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By Caroline Kettlewell

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North Carolina high schoolers celebrate on the victory stand at Richmond International Raceway after winning the first-ever EV Grand Prix in the mid-1990s. Photo by Carol Hedspeh who taught at their school for 15 years. >
Electric Dreams

AROUND THE INDUSTRY

Rayovac Acquires 85% of Ningbo Baowang China

Rayovac of Madison, Wisconsin, signed an agreement to acquire 85% of the NingboBaowang Battery Company of Ninghai, China. The remaining 15% will continue to be held by company founder/general manager Dunyong Qian and by the Ningbo Baowang Investment Company.

The transaction, subject to approval by the Rayovac board of directors and the Chinese government, is expected to close within 60-90 days. Rayovac's investment will be \$24 million and is expected to be accretive in the first year.

Ningbo Baowang, founded in 1995, produces alkaline and heavy-duty batteries

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for retail, OEM and privatelabel customers. The company exports its batteriesto customers throughout North and South America,Europe and Asia. In addition to export sales,Ningbo Baowang has 26 branches and regional salesoffices and distribution throughout China.

Other principal selling shareholders include:Ningbo Veken Group Co., Ltd.; Polar Win Limited;and Heirigs & Associates, LLC. Heirigs &Associates will continue as consultants followingthe close of the transaction.

Alcatel Sells Saft

In January, telecommunications giant Alcatel sold Saft, its subsidiary specializing in batteries, to Doughty Hanson & Co. for 390 million euros.

Saft, headquartered in France, is the leading manufacturer of industrial and specialty batteries, employing 4000 people in 14 sites worldwide.

The acquisition is Doughty Hanson's first private equity investment in France, following Yann Duchesne's appointment to run its Paris office in 2003. The independent fund management company has eight other offices in the U.S. and Europe.

For more information visit www.alcatel.com or www.doughtyhanson.com

PPF Substrate Adds to Marketing Materials

Battery substrate manufacturer Precious Plate Florida of West Palm Beach has a new literature packet, website, and trade advertising program directed at the substrate needs of battery producers through explanation of PPF's complete in-house processes.

PPF continuous coil processors assure a flat strip that yields greater efficiencies in pasting, slitting and winding. Using high-speed perforation presses with specially-designed perforation patterns, PPF can supply numerous production needs in steel, copper and aluminum.

To request literature, call 561-820-8150 or visit www.preciousplatefla.com

Nissan to License Hybrid Technology from Toyota

Nissan Motor Co. of Tokyo will license gas-electric hybrid engine technology from Toyota Motor Corp. of Japan for use in a hybrid version of the Nissan Altima. The new car is scheduled to hit showrooms in 2006. At the same time, Nissan intends to continue developing an alternative hybrid technology in-house, while it also works on cleaner-burning diesel engines and fuel cell technology.

Visit <http://www.nissan.co.jp>

Exide Supplies Batteries to Scandinavian Airlines

Exide Technologies, has secured a large order for motive power batteries and a complete battery maintenance system from Scandinavian Airlines Systems (SAS), the consortium of three national airlines for Norway, Sweden and Denmark that offer a broad range of airline services.

SAS is Europe's fourth largest carrier measured in total number of passengers, with Europe's highest share of business class service, and is a founding member of the Star Alliance global airline network.

SAS recently acquired 68 LINDE tractors, each unit fitted with 80V 620Ah Exide motive power batteries and supported by a complete Exide battery water maintenance system to maximize tractor fleet utilization. These tractors will be used as baggage carriers at Kastrup Airport in Copenhagen, Denmark.

Further information about Exide, its financial results and other information is available at www.exide.com.

Apollo Energy Moves



Apollo Energy Systems Inc. has moved to a facility in Pompano Beach, Florida. Plant and laboratory equipment for the production of Apollo Fuel Cells has been installed.

The new plant will also house a lead cobalt battery laboratory where prototypes of the new, lightweight battery will be built with Apollo Lead Foam substrate material to substitute for heavy lead grids now used in all lead-acid batteries. The surface area of lead foam is much greater than the surface area of lead grids. That means far greater contact between the substrate and active material, resulting in higher energy and power density. The new tri-polar

battery will be produced by subcontractor Millennium Battery Co. in Miami, Florida.

