

# SHOWTIMES

ETIC 2001

WEDNESDAY, DECEMBER 12, 2001



**THE EVAA**  
Electric Transportation Industry  
Conference



## Enter the Natrium

DaimlerChrysler will unveil its new Natrium fuel cell vehicle here at 10:00 this morning.

## Honda's Civic Hybrid

Honda reveals how it's boosting regenerative effect by tweaking engine valve function in its new four-seat hybrid vehicle.

—More on Page 5

## The EC Acts

Europeans draft ambitious agenda for a hydrogen future, targeting millions of vehicles over the coming decades. EC commits to buying dozens of DaimlerChrysler fuel cell buses for two-year trials in ten cities.

—More on Page 8

## The Momentum is Building

'The technology is getting closer,' Ballard chief Firoz Rasul says of fuel cells, and more people are committing to it.

—More on Page 9



CONVENTION & TRADESHOW NEWS



Some of the EVAA board and staff reveling at the ETIC 2001 reception Tuesday evening: Ed Kjaer, Ray Geddes, Robert Bienenfeld, Gail Hendrickson, John Wallace, Don Francis, Frank Ingriselli, Kateri Callahan, Mike McCabe, Ed LaRocque.

## Let the ETIC 2001 Show Begin

The Electric Transportation Industry Conference got underway in earnest yesterday evening at a reception in the exhibit hall here.

ChevronTexaco, here in Sacramento with an ETIC 2001 exhibit encompassing technology partner ECD-Ovonic, sponsored the reception.

ETIC 2001 is expected to be the largest display of electric vehicle technologies ever in the U.S. There are 62 exhibiting companies.

"In July we increased the exhibition hall in the Sacramento Convention Center to 20,000 square feet in

order to accommodate the significant demand for space from EV industry suppliers," said Kateri Callahan, executive director of the Washington, DC-based Electric Vehicle Association of the Americas.

"The ETI Conference exhibition reflects the expansion and continuing growth of the electric transportation technology industry," said Mike McCabe of the Ford Th!nk Group. "There is no other fuel cell, hybrid and battery electric vehicle conference that is as encompassing, exciting and educational as the ETI Conference." McCabe chairs the EVAA conference committee.

## Sacramento, Here We Come!

AC Propulsion's battery electric Toyota RAV4-EV made it from Southern California to ETIC 2001 without stopping to charge. The trailer has a Kawasaki-engined generator designed by AC Propulsion, effectively making it a hybrid electric vehicle. A Volkswagen Beetle with AC's new Gen II AC-150 drivetrain was similarly driven to the show.

AC electronic components and a Volkswagen engine will be incorporated into a Volkswagen Jetta sedan as part of a California Air Resources Board-backed project. The resulting hybrid will have an all-electric zero-emission mode. It will also be capable of running on low pressure, piped natural gas when parked, and supplying power from vehicle-to-grid (V2G).—More on Page 11



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TO SEE WHAT THE RAV4 EV AND PRIUS ARE TRYING TO DO FOR THE ENVIRONMENT, LIFT HERE.





## SHOWTIMES

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# Delegates Welcomed to ETIC, Preeminent EV Industry Event

*Eugene Zeltmann, co-chairman of the Electric Vehicle Association of the Americas, welcomes the delegates to the Electric Transportation Industry Conference.*

Dear ETI Conference Delegates and Exhibitors:

On behalf of the members of the EVAA, your conference hosts, I extend a hearty "Welcome!" and I thank you for choosing to join us for this important event.

We are pleased and very excited about this year's conference; it is a "first" for our organization in that the conference proceedings, exhibition hall and "Ride'n'Drive" now encompasses all modes of electric transportation from commercially available battery and hybrid electric vehicles to the fuel cell electric vehicles of tomorrow. The large number and diversity of products on display and available to you for this Friday evidences the tremendous growth of the

movement towards modes of personal transportation that can free us from reliance on insecure and finite supplies of foreign oil.

In so many important respects, the location of this conference serves to underscore the vital need of this country to find cleaner, more abundant and more secure fuels for our transportation network. California stands as the most populous state in the Nation, represents the largest automotive market, and consumes more petroleum than any other state. California also struggles to meet federal air quality standards and cannot do so without a paradigm shift in the way that people and goods are moved throughout the state. California state officials recognize the connection between air quality and transportation and have helped to spur the transition



EVAA co-chair & NYPA president Zeltmann.

to use of electric drive technologies. And, policy makers in this state, as elsewhere around the country and in our Nation's Capitol are waking up to the potentially dire consequences of continuing to rely on petroleum to move people and goods.

For an economy so dependent upon transportation, the fact that more than one-half of the oil we consume is imported, much of it from that part of the world where we are now engaged in war, ought to be truly alarming. Staying on this dangerous course will result in the import of more than 60 percent of the oil we will need in less than twenty years. We must transition the country's biggest consumer of foreign oil – the transportation sector – to other fuels. Electricity is an attractive, abundant and domestically-available fuel that is itself generated from a variety of U.S. resources. If we are looking, as I believe we must, to lessen our dependency on foreign oil then we need to look toward electricity.

No one ever assumed that transitioning away from oil and to the next generation of personal and mass transportation would be easy. But, the promise of electric transportation, using domestic energy resources, yielding greater distances per unit of energy used and emitting far less or zero emissions, is worthy of a national and international commitment. Your attendance at the conference is evidence that we'll succeed together in this transformation effort.

Happy holidays and, again, thank you for your attendance.

*Eugene Zeltmann is chairman of the New York Power Authority.*

## Walk the Walk, Says Sperling of ITS

Today's high-sounding talk of a cleaner and more efficient transportation future will come to naught without a stronger commitment to education, says Dan Sperling, director of the Institute of Transportation Studies at the University of California at nearby Davis.

