ELECTRIC AUTO ASSOCIATION NEWS

June 1990 Vol. XXII No. 6

The Shape of Things to Go

Automakers turn to high technology in search for a car that is clean, safe------and fun

Students aim to prove they have the fastest solar car in America

A collaborative effort by 45 students ranging from freshmen to graduate students has produced what might be the fastest solar-powered car in the United States.

The test of the Stanford Solar Car Project's design will come this summer, when the small car — dubbed SUnSUrfer — competes in an 1,800-mile race from Orlando to Detroit sponsored by General Motors.

The students have been working on their independent project for 16 months. Helpers were solicited through demonstrations held in White Plaza and through fliers promoting the effort.

In January 1989, the group submitted a 60-page proposal to General Motors and was one of 32 teams chosen to participate in the 1990 GM Sunrayce from July 9 through 20.

A core group of 25 students work at least 30 hours a week on the car, which is housed at a facilities maintenance site on the west edge of campus. More than half of the students are studying engineering, but the group also includes students majoring in history, symbolic systems, and philosophy.

Last summer, team members researched and tested plans for the SUnSUrfer, and in October they decided on a final design.

Early on, students decided that SUnSUrfer would wear the number "100," and in April the Stanford Centennial Committee endorsed the project and matched funds provided by the School of Engineering. The centennial logo will be painted on the car before the summer competition.

Trial and error

Each team member has three jobs. A person must design, raise funds for, and build a particular part of the car.

"We end up doing a great deal of trial and error and then trial again until we get it right — until we get it perfect, in fact," says sophomore Illah Nourbakhsh, a chemistry and computer science major from North Kansas City, Mo., who is design coordinator.

"But in the end we are all experts in our field — not just theoretical experts, but practical experts. You learn a great deal more than you would in a year of class by doing a month of this."

The SUnSUrfer is 3 feet high, 6 feet wide, 20 feet long, and weighs less than 600 pounds. The shell is built with an ultra-lightweight carbon composite that is allegedly stronger than steel.

The back of the car consists of five flat panels, each at a different angle of incidence to the sun to generate the most power.

"It will be less perfectly aerodynamic, but I think the fact that we are so much more efficient solarwise will more than compensate," says undeclared sophomore Jesse Ellenbogen from Nevada City, Calif., who serves as strategy coordinator.

Many of the solar cells were specially designed by electrical engineering Prof. Richard Swanson and are produced only at Stanford's Center for Integrated Systems. Most solar cells convert only 13 to 14 percent of the sun's energy into solar power, but Swanson's cells are 23 percent efficient.

The solar panels also will be covered with one of the most transparent materials available, a coating through which 97 to 98 percent of the sun's light is able to pass.

"We have the world's most efficient solar cell right now," says Nourbakhsh.

Computerized monitoring

A special version of a portable Macintosh SE/30 computer and a convoy of vehicles accompanying the SUnSUrfer will monitor the status of each part of the car during the race.

The topology, average weather, and other precise measurements of the course have been logged into the computer. Four drivers and team members will study these data to develop strategy for the race.

"Our car on paper is better than GM's on paper, and our strategy is probably better than GM's because they did not have these computerized three-dimensional maps," Nourbakhsh says.

Safety was also a consideration when designing the car. There is a "crumple zone" in the front and the back, and the driver, who wears a five-point seat belt, is able to exit the car in less than 15 seconds. The driver is also protected by a rigid composite roll bar.

"The whole idea is to get the car on the road as soon as possible, so we can get a lot of experience under real race conditions," said Ellenbogen.

"Our goal is to win the 1990 GM Sunrayce," says Stefan Heck, a sophomore symbolic systems major from Vienna, Austria, who is project coordinator.

Heck says the acceleration should be better than most standard cars.

"The key problem is the storage system for the energy," Heck adds. The car has a set of 50 batteries because it will not always get the amount of sunlight necessary to maintain a steady speed. In case of rain or clouds, or if the car has to go up a hill, the SUnSUrfer will be able to use stored solar power.

Lack of funds has slowed down the building of the car. The project will cost between $300,000 and $350,000 in materials. GM and the Department of Energy contributed a total of $7,000, which is a "drop in the bucket," according to Canyon Chan, the finance coordinator, who is a junior economics major from West Berlin, N.J.