An electric vehicle prototype shop will be included in the new facility where Apollo's electric propulsion system will be installed in various types of vehicles.

Contact Apollo Energy Systems Inc., 2301 N.W. 33rd Court, Pompano Beach, FL 33069, phone: (954) 969-7755, Fax: (954) 969-7788, or visit apolloenergysystems.com.

Laptop Batteries Outperform in Electric Vehicles

California firm AC Propulsion revamped its tzero prototype car to make the "super LIght versION." A move from lead-acid batteries to lithium-ion saved 230kb and tripled the vehicle's energy capacity.

Power comes from 6,800 65 x 18mm diameter (18650 size) Li-ion cells, as used in battery packs. President Tom Gage says, "The small cells for the tzero cost less, in total, than the nickel-metal hydride battery in the Toyota RAV4 EV, and they hold twice the energy."

Tzero weighs 900kg and will drive 250 miles in 75-80mph traffic. "On any type of standardized drive cycle, it will go over 300 miles," said Gage. Its best 0-60mph time is 3.6 seconds.

Enova Teams with EDO Corporation

Enova Systems, Torrance, California, received an order from EDO Corporation, New York, for the development and fabrication of power electronic components for EDO's unmanned surface mine sweeping vessel.

EDO Corporation was awarded a contract from the U.S. Navy to demonstrate the feasibility of Unmanned Surface Vessel mine-warfare technology and the application of this technology for fleet integration. The \$3.4 million award was issued by the Office of Naval Research (ONR) in Arlington, Virginia.

Enova Systems will develop and fabricate a high voltage DC-DC power conversion system using a Capstone microturbine as the primary power source for the minesweeper. The electronics package will feature Enova's advanced power components, including a new enhanced 50V, 700A DC-DC power converter, the battery care unit and the hybrid control unit which will power the minesweeper's electromagnetic detection system. The Enova power management and conversion system will be used to provide on-board power to other accessories on the platform. The program is valued at approximately \$420,000 and has the potential for additional system sales following the demonstration phase.

RBRC Collects Over 4 Million Batteries

The non-profit Rechargeable Battery Recycling Corporation (RBRC) collected more than 4 million pounds of rechargeable batteries in the U.S. and Canada in 2003, an increase of 22% from 2002.

"Since 1995, RBRC has recycled a total of over 21.9 million pounds of rechargeable batteries," said Ralph Millard, RBRC executive vice president.

RBRC works with national retailers, businesses and community recycling programs to set up convenient drop-off facilities for used rechargeable batteries. National participating retailers include Best Buy, The Home Depot, RadioShack, Sears, Staples, Target, and Wal-Mart.

To find nearby battery drop-off locations, consumers can simply log-on to www.rbrc.org or call 1-800-8-BATTERY, to locate participating retailers and community collection programs.

AnalogicTech Secures \$15M in Funding

Advanced Analogic Technologies, Inc. (AnalogicTech) has raised \$15 million in a new round of financing. Battery Ventures, a leading venture capital firm focused on investing in information technology companies at all stages of growth, led the financing with participation from existing investors Hotung Ventures, InveStar, Maton Venture, Mosel Vitelic, and Sunsino Ventures Group. Ken Lawler, general partner with Battery Ventures, will take a seat on the company's board of directors.

A number of AnalogicTech's corporate partners, including Mitsubishi Capital, Vanguard International Semiconductor, and VIA, also participated in the funding round with corporate venture investors China International Development Consulting Inc.(CIVC) and Sycamore Ventures.

The Series E private equity financing will be used for working capital and to expand infrastructure to support sales growth. As part of this process, AnalogicTech will extend its global presence with the addition of new sales and technical staff.

Philips Licenses Lithylene Technology

Philips Research, part of Royal Philips Electronics in the Netherlands, announced that Stone Battery Industries Corp. of Taipei, Taiwan, has completed the licensing agreement to employ Philips Lithylene™ battery technology in the manufacturing of batteries with free-form factors.