"Without a stronger commitment today to education in the area of clean transportation systems and vehicle technologies there will be a shortage of leaders and engineers to guide tech-

nology and policy development tomorrow," Sperling says.

"We talk about the next generation of vehicles, but who is going to build and design them?"

"There's a real concern," Sperling warns, "that universities are neither creating a knowledge base in fuel cell and clean-vehicle science and engineering, nor training engineers and policy makers who can encourage and guide the wise development of the clean-vehicle industry."

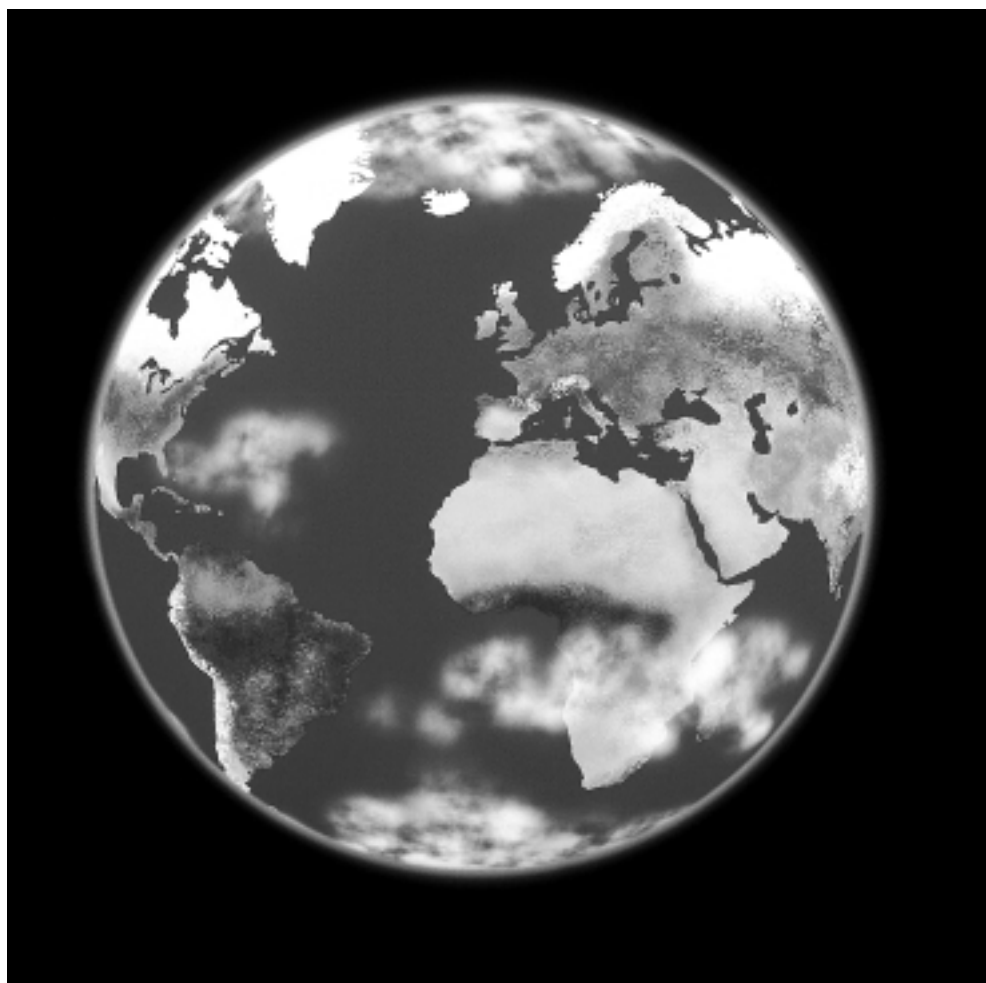
Congress has actually stopped funding the Energy Department's GATE (for Graduate Automotive Technology Education) program that was established in 1998 for advanced technology vehicle development, ITS says.

UC Davis graduates the most students in the field, but the numbers are few. This year, approximately 50 graduate students are working in a variety of interdisciplinary transportation fields there, and about 20 undergraduates become directly involved in these research projects as well.

Sperling will make his case at a press briefing here today.



ITS director Dan Sperling asks, 'Who will design the clean cars?'



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## Plugging Plug-Ins: EPRI Pushes Ahead

EPRI, still widely known as the Electric Power Research Institute, is promoting plug-in hybrid EVs as a viable means of cutting oil use and reducing pollution.

Studies show that consumers like the idea of an HEV with an all-electric, zero emission mode, EPRI says, conceding that automakers are reluctant to commit to the technology.

Only one has: France's Renault, which is launching a plug-in HEV called the Kangoo.

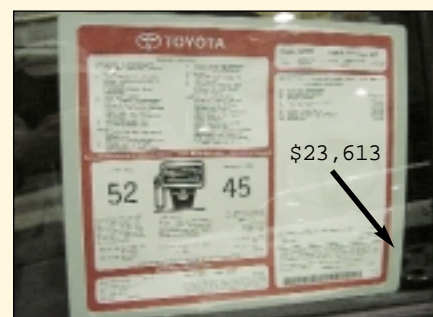
"Phase I told us plug-ins could work," EPRI transportation manager Bob Graham says in reference to an EPRI effort completed earlier this year.

The study found that a mid-size plug-in HEV with a 60-mile all-electric range, fully charged every night, could decrease energy use, and smog-forming and carbon dioxide emissions, by half.

Such a vehicle could reduce petroleum consumption by more than 75%, Graham says, when compared to an internal combustion engine vehicle meeting California's SULEV standard.

EPRI will focus on determining which plug-in hybrid electric vehicle configurations and technologies generate the maximum market interest.

"We believe this additional data from Phase II will answer any concerns that automakers may have," says Graham. "We know plug-in hybrids offer the best near-term solution to meet our environmental and health goals, and we think the next phase will show us a pathway to meet those goals at an acceptable cost."