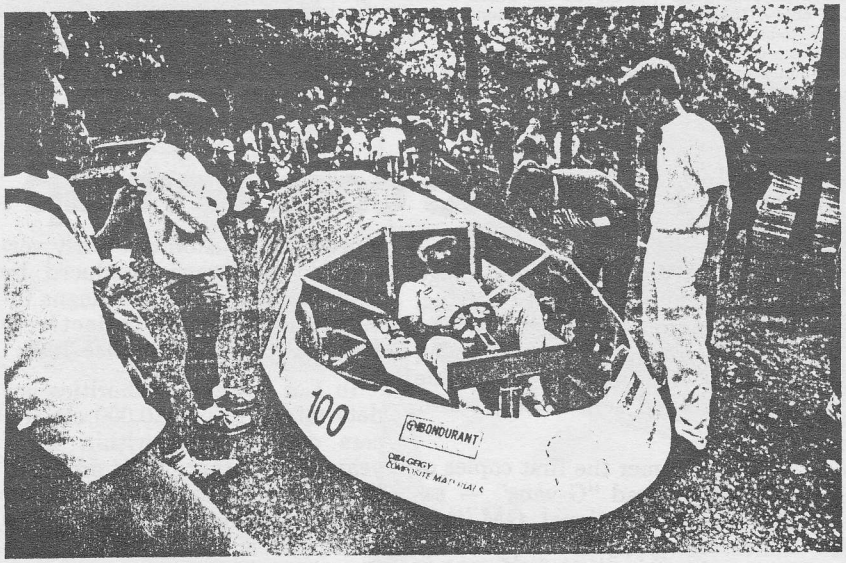
The students so far have raised $175,000.

Some of the materials have been donated by different companies, and the team has gone as far as Switzerland for technical advice and materials. However, Chan says, "now we are at the point where we need cash to keep on going." (The Stanford Solar Car Project can be contacted at P.O. Box 8827, Stanford, CA 94309-8827; [415] 327-9144.)

"What we are trying to prove is that with much less than millions of dollars you can make a car that runs on alternative energy," says Nourbakhsh. "It sounds ridiculous to have a car covered with solar cells, but . . . in the far future it may well be feasible."

If all goes according to plan and if the SUnSUrfer wins the GM Sunrayce this summer, Stanford's team will compete in the 1990 World Solar Challenge in Australia in November.

—Kristin De Voe
News Service student intern



Sixteen months of planning and construction paid off in April when a group of students rolled out their solar car, dubbed SUnSUrfer, for public inspection. Relaxing behind the wheel is head driver Dave Caditz, who will be protected by a shield when he gets started on an 1,800-mile race this summer. Leaning over the car wearing a Stanford sweatshirt is Jay Doherty, in charge of suspension drive train integration. At right is project coordinator Stefan Heck

Automotive Newsfront

By DAN McCOSH Detroit Editor *with Norman S. Mayersohn in Phoenix, David Scott in London, and Brian Nadel*

Western Washington University's Viking XX (1/10 scale model shown here) solar-powered wing car will use a single drive wheel in the near pod. The motor (see inset) uses thinly wound stator to produce 20 hp from a small lightweight package.

Rays of brilliance

"It's a lot like the America's Cup yacht race," says Professor Michael Seal of Western Washington University, describing the level of competition in this July's 11-day Sunrayce USA from Buena Vista, Fla., to the General Motors Technical Center in Warren, Mich. The two top finishers in this GM-sponsored event will be invited to compete in November's Australian solar race. Over the last year and a half Seal and an energetic group of students have been laboring to design, build, and test a solar-powered car to compete with 31 other college teams. "The rules are very restrictive, and winning the Sunrayce will be a matter of working within the rules to the best effect," adds Seal. For instance, a single-seat car is limited to an eight-square-meter (86 square feet) solar collector, while a two-passenger car is allowed an unlimited amount of solar cells on its surface.

That's where the Western Washington team sees an advantage based on the innovative design of the Viking XX solar racer. Their two-seat solar car (photo above) is composed of two pods—a long one with two steerable wheels that houses the silver-zinc batteries, and a second pod to carry the driver, passenger, control equipment, and large drive wheel. The pods are connected by a huge solar-cell array tilted at 15 degrees from horizontal.