Philips Lithylene™ battery-making technology enables the fabrication of rechargeable lithium-ion batteries without the need of outside pressure to keep the battery stack together. A stable battery structure is obtained by making

microscopic holes through the electrodes and separators, and subsequently filling these with a polymer. Having a stable electrode structure, Lithylene™ batteries can be tailored in a variety of forms without compromising on performance or price.

Philips Lithylene™ battery technology can be used to fabricate batteries with a variety of different electrochemical compositions to the contours of a product. Stone Battery plans to start mass production in the greater China region with an estimated capacity of 500,000 pieces per month effective the third quarter of this year.

Rayovac to Integrate Remington, Reorganize

Rayovac Corporation plans to integrate Remington Products, LLC, which it acquired in September 2003, between March and December of this year. Remington's worldwide operations will be absorbed into Rayovac's existing North American and European business units.

Approximately 96 hourly manufacturing and 121 administrative employees will be laid off. Rayovac expects to provide severance packages to all employees not offered continuing employment, as well as outplacement services. Layoffs will begin at the end of March.

Lester Lee, former Remington North America president, is now president of Rayovac's combined North American business unit in Madison, Wisconsin. About 100 new professional and administrative positions will be created there to be filled by either Rayovac employees or new hires. Another 30 jobs will be added to the Portage manufacturing plant. In conjunction with this, Rayovac will relocate its corporate headquarters to Atlanta, Georgia, this spring.

Arotech Buys Epsilor

Arotech Corporation has acquired Epsilor Electronic Industries, a privately owned Israeli corporation. For more than 10 years, Epsilor has developed and sold rechargeable and primary lithium batteries and smart chargers to the military and to private industry in the Middle East, Europe and Asia.

The purchase price for Epsilor is \$7 million in cash, with an additional \$3 million paid over the next three years. Epsilor management will continue to manage the company as a wholly owned subsidiary of Arotech.

Arotech plans to introduce the acquired lithium-based battery to its Auburn, Alabama, battery plant, as a base for broadening its U.S. military battery market. The acquired company has already developed European and Asian military markets for its batteries, which Arotech will use to expand the reach of its BA-8180/U zinc-air battery.

Arotech also announced they acquired FAAC Incorporated of Ann Arbor,

Michigan. FAAC provides simulators, systems engineering and software products to the United States military, government and private industry.

Johnson Controls Earns Award from Ford

Johnson Controls has been recognized by Ford Motor Company with its 2003 Corporate Citizenship Award for the supplier's strong commitment to supporting and doing business with minority-owned companies.

The company, which won this same award in 1999, was the only tier-one interior supplier to receive the annual award this year.

"We're honored to be recognized by Ford because it says our efforts to create a strong diverse supplier development program have been successful," said Keith Wandell, president of the automotive group. "Johnson Controls is committed to promoting diversity, building strong partnerships with minority firms, and expanding minority supplier development efforts in the future."

As a global market leader in automotive interior systems, automotive batteries, and facility management and control systems, Johnson Controls purchased goods and services valued at more than \$1.02 billion from diverse suppliers in 2002. This figure was expected to increase by an additional \$50 million in 2003.

Last May, Johnson Controls was named to the Billion Dollar Roundtable, an organization composed of the 12 U.S. corporations that spend more than \$1 billion annually with minority- and women-owned businesses.

Lenmar Introduces Fast Battery Charger

At the Las Vegas Consumer Electronics Show, Lenmar Enterprises introduced a charger that recharges camcorder and digital camera batteries in less than 30 minutes.

Lenmar said its Mach 1 SpeedCharger line, which uses microprocessor control to deliver a rapid charge, charges camcorder and digital cameras three times faster than traditional chargers.

The Mach 1 chargers can fully charge the battery without overcharging, unlike competitive products that only partially charge the battery in the rapid charge cycle or overcharge the battery.

Lenmar's Mach 1 Gamma is supplied with four 2300mAh AA batteries and has four charging slots that allow any combination of up to a total of four AA and AAA NiMH batteries to be fully charged at one time in about one hour.

The company said all models have LED status indicators, international voltage support (100-240V AC), a car cigarette lighter adapter (12 VDC) that lets the

user fully charge batteries on the road, and a three-year warranty.