Sticker price of a Prius is just \$23,613.00.

## Prius Is Said Profitable

It's not true that hybrids are too expensive for the mass market, says Toyota engineer and managing director Hiroyuki Watanabe.

"If we look at the entire Prius model cycle, it is profitable," Watanabe told *ShowTimes*.

"We produce more than 3,000 Priuses per month," he says. "The new Prius showed that we could reduce costs even faster than we originally thought."

"The new Prius contributes significantly to our corporate profits."



# Cylinders on Honda's New Civic Hybrid Shut Down to Improve Its Regen Power

Honda's big splash at ETIC 2001 is the gasoline-fueled but electrically assisted Civic Hybrid, which is being given its first public airing in the U.S. and is indeed available for the ride-and-drive here.

The vehicle follows on the heels of Honda's Insight, a two-seat hybrid, approximately 8,500 of which have been sold.

Honda has improved the IMA (for Integrated Motor Assist) system on the new hybrid, resulting in greater availability of power gleaned from the vehicle's regenerative braking, says Honda advanced technology vehicles specialist Steve Ellis.

When the vehicle slows, the new IMA's cylinder idling feature kicks in, closing the valves of three of the engine's four cylinders. That reduces the engine's braking power, making more power available for the regen system.

The Civic hybrid will have a 1.3-liter engine but will have the performance of a normal Civic

with a 1.7-liter engine. As on the two-seat Insight, power is stored in a nickel metal hydride battery pack.

The Civic Hybrid will be available with a standard transmission or with automatic CVT, for continuously variable transmission.

Honda is targeting a retail sales price of about \$20,000 for the new five-seat hybrid, which is to be available next year.

Honda is showing two fuel cell vehicles here, both based on the discontinued EV Plus, a battery EV. The FCX-V3 has a Honda-developed fuel cell while the FCX-V4 has a fuel cell from Canada's Ballard Power Systems, with what Ellis calls improved component "packaging."



*Honda's Insight hybrid, under the hood... Next year there'll be a four-seat Civic.*

Honda has made no disclosures as to how it will meet the California's zero emission vehicles sales mandate for model year 2003, other than to note that its Civic GX, a dedicated compressed natural gas-fueled vehicle, is the first to qualify for partial ZEV credits as an ATP, or advanced Technology Product car, and will thus contribute to Honda's mandate obligations.

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EVAA Booth 314**



Neighborhood Electric Vehicles on parade entering the exhibition hall here at ETIC.

## NEVs Could Satisfy Fleet AFV Buy Rules

There's a move afoot to amend 1992's National Energy Policy Act to allow neighborhood EVs to receive credit as alternative fuel vehicles.

EPA rules require federal and government fleet operators to buy increasing numbers of AFVs.

"When EPA was passed in 1992, NEVs didn't meet the definition of automobile," explains Jim Francfort, technical program manager of the U.S. Department of Energy's Field Operations Program. But times are a-changing.

Manufacturers also are encouraging the California Air Resources Board to provide incentive money for NEVs.

While neither scenario currently exists, NEVs are closer to meeting criteria for EPA credit or CARB incentive money if they participate in the Field Operations Program's performance testing program. Now called NEV America, (formerly EV America) the program's purpose is to ensure a baseline standard for performance, to avoid the "buyer beware" problems that can occur in young technology industries.

Phoenix-based Electric Transportation Applications conducts the tests under contract with DoE.

The NEV class of vehicles requires different tests than those used for full-function EVs, Francfort says. Full-function EVs met performance goals at constant speeds of 45 m.p.h., 60 m.p.h. and on a dynamometer drive cycle. NEVs are tested at a constant speed of 25 m.p.h. The program also is developing test procedures for urban electrics.

Eleven NEVs made by four manufacturers will be tested in coming weeks, Francfort says.

"The manufacturers who have chosen to do testing are doing so to demonstrate – by a third party – their vehicle performance and capabilities," he says.

While that doesn't ensure they'll qualify for EPA credit or CARB incentive funds, previous experience shows that this procedure helps pave the way. EV America testing was one of several criteria that CARB and DoE used to determine full-function EV incentives.

## Mid-Del Targets Training Mart

Mid-Del Technology Center offers a range of EV training services, boasting a fast-developing new specialty in airport ground support equipment technician training as airport GSE fast emerges as a major – and commercially viable – EV market sector.

The Oklahoma City organization recently took delivery of a 66-passenger Blue Bird school bus with a 220-kilowatt AC induction drive,

regenerative braking, and sealed lead acid batteries with thermal management and onboard charger.

The bus will be used both for training and for transporting students.

Mid-Del's Electric Center of Technology is said to be the only Automotive Service Excellence-certified EV training facility in the U.S.

Mid-Del is developing a technician course for fuel cell vehicles, too.

## SNAPSHOTS

### New, Fluid Hydrogen Carrier

Eatontown, NJ-based Millennium Cell (Booth 419) is promoting "Hydrogen On Demand" as a new way of providing the elemental fuel for fuel cells — or internal combustion engines. The process stores hydrogen in a solution of sodium borohydride, described as "a benign, non-flammable solution that combusts only when exposed to a patented catalyst" — likewise developed by Millennium Cell. The water-based solution is said to generate the same amount of energy per gallon as gasoline. Millennium Cell has already disclosed development deals with Ford and Peugeot, the latter to apply to a prototype fuel cell taxi. "We believe our Hydrogen on Demand fuel system provides important range extending technology in a very compact package that no other hydrogen storage alternative can provide," says transportation business development VP Rex Luzader. Steve Tang is Millennium Cell CEO.



### Bigger Digs for Solectria

Solectria (Booth 122) has relocated from Wilmington, MA to a new facility in nearby Woburn. The 75,000-square-foot facility more than triples the company's workspace, while affording better electrical service and shipping facilities.

