Law of Motion:

$$\text{ACCELERATION} = \frac{\text{FORCE}}{\text{MASS}}$$

Before we can plug the car weight into Newton's Equation the proper units must be used. Dividing the weight by the acceleration of gravity, G, (32 feet per sec-sec) gives the car's mass.

$$\text{MASS} = \frac{3200 \text{ Pounds}}{32 \text{ Feet per sec-sec}} = 100 \text{ Poundals}$$

For an electric car to keep up with urban area traffic, it should be able to equal their acceleration capability. Assume you wish your converted car to go 0-30 in three seconds. This, however gives only one part of the story. We need to calculate the distance traveled in this time. Assuming constant torque during acceleration, a close approximate calculation for distance is :

$$\begin{aligned}\text{DISTANCE} &= (0.5)(\text{TIME})(\text{FINAL VELOCITY}) \\ &= (0.5)(3)(30\text{MPH}) \\ &= 45 \text{ feet, About the width of a typical city lot}\end{aligned}$$

The average acceleration is ten feet per sec-sec.

Volummetric considerations are also important. Where will you place the batteries? The ideal weight distribution is one equally divided between the front and rear wheels. There is limited space in which to install batteries and make connections. There are two usual locations for batteries; in front after the engine is removed and an electric motor is in-place, connected to the transmission.

If you put five batteries in the front under the hood and another seven in the rear trunk space over the rear axle this will give the desired 50-50 front-rear weight distribution. Car handling is affected by a polar moment of inertia where the car tends to rotate about its vertical center point when you abruptly turn.

Another safety factor is the height at which the batteries are installed. They should be kept low to minimize vehicle roll-over if a sharp turn to avoid a collision is made. You can put a battery box in the rear space formerly occupied by the spare tire and gas tank, maintaining sufficient road clearance height so the box will not drag when crossing a driveway gutter. Then you have to decide where the spare tire will be relocated.

A final note; batteries require maintenance. The standard lead-acid battery requires periodic watering so the cell caps should be easy to reach.

William H. Shafer
August 20, 1999