Its Mach 1 "Delta" SpeedCharger was recognized for CES Innovations and Design Award for 2004, the third year in a row that Lenmar's chargers won the award.

Lean Production Rewarded for Battery Maker

The Chloride Motive Power factory at Over Hulton, Bolton, United Kingdom, has achieved the bronze Excell award from Exide Technologies's Centre of Excellence. The Excell program aims to reward "lean production" techniques, a concept introduced by Toyota to minimize waste from production processes as a result of post-WWII resource shortages. It has been adopted by Exide Technologies worldwide to drive continuous improvement.

There are five award levels, platinum being the most difficult to achieve. Relatively few companies in the U.K. have taken up the initiative. Many that do undertake to comply with the system concentrate on cutting inventory.

David Ling of CMP Batteries says, "Raw material inventory has indeed been reduced by 65% at CMP with a total inventory reduction, including finished goods, of 31%. However, we needed to concentrate on other aspects of the business as well. We also have achieved a 45% reduction in factory maintenance costs and recorded an 80% reduction in accidents."

A specific example within CMP involved the creation of an Area Improvement Group, which redesigned the work area with defined locations for components, cells and WIP batteries. Storage bins were clearly labeled, tool kits were standardized and a daily cleaning routine was established. Strict targets were set and the "lean team" at Over Hulton achieved or exceeded all of them.

ELECTRIC VEHICLES

Mack Chooses Enova for Hybrid Refueler

Enova Systems of Torrance, California, received a contract from Mack Truck, Inc., Powertrain Division, a member of The Volvo Group of Sweden, for the development and fabrication of an advanced heavy-duty hybrid drive system, funded by the U.S. Air Force for its diesel-electric hybrid R11 refueler vehicle.

Enova will develop and manufacture the motor controller, electric motor, and battery management systems for the new parallel hybrid drive system using Mack Trucks' MD11 diesel engine. The refueler fleet consists of approximately 300 vehicles. Mack Trucks will also evaluate the applicability of the drive system to commercial vehicles, commencing with its Class 8 refuse hauler.

Enova's portion of the \$1.2 million development program is valued at

approximately \$250,000, and has the potential for additional system sales for both military and commercial application following the evaluation phase.

Honda Accord Hybrid Due in Fall 2004

Honda Motor Co. will introduce a gas-electric hybrid version of its Accord this fall. The new Accord will provide fuel economy similar to a four-cylinder Civic, according to president and chief executive Takeo Fukui. Honda already sells two hybrids, the Insight and the Civic.

He also said the company will introduce in 2005 a fuel cell unit with increased performance and fuel efficiency capable of starting in below-freezing temperatures. Fukui said Honda wants to gain experience with fuel cell vehicles to help speed their development. And he said the company is committed to supporting the development of a hydrogen fueling infrastructure that would be needed for such vehicles to gain wide use.

DaimlerChrysler to Help Create GEM Village

Global Electric Motorcars (GEM), a DaimlerChrysler AG company in Auburn Hills, Michigan, and Tuttle-Click Dodge of Irvine, California, have formed a partnership with Rancho Mission Viejo to create a premier village designed for zero-emission electric cars. Rancho Mission Viejo is the largest family-owned cattle ranch in California and the second-largest family-owned land-holding company in Orange County.

According to the partnership, a fleet and dealer discount of up to \$1,000 off the listed price on every new GEM vehicle purchased at Tuttle-Click Dodge will be awarded to all home buyers within the 1,260-home Terramor village, the nation's largest green-oriented village of production-style homes. Terramor opened in November at the 4,000-acre Orange County community of Ladera Ranch, master-planned and developed by Rancho Mission Viejo.

Homes at Terramor feature garages with conveniently located electric vehicle recharging outlets. Designed around a single, circular, arterial street and a network of connecting trails, Terramor encourages both neighborhood "walkability" and the use of alternative fuel vehicles.

Toyota Unveils 2005 Highlander Hybrid SUV

Toyota Motor Corp.'s 2005 Highlander Hybrid sports utility vehicle (SUV) follows the second-generation Prius sedan as the company's second hybrid vehicle. The Highlander has double the power of the Prius and fuel efficiency that is better than today's average compact sedan.