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Woburn, MA 01801 USA  
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### 'Accurate & Unbiased' Info

The U.S. Energy Department of Energy's Field Operations Program (Idaho Falls, ID and Golden, CO; Booth 417 here) is promoting evaluation services of advanced technology vehicles for fleet managers and other potential users, promising "accurate and unbiased information on vehicle performance." ATVs are subjected to baseline, accelerated reliability and fleet testing, with results made available on the web and in the form of vehicle fact sheets, summary reports, and survey results. More than 200 light-duty ATVs, including neighborhood, hybrid and hydrogen vehicles, are being evaluated during this fiscal year, DoE says.

### Connecticut's UTC Fuel Cells

United Technologies Corp last week rechristened its fuel cells unit, and now calls the South Windsor, CT-based operation UTC Fuel Cells. The company, formerly known as International Fuel Cells, claims to have been the first to commercialize fuel cells for stationary applications. It has vehicle projects and partnerships with organizations including Hyundai (for the Santa Fe SUV), Thor Industries (for a developmental El Dorado Bus), and Shell Hydrogen (for hydrogen generation).



## CENTER STAGE

# Enova Systems Sets Strategic Alliances

**Carl Dean Perry**  
**CEO & President**  
**Enova Systems, Inc.**

Torrance, CA-based Enova Systems is forging ahead with a series of alliances with automakers on the sales end and experienced component producers on the supply end for the development and production of electric vehicle drivetrains.

"We're a company that's aggressively continuing in research and development into hybrid and fuel cell vehicles," says Enova president and CEO, Carl Dean Perry. Enova handles drivetrains for battery EVs too.

Enova drivetrains range from 10-kilowatt units for small vehicles to 240-kW drives for heavy vehicles.



Enova has designed hardware for battery, fuel cell and hybrid electric versions of Hyundai's Santa Fe SUV, which is key to its commercialization plans.

The latest alliance is with Ford's Th!nk Group, as Enova has agreed to help develop a high-power, high-voltage conversion module for a new Ford fuel cell vehicle.

Ford may also take up to 4.6% of the outstanding Enova stock.

Enova designed the controller for the Ford's new Th!nk City too, a battery EV that will be commercially available in the U.S. next year. It also supplied the drive for Hyundai's award-winning fuel cell-powered Santa Fe, as well as developmental hybrid versions of the Hyundai SUV.

In larger vehicles, Enova is working with Ireland's WrightBus, which is developing a low-floor hybrid electric bus with a fuel-fired Capstone turbine.

"The Enova strategy is to do all the design and development and low-rate production," says Perry. "We are outsourcing our high-volume manufacturing." Enova's drivetrain component



Carl Perry shows an Enova battery control unit to President Bush at a DoE meeting earlier this year. Energy Secretary Spencer Abraham (center) looks on.

manufacturing partners include QS-9000-certified Hyundai Autonet, a unit of Hyundai Electronics, for the Th!nk City controller, and Hyundai Heavy Industries (which also holds QS-9000 certification) for electric Santa Fe SUV componentry.

Enova is working with British transmission specialist Ricardo on gear reduction units for the 240-kW Wright buses.

Ed Moore is Enova sales VP. Dr. Abas Goodarzi is technology director.

## Maxwell's Showing the TC2700, A Better Ultracapacitor Module

Maxwell Technologies is giving ETIC 2001 attendees a glimpse of its new TC2700 ultracapacitor module at Booth 223.

"This new cell will be more geared towards transportation," says Maxwell applications engineer Bobby Maher.

The TC2700's capacity is 2,700 farads, Maher says, and as such is an 8% improvement over the PC2500s used in existing versions of transit buses with GM-Allison hybrid drivetrains.

California's Orange County Transportation Authority is testing 40-foot New Flyer buses with a GM-Allison drivetrain and Maxwell's PowerCache brand PC2500 ultracapacitors.

Ultracapacitors are said to be better than batteries for holding the regenerative brake-derived power that's the key to a hybrid

vehicle's efficiency. Lead acid batteries, though cheap to buy, don't last when used in hybrids. New York City Transit, which has committed to the purchase of several hundred hybrid electric buses with drivetrains from BAE Systems, is working to evaluate Maxwell ultracapacitors in lieu of lead acid batteries in at least one of original test vehicles.

Mass production on the order of a million units should drop the price of a TC2700 module to about \$30, or just a little more than a penny a farad, says Maher. The PC2500s for the OCTA buses cost about \$175 apiece, and each bus has 500, Maxwell said early this year.

Depending on size, power and capabilities, a hybrid electric automobile could have as few as 20 ultracapacitor modules.



## Ford Plans 2003 Hybrid Escape SUV

Ford is planning to offer a hybrid electric version of its Escape sport utility vehicle in 2003.

The vehicle will have a new transaxle developed in league with Volvo and with Aichi, Japan-based Aisin AW. It'll have a 2.3-liter, Atkinson-tuned engine yielding V-6-like performance.

Regenerative braking will afford city mileage of nearly 40 miles per gallon, Ford says, promising range

in excess of 500 miles on a single tank of gasoline.

The Escape SUV will have a 65-kilowatt permanent magnetic electric motor and 28-kilowatt generator, as well as a 300-volt, 45-kilowatt, air-cooled nickel-metal hydride traction battery pack and controller, from Japan's Sanyo Electric.

That's a model year 2002 Escape SUV 4X4, shown above.

# EC Drafts an H Plan: Millions of Vehicles

The European Commission has drafted plans for an ambitious transition to a zero emission hydrogen economy, figuring to have hydrogen fuel 2% of all European vehicles by 2015 and in 5% by 2020.