The photovoltaic panel's set incline should be ideal for gathering the sun's energy and converting it to electricity while driving with the sun on the left. But will the car run out of juice and slowly wind down when the solar array is in shadow? Seal and his crew anticipated this problem, and the solution is an intriguing aspect of the Viking's design: To keep the solar cells facing the sun, it can travel in either direction equally well and has a steering wheel at both ends of the passenger pod. "At midday we will turn around and run in the other direction to keep the panel aimed toward the sun," explains Seal. Despite jokes about whether the solar car is coming or going and the ever-present problem of running between 75 and 205 miles a day with a back-seat driver, the design allows it to generate 50 percent more power than a typical single-seat entry, but at only a 154-pound weight penalty, says Seal.

And that's the name of the game for a solar race: maximize power generation, minimize weight and power drain. As far as the power-generation side of the equation goes, the Viking's 14.9-square-meter (160.3 square feet) panel has an output of up to two kilowatts of electricity—about the power consumption of a typical apartment or small house— to power the drive motor. Seal estimates that running at a constant speed of 30 mph, this should be good for a 350-mile range on an overcast day, and obviously farther under bright sunlight. With the longest leg of the race being about 200 miles, range will be of less concern than consistently running faster than the pack regardless of weather or terrain. "The Viking XX has a theoretical top speed of 120 miles per hour," says Seal chuckling, knowing that the race has a 55-mph speed limit. To trade some of this unneeded top speed for better acceleration, Seal's group is in the process of changing to a numerically higher final drive ratio.

To keep weight to a minimum, the Viking XX is built on a lightweight carbon fiber honeycomb monocoque shell, and the silicon solar cells are mounted on an aluminum panel. The car weighs 400 pounds, and increases to 748 with both passengers aboard.

Another way to keep the Viking lean and mean was to utilize the Unique Mobility electric motor in the drive train. The rare-earth permanent-magnet brushless motor has a thinly wound stator shaped like a small cup (see photo on page 26) and is rated at 20 horsepower and 13 pound-feet of torque. All this fits in a package 6.4 by 5.25 inches, weighing just 13.5 pounds. This means a power-to-weight ratio of about 1.5 hp per pound and an efficiency of 96 percent, according to Unique Mobility. Early indications are that about half the entries in the Sunrayce will use this motor. Some teams found the motor jerky at low speed, but Seal says that minor modifications to the motor's controller made at the suggestion of Unique's engineers have almost eliminated this problem.

Unique Mobility, based in Englewood, Colo., has put this motor into limited production mostly to supply Sunrayce entries, but the company's eventual goal goes further than the 1,800-mile race. The company plans to produce an electric van based on the redesigned 1991 Chrysler minivan for use in the nation's most smog-ridden metropolitan areas; it will be powered by one motor on each front wheel.

Events like the Sunrayce USA and the Australian solar car race to be held later this year are increasingly important because they push the state of the art and become a proving ground for one of tomorrow's most promising alternate automotive technologies. Says Seal: "We're trying to stay with known engineering principles wherever possible because it will take a reliable car to win this c test. Other than the fact that it' radical car, it's actually quite conv tional." —*B.N.*

Global interest in electric cars revs up

By Curtis A. Moore
Washington Post

Around the world, numerous corporations are showing increasing interest in electric automobiles.

Earlier this year six Japanese manufacturers — including Nissan and Toyota, the country's largest — unveiled electric cars at the Tokyo Auto Show. In addition, BMW, Peugeot and Volkswagen have developed models powered in whole or part by electricity.

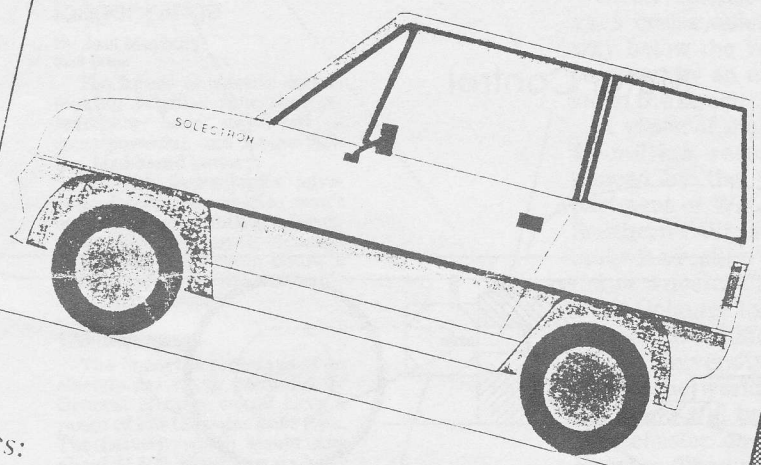
The BMW already has a range of over 100 miles in city driving, and the company's target is to hit a 133-mile range with this model, which is their bottom-of-the-line 325i equipped with sodium sulfur batteries.