The Highlander will feature two versions of Toyota's Hybrid Synergy Drive®: a front-wheel drive model and a four-wheel drive with intelligence (4WD-i) model. The four-wheel drive Highlander's Hybrid Synergy Drive® combines the

power of a 3.3-liter, 24-valve, V6 gas engine with the efficiency of two high-torque electric motors for an estimated 270 horsepower. The Highlander has a good fuel economy with a cruising range of over 600 miles on a single tank of gas. It can travel from 0mph to 60mph in less than eight seconds.

Anuvu Tests First Fuel Cell Ferry in Frisco Bay

After testing its 30-foot, 18-passenger, hydrogen-powered water taxi on the San Francisco Bay in late October, Anuvu Inc. is finalizing paperwork to be the San Francisco Bay Area Water Transit Authority's (WTA) contractor for the world's first fuel cell-powered commuter ferry. With \$2.6 million in federal grants, the WTA is charged with building a 149-passenger ferry to run between San Francisco and Treasure Island by 2005.

"The ferry will be a double-decker beauty and roughly 79-feet long," says Mary Culnane, WTA's manager of marine engineering. The WTA is searching for a boat-building contractor to construct the vessel this year in accordance with a design by John J. McMullen Associates Inc. of Hilton Head, South Carolina.

The ferry's fuel cell will be fed hydrogen via a metal hydride battery - a sponge-like metal that can absorb and store hydrogen. When the ferry is docked, the battery will be restocked with hydrogen via a tube. The fuel cell will be housed in a metal container on top of the boat near the pilot house, while the battery will be stored at the back of the boat and doubles as ballast.

Anuvu's approach to the ferry project is to stack small fuel cell modules to create enough power for the boat. "Just like putting multiple batteries in a flashlight, we can build the 240kW power plant with 20 individual 12kW fuel cell stacks wired together," explains Rex Hodge, Anuvu's president and CEO. This modular approach also enables the boat to keep running even if an individual fuel cell stack has a problem.

"But the new ferry will serve as a demonstration vehicle only," Culnane says, "and will likely transport commuters only twice a day rather than on a regular, more frequent ferry schedule." She hopes that after the ferry runs for a few years, the public will recognize the benefits and support federal funding to build additional vessels.

Hybrids Will Need Increased Performance

The common perception of hybrid electric vehicles is that they get tremendous gas mileage, yet lack higher performance. However, the direction of hybrid product introductions for the North American market will feature added performance and functionality as a priority over best-in-class gas mileage, finds technology research firm ABI of Oyster Bay, New York.

Current hybrids such as Toyota's Prius and Honda's Insight and Civic Hybrid are the most fuel-efficient gasoline-powered vehicles in North America. They

currently use electric motors to augment small gasoline engines. The next breed of North American-targeted hybrids, however, will feature electric motors in conjunction with much larger fuel-burning engines. Because of different goals, the marketing of hybrids will need to differ in each global region. In Europe and Japan, fuel is far more expensive, so development will continue to hinge on the use of smaller-displacement gasoline and diesel burning engines.

"Several hybrid vehicles will soon reach the North American market, and will feature much larger conventional engines," states Dan Benjamin, ABI analyst. "North American OEMs will incorporate hybrid technology into larger engines to provide superior performance, and are expected to offer hybrid six-cylinder vehicles with the performance of an eight-cylinder. Outside of North America it will be the opposite - hybrids will be used to extract performance from engines smaller than one liter."

According to the findings of the new study, the global hybrid vehicle market will remain very small through the end of this decade, with fewer than 500,000 vehicles produced in 2007. Market growth will hinge on cost reductions for key components and hybridization becoming available on a greater number of mainstream models. Annual global hybrid production promises to reach one million units by 2010. Although the current generation of hybrids may not sell in large quantities, hybrid technology has arrived and some automakers are taking this more seriously than others. Automakers not currently developing them will fall further behind on the learning curve.

PRODUCT NEWS

Energizer Rolls Out New Lithium Battery

Energizer Holdings Inc. produced the industry's first AAA lithium battery in January.