The idea is to use clean alternative fuel vehicles, including natural gas vehicles, as a bridge to hydrogen. The NGVs will use natural gas

from conventional sources and from biomass.

The EC is targeting 2% NGVs by 2010 and 5% by 2015, leading to 10% in 2020.

Deserving no small credit for the policy is the Amsterdam-based European Natural Gas Vehicle Association. ENGVA is headed by Jeff Seisler, who also founded the Natural Gas Vehicle Coalition in Washington.

ENGVA embraced hydrogen, especially as derived from natural gas (the principal component of which is methane, or CH<sub>4</sub>) as part of its charter at its annual meeting in Sweden earlier this year.

"We cannot, of course, claim responsibility for the final development of this directive," Seisler said last month. But the ENGVA chief, who has shared views with the EV industry at meetings including 1998's EVS-15 in Brussels, also said, "We feel that our work over the past seven and a half years has contributed substantially to many of the concepts and issues that have appeared in the directive, and that now will be debated by the Commission, Parliament and European Council."

"It's going to take a lot of focused work on the part of government and the other stakeholders to create the economic environment to make the targets a reality," Seisler said.



Seisler: ENGVA advocates hydrogen.

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PC100	2.5	2.7	100	125	34.3 x 58 x 17.9
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PC2500	2.5	2.7	2500	1800	161 x 62 x 61.5

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European cities to test 30 Citaro fuel cell buses.

## EC Signs Citaro Contract

The European Commission late last month made formal its pending order for fuel cell buses to be tested in various cities. 30 buses will be tested, in groups of three, on regular routes under normal operating conditions, for at least two years in Amsterdam, Madrid, Barcelona, Hamburg, Stuttgart, London, Luxembourg, Stockholm, Porto (Portugal), and Reykjavik (Iceland).

The EC is helping fund 27 of the buses (excluding Iceland) to the tune of approximately 18 million euros, or about \$16.1 million at current rates of exchange.

The hydrogen-fueled 'Citaro' vehicles will be supplied by DaimlerChrysler subsidiary EvoBus GmbH.

They will have Ballard's new Mark 902 fuel cell stacks packaged by Ballard subsidiary Xcellsis.

DaimlerChrysler has said that the fuel cell buses are to be priced at 1.25 million euros apiece, or about \$1.1 million U.S.

Fuel cell Citaro deliveries are now scheduled to start in early 2003.



## CENTER STAGE

# Ballard Power Is Spreading Its Wings

**Firoz Rasul, President & CEO**

## Ballard Power Systems

"The technology is getting closer," says Firoz Rasul. "More people are recognizing its benefits and are beginning to sign up."

Rasul is chairman and CEO of Vancouver-based Ballard Power Systems (Booth 101 here)



Ballard president Rasul.

and the technology, of course, is the proton exchange membrane fuel cell and its promise of zero-emission transportation future.

Ballard, with the backing of DaimlerChrysler and Ford (and a record of having sold fuel cells to GM, Honda, Nissan, Volkswagen, and others) has emerged as the de facto industry leader.

"Our goal is to commercialize these technologies and be a viable, profitable business," Rasul says. Ballard is banking on a sea change, on the

automotive industry's moving away from the internal combustion engine that, after decades of trial and error, emerged as the dominant replacement for the horse some 80 years ago.

Rasul points to the example of the jet engine, which he says took 15 to 17 years after its 1950s introduction to claim 80% of the market. A new fuel infrastructure was necessary, as is the case with fuel cells, and so were changes to the design and structure of aircraft, a situation that roughly parallels that of ground vehicles today.

Ballard has meanwhile gotten a new infusion of money from its OEM partners, with Ford placing an order for \$49.3 million worth of fuel cell engines and related engineering and support services, and DaimlerChrysler and Ford raising their Ballard stakes to 23.6 percent and 19.5 percent, respectively, up from 18.0 percent and 13.5



Ballard-powered ZeBus has finished service trials at SunLine Transit.

percent. As part of that transaction, Ballard has taken over the Ecostar electric drivetrain and Xcellsis fuel cell "engines" operations.

"We wanted to bring the whole powertrain under one roof so we would have the capability to integrate and reduce cost," says Rasul. "The simplicity of the organization is going to translate into the simplicity of the vehicle product."



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# Hypercar Offers Integrated Fuel Cell Car It Needs a Production Partner to Build

Colorado-based Hypercar hits ETIC like an avalanche, promoting a new electric drive concept vehicle it says marks an innovative marriage of key technologies enabling the clean, economical car of the future.

Chairman Amory Lovins of the Rocky Mountain Institute is credited as the Hypercar concept inventor. His vision of a composite-bodied car expressly designed to be a hybrid electric vehicle made worldwide waves in an article in *The Atlantic Monthly* in January 1995.

Nearly seven years later, Hypercar, Inc. (Booth 335) is showing the revolutionary Revolution, and is offering its designs and design expertise to automakers. The company claims the vehicle is the first to fully integrate four key areas of advanced vehicle design:

- lightweight carbon composite structures, including processes for making automobile parts that can cut car body weight by almost 60%, offer superior crashworthiness, and be made repeatably and cost-competitively in production volumes of 50,000 per year;

- hybrid electric drives, including networked power distribution, vehicle control, and information management systems, making use of wireless communication, embedded electronics, and advanced software technologies;

- a networked and digitally controlled system to manage unique power and cooling requirements of hybrid-electric and fuel-cell propulsion systems, cutting both costs and mass by half; and

- chassis systems and "corner" modules integrating electronically controlled active dampers and fully



Hypercar's fuel cell-powered 'Revolution' is making first show appearance.

electric disc brakes with semi-active suspension and a complete system of hubs, steering, and suspension arms, all said to work better, use less energy, and last longer.

"The technologies encompassed in the Revolution will lead the way in the engineering and design of future vehicles with no compromise to the driver or the environment,"

says Hypercar marketing director Thammy Evans.