Next summer the first copies of battery-powered "G-vans" — essentially conventional GM vans converted to electrical power — will roll off assembly lines, destined for 43 customers. Early versions of the vans, produced by Canadian conglomerate Magna International, have collectively logged 300,000 miles since 1985.

In Los Angeles authorities are determined to put 10,000 electric cars on the road within three years. The author of the program, City Councilman Marvin Braude, says unequivocally: "We're going to ride them, use them and buy them."

Solectria Solar Cars

The Solectria Commuter Car



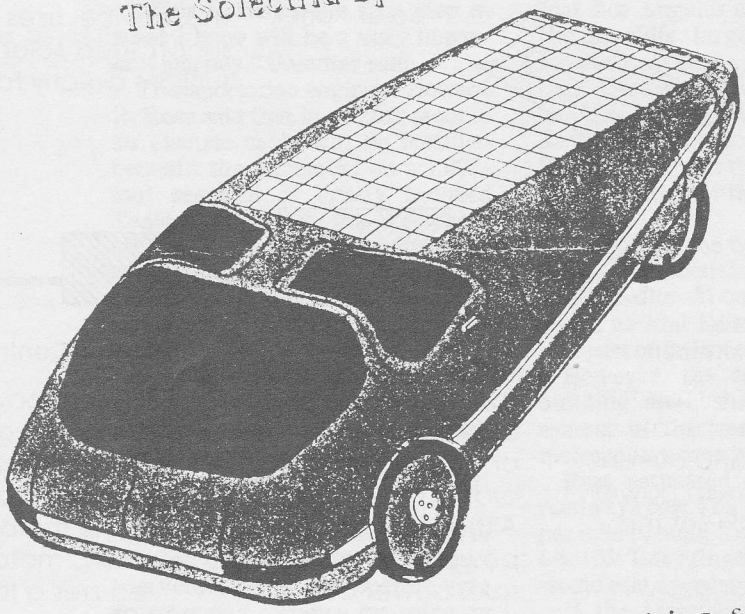
Specs:
Seats two people & luggage; 45 mph cruising speed; 50 mile range per charge; maintenance free; no pollution

The Company

Solectron Corporation is dedicated to the future of our country. As a research oriented company, we have found a means to help end the pollution problem. We now are developing solar assisted electric cars that are clean, efficient, produce no pollution, and which cost pennies to fill up.