It also has improved the performance of its line of AA lithium batteries, designed to last up to seven times longer in some digital cameras versus alkaline batteries. Because of the increased use of high-tech and digital devices, sales of AA lithium batteries have increased 25% in the last year. Energizer is the only battery manufacturer to put the power of lithium in a 1.5-volt cell.

St. Louis-based Energizer Holdings Inc. manufactures batteries, flashlights, and shaving products.

Saphion Lithium-Ion Technology

Valence Technology Inc. delivered samples of its second generation cylindrical Saphion Lithium-ion technology for customer evaluation.

A primary feature of Saphion Lithium-ion technology is its high rate capability,

required for power applications in the consumer and vehicular markets. The superior cycle and service life characteristics of Valence's first generation Saphion technology are needed for large format energy applications such as utility and telecommunications backup power systems.

Valence launched its Saphion Lithium-ion technology in the spring of 2002 and has since commercialized it in applications such as the N-Charge™ and K-Charge™ Power Systems.

New Generation Ultracapacitor

Australian and South African researchers have designed and produced an ultracapacitor containing gold instead of the carbon used previously. Gold-based devices can store up to six times the energy of a standard capacitor.

The research program by Professor Michael Cortie of the University of Technology, Sydney, Australia, and Dr. Elma van der Lingen from Mintek in Johannesburg, has improved existing designs, which are subject to significant operational problems, including a 'modest' capability for energy storage and operational inefficiencies due to internal heat generation.

This is the first time that an ultracapacitor based on gold has been made anywhere in the world. The researchers first used an intermetallic compound of gold and aluminum, known as purple glory. Subsequently they removed the aluminum, leaving a sponge of pure gold.

"Gold seems rather an improbable choice compared to carbon," Professor Cortie said. "But it turns out the electric power that can be efficiently drawn from a carbon-based ultracap is limited by the high internal resistance of such devices. Gold by contrast is a truly excellent electrical conductor. Additionally, carbon-based ultracaps are not cheap, so including a fraction of a gram of gold in an ultra-cap is only slightly more expensive."

Smaller Smart Li-ion Batteries

Inspired Energy, Inc. launched two smaller versions of their already highly successful NI2040 standard lithium-ion smart battery.

Both new batteries share the same oval cross-section as their larger, 9-cell sibling. The NC2040 contains only 3 cells and the NF2040 contains 6 cells, which results in a shorter, lighter battery pack.

Characteristics of Inspired Energy's "2040" range of smart lithium-ion batteries are:

- abNC2040: 10.8V, 2.2Ah, 23.7Wh, 170g / 6oz - for handheld devices

- abNF2040: 10.8V, 4.4Ah, 47.6Wh, 330g / 12oz - For small, mobile devices

- abNI2040: 10.8V, 6.6Ah, 71.2Wh, 484g / 17oz - for power-hungry mobile electronics

In addition, Inspired Energy has increased the capacity of their existing standard lithium-ion batteries, introduced two high-energy 95Wh new standard batteries and introduced a full range of battery diagnostic tools.

For information, visit www.inspired-energy.com.

Vapex Offers New NiMH Battery

Vapex Technology of Hong Kong has a new VTE2000AAP rechargeable nickel-metal hydride (NiMH) battery with a high energy density 15% over the normal 1,800mAh battery, a high drain performance of up to 3C, and a shelf life that is 80% of the initial capacity storage for two years.

With no memory effect, the 1.2V AA battery has a resealing safety vent. The charge time is 15 minutes and the lifespan is >500 cycles.

Report Predicts Increase in Materials Demand

The Freedonia Group's 245-page study, U.S. Battery & Fuel Cell Materials, predicts that battery and fuel cell materials demand will increase 6.2% annually through 2007 to \$3 billion. This report analyzes the market and presents detailed historical demand data.

Forecasts to 2007 and 2012 are broken out by application (e.g., alkaline batteries, lead-acid batteries); by function (e.g., anodes and cathodes, catalysts, electrolytes); and by material (e.g., carbon/graphite, metallic chemicals, steel). The study also examines the market environment, details industry structure, evaluates company market share, and profiles major competitors.