Hypercar says it's in discussion with strategic investors and joint development partners to further its business and product development efforts. \$5 million has been raised to date. Hypercar lists TWR Engineering, Sun Micro-systems, and Michelin as technical partners.

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## Fomenting the Revolution

Hypercar, Inc. is seeking an automaker partner to take its designs and make the Revolution vehicle on display here into a production reality.

Hypercar has worked with numerous companies to engineer the show car at Booth 335, says strategic partnerships VP David Cramer. One key contributor is the UK's TWR Engineering, a firm associated with racer Tom Walkinshaw.

Hypercar set the specs for the Revolution's fuel cell with UTC Fuel Cells (formerly IFC), and figures to fuel the 35-kilowatt unit with hydrogen stored in 5,000-psi, Type IV, tanks from Impco/Quantum.

Motors from UQM Technologies were used to set the specs for Revolution's two front motors, which partially share a housing and connect with the wheels via axles, while the hub-mounted rear motors are from SR Drives of Leeds, UK.

Switzerland's Reiter helped out with the Revolution's lightweight acoustic interior, Cramer reports, and Hypercar worked with Michelin on wheels and tires.

Lightweight carbon composite materials are key to the Revolution vehicle. Hypercar has worked with UK-headquartered Advanced Composites Group, but is developing fabrication technology in-house too. Hypercar's emphasis – and technical edge – is low-cost production of fiber preforms that can be used with either thermoset or thermoplastic resins.



## CENTER STAGE

# Low Profile & Big-Name EV Customers

**Larry Machak**

**Sales & Marketing Manager**

**Saminco, Inc.**

Saminco, Inc. (Booth 322) keeps a low profile, but the privately held, Fort Myers, FL-based company manufactures solid-state controllers and motor drives for high-profile customers worldwide. Saminco components are in Ford's P2000 and DaimlerChrysler's Ncar 4 fuel cell



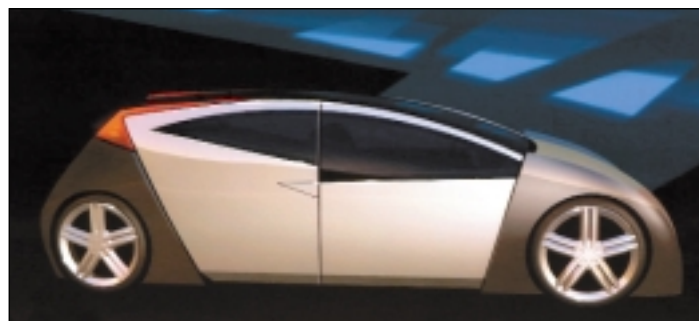
Saminco's Larry Machak.

prototypes, as well as Ballard/Xcellsis fuel cell and GM-Allison hybrid buses. Saminco is working with Ballard on its Phase 5 fuel cell bus that will operate in multiple European cities. "We've been in every Ballard/Xcellsis/DBB bus made; we have a strong commitment on both sides," says sales and marketing manager Larry Machak. For years Saminco

has made AC/DC and DC/DC controllers for underground mining EVs, which comprise about 60% of its business.

Its controllers are in shuttle cars and locomotives known as "mantrips," which transport workers and equipment into a mine; railed vehicles; and long-wall "shearer" haulage vehicles, which scrape coal off earthen walls. Because the shearer operates in a high-methane gas environment, the controller is in a steel explosion-proof enclosure. These EVs range from 5 kW to 200 kW and operate from 230V AC to 575V AC, and 72VDC to over 900V DC.

Saminco developed a system that charges a mining vehicle battery from the trolley line while it's at the surface, allowing it to operate in both "trolley" and battery modes. Saminco is the only company certified by the Mining Safety and Health Administration to do onboard battery



Far cry from the coal mine: Saminco's on Ford's existing P2000 fuel cell car and could figure on such future vehicles as the concept P2000 shown above.

charging, Machak says. The company recently opened a manufacturing, repair and training facility in Lavalette, WV, near Huntington, to accommodate the eastern U.S. coalfields.

Saminco also is setting its sights on the airport ground support equipment market, having inked new product development deals with S&S Tug and FMC Corp.

Machak likens the company's 40-person shop to a fast-turning speedboat, "Because of our size we can react and develop products much more quickly than others," he says.

## V2G: AC's Two-Way Charger Can Aid Utilities

AC Propulsion (Booth 400) has vehicle-to-grid technology allowing EVs to help utilities by serving as power reservoirs that can be drawn on during hours of peak demand.

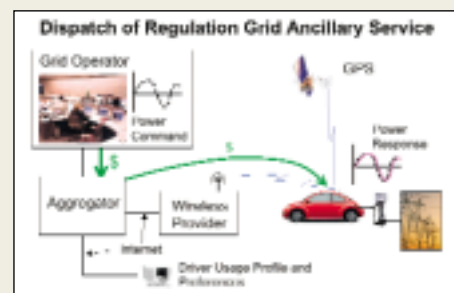
Making V2G possible is EV charging hardware that lets the vehicle be charged during off-peak hours and pass electricity back to the grid during periods of peak usage.

A Volkswagen Beetle with a bi-directional

battery charger from AC is being shown here.

"Most vehicles sit idle about 23 hours out of every day," says AC's Alec Brooks. "If the power system in an electric or hybrid vehicle could be deployed to provide valued services to the power grid during otherwise idle times, a new income stream could be generated.

"The value created could go a long way toward offsetting ownership and operating costs."



V2G would use vehicles as utility power reservoirs.

## Italy's Graziano Weighs In

Graziano Trasmissioni is here from Italy promoting drivetrain products for small electric vehicles, including neighborhood EVs.