Solar-car celebrity wants to start his own company

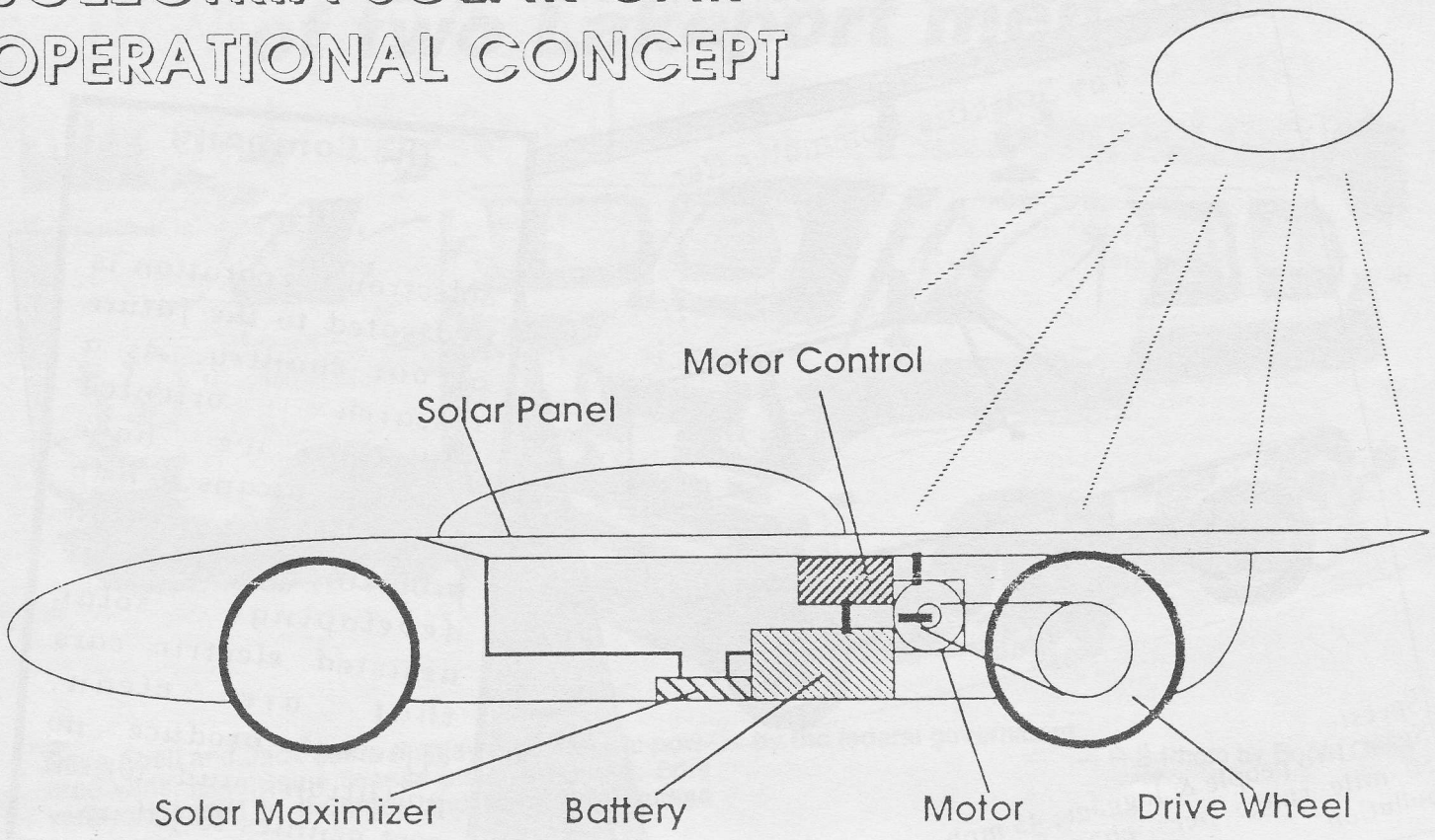
The Solectria Sports Car

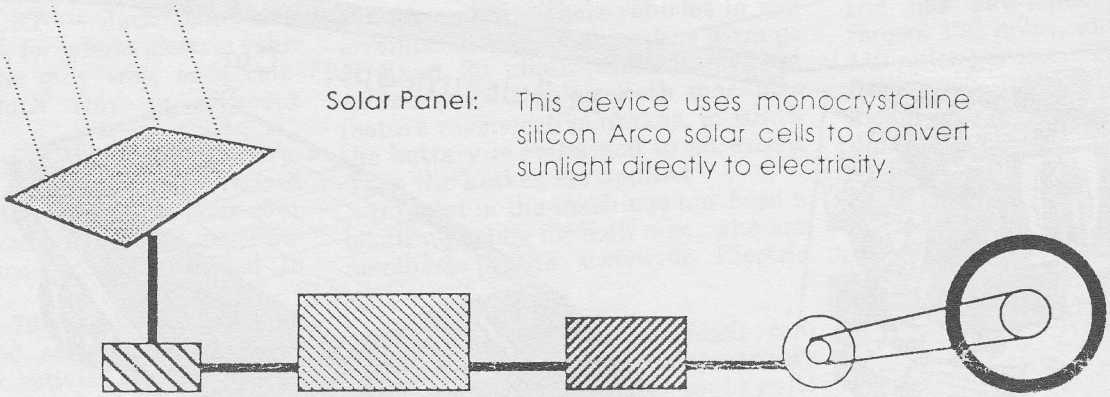


Specs:
Seats two people & luggage; 65 mph cruising speed; 100-200 mile range per charge; maintenance free; no pollution

Solectron Corporation, Solectria Solar Cars, 27 Jason St, Arlington, MA 02174 (617) 646-8303

SOLECTRIA SOLAR CAR OPERATIONAL CONCEPT





Solar Panel: This device uses monocrystalline silicon Arco solar cells to convert sunlight directly to electricity.