U.S. Battery & Fuel Cell Materials (Study #1722, October 2003) is available for \$3,800 from the Battery Bookstore, P.O. Box 650, Boalsburg, PA 16827, phone: (814) 466-6559, fax: (814) 466-2777, or visit www.7ms.com.

P212/220 Lead Acid Battery

China's Ningbo Sunbright Battery Co. Ltd. has introduced its P212/220 lead-acid battery, designed for use in emergency lighting systems, portable instruments, small uninterruptible power systems, safety and alarm systems, and electronic tools and toys. It comes with a sealed configuration and low self-discharge.

Offered in a flame-retardant container, the battery

features a nominal voltage of 12V, a nominal capacity of 18Ah at a 20h rate, and internal resistance of 15 milliohms. With high energy density, the product measures 180mm x 77mm x 167mm and weighs 6.1kg.



For information, visit <http://www.sbt-battery.com>

Bulletin for Choosing the Right Battery

East Penn Manufacturing has just released a new technical bulletin available to all Deka Marine and RV dealers and consumers that helps them select the correct battery for any purpose.

With an expanding array of battery designs (e.g., flooded, AGM, gel, deep cycle, starting and now dual-purpose) choosing the correct battery can be confusing. This bulletin is an analysis of different battery designs and the optimization of their use within the intended application - an invaluable tool in helping to select the appropriate battery type to match individual needs.

East Penn produces a complete line of starting, deep cycle and dual-purpose Deka Marine Master flooded, Deka Dominator Gel and Deka Sea Mater AGM (absorbed glass mat) lead-acid batteries for marine, RV and special applications

New Hot-Swap Systems Brochure

UNIPOWER Corp. of Coral Springs, Florida, has a new 12-page brochure featuring hot-swap power systems from 200W to 7,500W. There are eight series of products, each consisting of hot-swap power modules and a compatible 19-inch system rack in heights of 1U, 2U or 3U.

The brochure has a two-page description of each product series and a series selection guide. There are 27 different models of power modules, with output voltages ranging from 3.3VDC to 48VDC. The 1U- and 2U-high racks hold up to three modules; a 3U-high rack holds up to five modules. The power systems can implement true N+1 redundant, hot-swap operation.

RESEARCH AND DEVELOPMENT

Canadians Generate Electricity from Tap Water

What started as a simple conversation between two University of Alberta engineering professors has led to the discovery of a new way to harness electricity - from flowing tap water.

The Montreal Gazette reports that Dr. Daniel Kwok, who specializes in nanofabrication, and Dr. Larry Kostiuik, whose expertise is thermodynamics, combined their skills with two graduate students, Jun Yang and Fuzhi Lu, and built an apparatus that produces electricity by pushing water through a ceramic filter containing 10,000 tiny tubes. They call it an electrokinetic microchannel battery.

Their research, touted as the first new way of producing electricity in 160 years, was published by the London-based Institute of Physics's Journal of Micromechanics and Microengineering. Their paper reveals a new source of clean, non-polluting electric power with a variety of possible uses, ranging from powering small electronic devices such as cellphones to contributing to a national power grid.

According to Kostiuik, the apparatus can produce up to 10 volts, but a current of only a few thousandths of an ampere. That's not enough to run a light bulb. But it could be enough to power the so-called "lab-on-a-chip" instruments envisioned by those working in nanotechnology or on MEMS - micro-electronic mechanical systems, he said.

The project started soon after Kostiuik was appointed chair of the university's department of mechanical engineering. When he made his rounds to learn what his colleagues were studying, he listened to Kwok describe his work with electrokinetics - the science of electrical charges in moving substances, such as water.

In that meeting Kwok explained how, when water travels over a surface, the ions that it is made up of "rub" against the solid, leaving the surface slightly charged. "Then Larry said, 'That sounds like a battery to me,' and I just paused and then realized what he said. This shows the importance of interdisciplinary work - sometimes we focus so much on our research that we aren't able to take a step back and see what others can see."