The Turin, Italy-headquartered company (Booth 339) offers a range of motors and gearboxes, and rear axles. It's here as part of an effort to "consolidate our presence as a preferred



Graziano Trasmissioni is targeting NEVs.

supplier of complete driveline modules," parlaying extensive experience in passenger cars into a position in a new emerging market.

Besides Europe, the 50-year-old company claims customers in Japan, Malaysia, Thailand and Latin America; and EZ-Go, Club Car, Columbia ParCar, Taylor-Dunn and Cushman in the U.S., as well as NEV players including the Ford Th!nk Group and DaimlerChrysler's GEM.

Graziano Trasmissioni has a dedicated plant for small EV components in Bari, Italy.

The company has an office in Duluth, GA.

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## CENTER STAGE

# GM: Hybrids, Fuel Cells, and the Lawyers

**Ken Stewart, Brand Manager  
General Motors ATVs**

"We think we're going to win." So says General Motors Advanced Technology Vehicles brand manager Ken Stewart of the automaker's legal challenge to California's zero emission vehicles sales mandate for 2003, a lawsuit that appeared on the eve of ETIC to the company's main strategy in battery electric vehicle compliance.

GM has made it clear that it sees no viable market for battery EVs. Unlike Ford with its Th!nk vehicles, and DaimlerChrysler with its new Global Electric MotorCars subsidiary, GM has as yet unveiled no product for California in 2003, and instead is suing the California Air Resources Board over the legitimacy of the state's mandate.

"GM has trouble with the direction that CARB has taken," Stewart understates.

"This mandate as it's been turned around is really not producing cleaner air."

GM's argument is that battery EVs are too expensive to produce, and if they're mandated

will force up price of other cars. Older dirtier cars won't get replaced as soon as they otherwise would, and the net result will be dirtier air.

"Their mandates don't create demand," Stewart says of CARB (which clearly disagrees with the OEM's assessment). "Their mission is to provide cost-effective solutions for cleaner air," he says. "We want the freedom to be able to provide cleaner air and better economy through a variety of options."

"We're bringing out the hybrids," Stewart says, in reference to electrically assisted light trucks promised for 2004 and beyond, and fuel cells. GM has its own fuel cell development effort, and in recent weeks has gone head-to-head with Ballard over the fundamental quality and power of their respective stacks.

Here at ETIC 2001, GM is on the defensive, not only for suing the state over its mandate, but



GM's EV emphasis is on hybrids, like this 40-foot bus with GM-Allison drive.

because of word earlier this year that the company would be scrapping some of its older EVs. The EV1, of course, is GM's high-performance battery EV1, beloved by the relatively few people that were able to lease them, but never brought into full-scale production.

"We're going to eventually have some vehicles that don't have any use and these are going to be recycled," Stewart says, with reclamation of both components and materials.

"Nowhere in this plan am I going out and taking cars off the road from customers," he says, "without the customer requesting it first."

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## Avestor Touts Lithium-Metal-Polymer Batteries

Montreal-based Avestor (the former Hydro-Quebec/ArgoTech) is stepping up its promotion of lithium-metal-polymer technology for electric vehicles, noting that advanced LMP batteries have been tested in vehicles including the Ford Th!nk City and the Honda Insight hybrid.

The batteries can be configured for both high-energy battery EV requirements and high-power hybrid applications, the company says.

Attractive to developers of battery EVs is

241 watts per kilo.

The batteries have the added advantage of being stable under extreme operating temperatures, without special cooling, and have a long life expectancy.

"The Avestor battery is a fully functional battery," the company says, noting that it was installed in the Th!nk City with no other modification of the vehicle.

LMP batteries in the Th!nk City improved single-charge range to 101 kilometers from

the 85 gotten from the vehicle's standard nickel cadmium cells, states a paper being circulated here by Avestor.

The project involved off-the-shelf battery modules, and would have resulted in even better performance improvements "with a new battery pack using the latest LMP technology and designed to utilize all the space available in the



Avestor is testing lithium-metal-polymer batteries in the Th!nk City.

specific energy of 121 watt-hours per kilogram, which is three to four times better than lead acid batteries. Specific power is stated at

Th!nk City battery compartment."

The company is displaying the vehicle here (Booth 201).



# eMotion Breaks Ground in Hinesville, GA For Plant to Electrify Daimler Smart Cars

eMotion Mobility (Booth 431) is talking up this week's ground-breaking for a 30,000-square-foot plant in Hinesville, GA to install electric drives from Solectria in DaimlerChrysler Smart cars.

"The first-of-a-kind facility will install electric batteries, motors and other parts into 'gliders,' or semi-completed cars," says eMotion president and CEO John Wilson. "Completed electric smart cars will then be used in eMotion's revolutionary car sharing program, first in Atlanta, then in other parts of the nation."

eMotion's plan is to establish the station car program late next year "with over 100 vehicles at selected transit stations."

Gearbox and motor will be the same as those specified by Ford affiliate Ecostar for the new version of the Th!nk City vehicle, Wilson says.

The company hopes to have more than 2,500 vehicles in service in Atlanta in five years, by which time similar programs in California and the Northeast will have taken the total of eMotion station EVs to more than 16,000.

The new Hinesville plant will house "a micro-assembly process that will match dozens of parts needed for the electric drive system and other

U.S. regulatory requirements with the smart gliders after they arrive through the Port of Savannah," eMotion says. The Monday ceremony included officials from the State of Georgia and Daimler, as well as eMotion Mobility founder and chairman Donald Panoz.

"Hinesville was chosen for many reasons," Panoz said.

"First, we needed a good location — close to the Port of Savannah, and near the major rail lines and Interstate Highways that serve the eastern seaboard.

"Second, we wanted to continue our contribution to economic development within the rural regions of this great state.