Solar Maximizer:

This device finds the optimum operating voltage and current or "maximum power point "(MPP)of the solar cells. This power point changes with light intensity and temperature.

Battery:

The battery can be charged by solar power and/or by regenerative braking from the motor. Although it usually powers the motor, the solar power can also bypass the battery and go directly to the motor. A lightweight and efficient battery is an important part of the solar car.

Motor Control

Efficient power MOSFETs are driven on and off 20,000 times/sec. to precisely control current to the motor. The use of an AC motor also requires a three-phase inverter.

Motor and Drive

The motor is usually a high efficiency permanent magnet AC or DC motor rated at 2-5kW continuous. The drive trair contains the final ratio of motor to drive wheel and can contain a transmission as well.

James D. Worden

Electric cars can run longer

Improved lead-acid batteries promise more power and longer range

By Joel Maybury
Staff writer

The future of electric cars is looking brighter now that researchers have developed a more powerful, and longer-lasting, lead-based battery.

But the technology's advocates know the vehicles won't become popular until the inconvenience of having to recharge the battery for several hours is eliminated and the battery's range is increased.

120-mile range

The Impact, a prototype of an electric car being produced by General Motors, would have a range of 120-125 miles at 55 mph. The battery, which would cost about $1,500, requires a six-hour recharge and would run for about 20,000 miles.

Jerry Mader, president of Electric Vehicle Development Corp. of Cupertino, said the same lead-acid battery exists to produce cars with a top speed of more than 100 mph.

"I think it will be a car that is very attractive to the consumer," Mader said when asked whether he thought people would buy electric vehicles.

"It would be a car you drive in the Bay Area, not one for long distances," he said.

He envisions preferential parking spaces for electric-car users. "I would get the space because my car doesn't pollute," he said. The car would be plugged into a battery charger so it would have enough juice for the trip home.

Mader's remarks came after he addressed the 62nd annual meeting of the Lead Industries Association (LIA) being held in San Francisco on Thursday.

GM starting production

Prototypes of electric cars have been around for years, but the auto makers have never gone forward with mass production. GM three weeks ago announced its decision to produce the Impact. Peugeot and Fiat have said they will market electric passenger cars for private use in Europe.

Mader predicted that thousands of electric cars will be rolling on Bay Area roads by the end of the decade.

"The consumer is saying, 'We want a cleaner environment,' " he said. So a group of utility companies, auto makers and government agencies is responding by jointly funding lead-battery research and development and introducing legislation that promotes electric vehicle use.

Los Angeles Times

Electrified Road Will Be Built in Westchester

THURSDAY, APRIL 19, 1990

By JEFFREY L. RABIN
TIMES STAFF WRITER

Clean electric cars, buses and vans cruise quietly along a roadway below the Westchester Bluffs powered by an electric cable buried in the street.

A vision of the future, yes. But a $2-million research project financed by the Los Angeles Department of Water and Power and Southern California Edison aims to make it a reality.

Los Angeles City Councilwoman Ruth Galanter told a press conference on the bluffs at Loyola Marymount University Wednesday that one of the world's first electrified roadways will be built this year in Westchester on land provided by Maguire Thomas Partners, developers of the Playa Vista project.

Galanter said dependence on gasoline-powered vehicles has created "a terrible mess in the air we breathe." She expressed hope that the experimental electrified roadway will give rise to new technology that will change the way Los Angeles moves and breathes.

"This is really the first step in what I hope will be a very important journey," Galanter said.

Transportation engineer Howard R. Ross said that in coming months an electric cable will be installed beneath the pavement on a 1,000-foot segment of lightly traveled Teale Street, below the Westchester Bluffs. Two electric vans and a passenger bus will be equipped to draw power from the street by tapping a magnetic field created by the electrified roadway.

Ross described the initial $2-million experiment as "simply the down payment on a larger research and development program expected to be carried out over the next four or five years."

The project's goal, Ross said, is to develop commercially viable electric vehicles that can operate over an extended distance by using an electrified roadway to power a motor and simultaneously recharge batteries for travel on ordinary streets.

For the past 100 years, he noted, automobiles have been powered by fossil fuels that pollute the air and deplete natural resources. "We have to get a clean, quiet vehicle that doesn't use petroleum fuels."