"Hinesville fit the bill on all fronts, from its highly accessible location to its vast pool of



'Smart' gliders from Daimler will get electric drives from Solectria at new plant.

highly trained vehicle technicians residing at the neighboring U.S. Army base, Fort Stewart." Georgia has initiated a technical training initiative to help eMotion Mobility recruit and train workers to assemble and test the vehicles.

The plant is to initially employ approximately from 100 to 150. It will be able to handle more than 6,000 vehicles per year.



Commuter Cars Corp's Tango promises performance that belies its size.

## Spokane Company Debuts the Tango

Spokane, WA-based Commuter Cars Corp is here (Booth300) with the Tango, a peppy new commuter battery EV.

The vehicle, ballasted for stability, is 38 inches wide, or about six inches narrower than a Honda Gold Wing motorcycle, yet is fully freeway capable. It has a single-charge range of about 80 miles with lead acid batteries.

The Tango can go from zero to

60 mph in less than four seconds.

The vehicle has a pair of Advanced DC motors, and a Zilla controller, providing up to 1,800 amps at 300 volts, designed and built by Otmar Ebenhoech at Café Electric in Palo Alto, CA.

Production is slated for 2003.

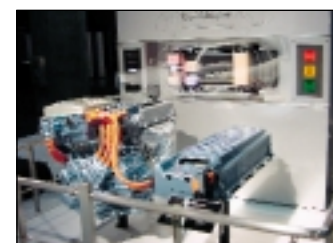
CCC is planning a lower-priced variant called the Foxtrot.

CCC is represented here by VP Bryan Woodbury.

## Toyota Shows Versatility With Trio of Hybrid Drives

Toyota (Booth 630) is displaying its battery electric RAV4-EV here, as well as the popular Prius sedan, and is showing off three drivetrain configurations for such electrically assisted fossil fuel vehicles.

The display includes a drivetrain for the Prius dating from 1997. More than 70,000 Priuses have been sold worldwide, most of them in Japan but some 20,000 in the U.S. Toyota launched the Estima minivan with the THS-C drive with continuously variable



Toyota 'mild' hybrid drive.

transmission in Japan this past June. It began selling and the Crown sedan with THS-M "mild" hybrid system (just 3 kilowatts of motor boost), in August.

### Toyota's Three Hybrid Drives

	THS Prius	THS-M Mild Hybrid	THS-C CVT*
engine displacement	1.5 liters	3.0 liters	2.4 liters
cylinders/valves	4/16	6/24	4/16
engine max output	53 kilowatts	147 kilowatts	96 kilowatts
rear motor max output	-	-	18 kilowatts
front motor max output	33 kilowatts	3.0 kilowatts	13 kilowatts
voltage	274 volts	36 volts	216 volts

\*continuously variable transmission

## CONFERENCE AGENDA

**WEDNESDAY, DECEMBER 12 — MEDIA DAY**

<b>8:00 AM – 10:00 AM</b>	OPENING PLENARY SESSION
<b>10:00 AM – 12:00 NOON</b>	EXHIBITOR PRESS CONFERENCES (held at each participating exhibitor's booth)
<b>12:00 NOON – 1:30 PM</b>	MEET THE INDUSTRY LEADERS LUNCHEON (held in the exhibition hall)
MEDIA ONLY RIDE N' DRIVE HELD DURING THE LUNCHEON (battery, hybrid and fuel cell vehicles available)	
<b>1:00 PM – 3:45 PM</b>	EXHIBITOR PRESS CONFERENCES (held at each participating exhibitor's booth)

### EXHIBITOR PRESS CONFERENCE TIME-LINE

10:00 AM	DAIMLERCHRYSLER
10:15 AM	FORD MOTOR COMPANY
10:30 AM	AMERICAN HONDA MOTOR COMPANY
10:45 AM	COLUMBIA PAR CAR CORPORATION
11:00 AM	SOLECTRIA/VOLTAGE VEHICLES
11:15 AM	ENOVA
11:30 AM	MAXWELL TECHNOLOGIES
11:45 AM	TOYOTA
1:00 PM	DAIMLERCHRYSLER/GLOBAL ELECTRIC MOTORCARS
1:15 PM	MILLENNIUM CELL
1:30 PM	AVS, INC.
1:45 PM	EPRI
2:00 PM	POWERZINC, INC.
2:15 PM	ELECTRIC VEHICLE INFRASTRUCTURE, INC.
2:30 PM	AC PROPULSION, INC.
2:45 PM	ITS-UC DAVIS
3:00 PM	METHANOL INSTITUTE
3:15 PM	HYPERCAR, INC.
3:30 PM	COMMUTER CARS CORPORATION

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American MagLev Technologies, Inc.	<b>Energy Conversion Devices/Ovonic</b>	SAFT America, Inc.
American Public Power Association	Enova Systems	Salt River Project
Avestor ( <i>Hydro Quebec</i> )	<b>EPRI</b>	Saminco
Atlantic Center for the Environment	ERIM	San Bernardino Associated Governments
Azure Dynamics Corporation	<b>Florida Power and Light Company</b>	Solectria Corporation
<b>Baker Equipment Engineering Company</b>	<b>Ford Motor Company</b>	Southern California Economic Partnership
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Carolina EV Coalition	<b>General Motors Corporation</b>	<b>Southern Company/</b>
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Chattanooga Area Regional Transportation Authority	Global Venture Investments, LLC	Technologies M4
CITELEC	<b>Hydro-Quebec</b>	Tennessee Valley Authority
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Copper Development Association	National Rural Electric Cooperative Association	<b>Toyota Motor Sales, USA</b>
Curtis Instruments	<b>New York Power Authority</b>	Unique Mobility, Inc.
DaimlerChrysler Corporation	New York State Technology Enterprise Corporation	University of California, Davis/ITS
Delta Airlines	Nissan North America/Nissan R&D	US Department of Energy
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