Operating out of a former aircraft hangar on the Playa Vista property, which until recently was owned by the estate of industrialist Howard Hughes, Ross hopes to prove that electrified roadways hold promise as a transportation system of the future. "We are civilizing the automobile," he said.

The project has drawn the financial backing of Los Angeles' largest utilities, which are seeking ways to offset air pollution from electric power-generating plants.

"We are at the forefront of an emerging technology," said Eldon A. Cotton, assistant general manager of the Department of Water and Power.

Cotton said the Los Angeles area's "poor air quality is a byproduct of an inefficient transportation system." If electrified roadway technology proves successful, he said that it may be more economical to reduce air pollution through use of electric vehicles than to further tighten emission standards on power plants.

Robert Dietch, Southern California Edison vice president, noted that Los Angeles once had one of the world's largest interurban streetcar systems. But the Red Cars were replaced by freeways, and Los Angeles became dependent on gasoline-powered vehicles. He observed that the area now has the distinction of the dirtiest air in America.

Dietch said the time has come to return to electric transportation. Through its $1-million research grant, he said Edison is "trying to be a part of the solution."

However, the cost of actually building an electrified roadway system in the vast Los Angeles metropolitan area is staggering.

Ross estimated that electrified roadways cost $1.5 million per lane per mile to build. To electrify 3% to 5% of Los Angeles' roadways would cost a whopping $18 billion.

If the technology works, who would pay? The general consensus: business, government and motorists.

"The numbers have to prove out," said Ed Rowe, general manager of the city of Los Angeles Transportation Department. "It has to be profitable to the private sector."

Electric vehicles pride of two Lakeport men

Dave Abell and Jack Sams display their electric-powered vans. Note Sams license plate — Futur 1. Both vans originated in Bermuda and were later studied by the federal government.

— R-B Photo by Bobbi Oliver

By Graham Rayman
R-B staff writer

LAKEPORT — Jack Sams and Dave Abell, for whom electric vehicles are the only way, each celebrated Earth Day in different ways.

The 69-year-old Abell, an irrepressible tinkerer and retired home-builder, mowed his lawn over last weekend with a once gasoline-powered mower he converted to electricity.

Sams, a 79-year-old retired electrician and self-proclaimed environmental activist, was in Santa Rosa with his wife in the Gray Panthers booth, handing out literature protesting oil drilling off the coast of California and changes in national health care problems.

Abell says his "environmental conciousness is more personal, confined to his use of an electricity-powered Subaru mini-van for most of the local travels. "I only use the (gas-powered) pickup for trips to the dump," he said.

Both men use their vehicles to run errands. Abell's machine has a range of about 20 miles, while Sams' can extend out 40 miles. Both machines feature regenerative brakes, in which the battery is recharged to an extent when the brakes are applied.

Interest in the machines has been a longtime hobby for both men, who are members of the statewide Electric Automobile Association. Abell converted two Karmann Ghia sports cars to electric, and says they could go to 70 miles per hour. In past years, he has also built his own electric golf cart and cable car set-up.

The machines run on 18 six-volt "deep cycle" batteries, which emit a low hum when driving, and represent the older line of electric cars. Abell's car takes four hours to regenerate, whereas Sams' needs six-eight hours.

According to Abell, General Electric has developed a vehicle that ranges 120 miles, and hits speeds of 110 miles per hour. The machine goes from 0-60 in eight seconds. That model is in an early production phase.

Electric Van Special Offer

for EAA Members

Electric Vehicles Inc. aquired limitted quantity of US Postal Electric Vans. They will be refurbished and offered for sale to individuals on a first come first serve basis.

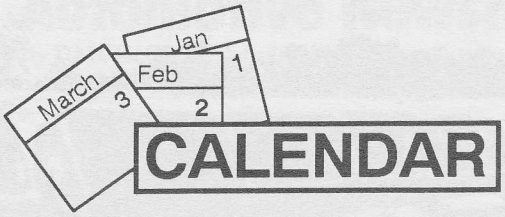
The vehicles were built by Gruman Corp. and delivered to USPS in 1984. They were in postal service untill August 1989.

The vans have aluminum body, VW drive train and Prestolite motor. The 84V battery is on a sliding tray in the center of vehicle. The steering is on the right side. The present top speed is 50 MPH and range approx. 40 miles with new battery. They were charged by large 3 phase 480V off board chargers. EVI will provide upgrades to improve performance and useability of these vehicles. This first uprade will be 240 V single phase on board charger.

This vehicle, fully operational should perform well as a commuter vehicle. It will be sold at very effordable price, estimated at 3.5-4 K$, depending on vehicle condition and selected options. The options will be : new or used battery (one year old), new or used tires, etc., subject to available quantity.

EVI will arrange for service of vehicles within Santa Clara and San Mateo County. If we get enough interest and find somebody willing to service them in East Bay - Oakland, we may make them available there too.

If you are interested please call 415 964 3974 or 415 366 0643 and leave your name and phone #.



June 25-30 Tour de Sol '90 SWITZERLAND

JULY 8-19,1990 GM SUNRACE USA, Orlando,FL to Detroit, MI

WORLD SOLAR CHALLENGE-Due to start in Darwin, Austrila on Sunday November 11 1990. ENERGY PROMOTIONS P.O. BOX 290, Bribie Island Qld. 4507, Australia

Willits Ca. EV Rally Aug. 11 & 12, 1990

Dec. 3-5, 1990 EVS - 10, Hong Kong

125vdc generator on a trailer. Built specifically for Electric Ve Vehical use. Driven by an Onan 18hp gas engine. Includes a 12vdc alternator, rain shield, 4 gallon gas tank, in the vehicle metering, shut off and field adjustment. $900. Call Larry at (206)365-4335

Advertisement Rates: 5 Lines for $5.00 - 1/4 page for $15.00
Full Page for $50.00

EAA Chapters

ARI ZONA: Phoenix
Lee Clouse 602 943 7950
P.O. Box 11371
Phoenix, AZ. 85061

CALIFORNIA
East Bay
Charles Smith 415 525 4434
61 San Mateo Rd.
Berkely, Ca. 94707

North Bay
G. Schaeffer 415 456 9653
211 Ballan Blvd.
San Rafael, Ca. 94901

Peninsula
Jean Bardon 415 355 3060
540 Moana Way
Pacifica, Ca. 94044

Santa Clara
Lee Hemstreet
787 Florales Dr.415 493 5892
Palo Alto, Ca. 94306

San Jose
Don Gillis
5820 Hermes St.
San Jose, Ca 95123
(408)255-5446

Southern Cal-EVA of SC
Ken Koch 714 639 9799
12531 Breezy Wy.
Orange, CA. 92669

TEXAS: Houston
Ken Brancroft 713 729 8668
4301 Kingfisher
Houston, TX. 77035

WASHINGTON: Seattle
Ray Nadreau 206 542-5612
19547 23rd N.W.
Seattle, WA. 98177

WISCONSIN: Milwaukee
Dave Pares 414 481 9655
3251 S. Illinois
Milwaukee, WI. 53207

NEW JERSEY: Hackensack
Kasimir Wysocki 201 342 3684
293 Hudson St.
Hackensack, NJ. 07601

NEW ENGLAND
Bob Batson 508 897 8288
1 Fletcher St.
Maynard, Ma. 01754

VANCOUVER, BC:
VEVA 604 987 6188
543 Poweii St.
Vancouver, BC. V6A 1G8

NON-AFFILIATED GROUPS

CANADA: Ottawa, Ontairo
EVCO
Box 4044 Sta. "E"K1S 5B1
Ottawa, Ontario, Canada

Denver, CO. DEVC
George Gless 303 442 6566

Fox Valley, IL. 312 879 0207
John Stockberger
2S 643 Nelson Lake Rd.
Batavia, IL. 60510

Eastern-EEVC 215 696 5615
P.O. Box 717
Valley Forge, PA. 19482

For information on forming a chapter in your area write to the address below or phone between 10AM-5PM Pacific Time 415 591 6698

EDITORS: JOHN NEWELL-BILL PALMER-PAUL BRASCH-E.W. AMES
Send your chapter news, coming events, articles to the address below

ELECTRIC AUTO NEWS

EAA

1249 Lane Street
Belmont, Ca. 94002 **ASSOCIATION**

June 1990

NON-PROFIT
ORGANIZATION
U.S. POSTAGE
P A I D
SUNNYVALE. CA.
PERMIT NO. 420

Forwarding and Return Postage Guaranteed, Address Corection Requested

TIME DATED MATERIAL-PLEASE DO NOT HOLD