Initial efforts at using the phenomenon generated such a minute amount of energy the task was thought "impossible," said Yang, a Ph.D. student in mechanical engineering who designed the experiment at Kwok's request.

But Yang, who came to the U of A from the Beijing Institute of Technology in 2002, wanted to try again. The idea, he says, was magnificent.

Yang and Kwok exchanged ideas on ways to increase the amount of energy generated by increasing the number of channels they forced water through. The fourth member of the team, graduate student Lu, now has improved on the results detailed in the JMM paper, generating 20 times as much energy and illuminating LED lights.

A paper published in June 1964 (J.F. Osterle, Journal of Applied Mechanics) addressed the broad concepts of the phenomenon but not its applications.

"This new technology could provide an alternative energy source to rival wind and solar power, although this would need huge bodies of water to work on a commercial scale," said Kostiuk. "Hydrocarbon fuels are still the best source of energy but they're fast running out and so new options like this one could be vital in the future."

Although the power generated from a single channel is extremely small, millions of parallel channels can be used to increase the power output.

The environmental benefit of clean energy conversion using safe, renewable materials is motivating the team to explore how their prototype device may be developed into a battery for commercial use. The inventors are working with the U of A's Technology Transfer Group (TTG) to develop a commercialization strategy for their work. A patent application has been filed by the university to obtain broad, early protection of the invention, and the TTG is conducting an in-depth evaluation of the market.

The research was funded in part by a Natural Sciences and Engineering Research Council of Canada (NSERC) grant. Dr. Kwok's work is also supported by the Alberta Ingenuity Fund.

Curvaceous Batteries

New Scientist reports that a new generation of curved batteries will allow electronic devices to be built in shapes that till now have been impossible. Mobile phones, for example, have had to be designed around their batteries, which are normally shaped like a fat rectangle or a cylinder. These shapes have been forced on designers because rechargeable lithium-ion batteries need strong metal cases to keep the stack of electrodes inside them pressed firmly together, says Ben Borves of Philips Research in Eindhoven, The Netherlands.

Philips's solution is to punch holes through the electrode stack and fill them with a polymer. When thermally set, the polymer behaves like a rivet, holding the stack together. This should allow any shape of battery stack to be produced, says Borves, including curved and even spherical ones.



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BOOK REVIEW

"Electric Dreams"

by Caroline Kettlewell

Scheduled to be published in April is an easy-reading, feel-good 304-page book subtitled *One Unlikely Team of Kids and the Race to Build the Car of the Future*. A true story, *Electric Dreams* tells how some underprivileged high school kids in NASCAR country North Carolina won the first-ever contest to build an electric car.

Ms. Kettlewell has written other memoir books and is a regular contributor to the *Washington Post*. She introduces the reader to an interesting assortment of small-town southern characters and the science teacher from California who made a difference in his students' lives. She also writes informatively about electric car technology and never-say-die invention.

The teacher, Eric Ryan, had been a pre-med student at Berkeley who when he was 20 went "searching"; he dropped out of school, worked in construction, fished in Alaska, went back to Berkeley, changed his major, graduated, went backpacking and spent a year teaching part-time at East Los Angeles High School, an alternative school for troubled youths. This led him to Teach For America, an organization which offers young college graduates who want to change the world an opportunity to start by serving in rural and inner-city schools where teachers are scarce.

At age 26 Eric wound up at Northampton High School-East in northeastern North Carolina. The beige one-story school building was, as Kettlewell describes it, from the fallout shelter school of design. Houses in nearby towns such as Jackson and Woodward flew flags displaying only a number — 3 or 9 or 22 — next to the stars and stripes, declaring their loyalties to particular NASCAR drivers as well as to their country.

The Research Triangle of Raleigh-Durham-Chapel Hill lies two hours to the west while the tourist-rich Outer Banks are about an hour away. But in between are hardscrabble farms and small towns whose populations were smaller in 1990 than they had been in 1900. Kids had little expectation of success and figured to stay there and work like their parents had.

The second year Eric taught there Harold Miller, a teacher of auto technology for 24 years at Northampton-East, who grew up with a torque wrench in his hand and a grease rag tucked in a pocket, told him, "We're gonna build an electric car!" John Parker, who taught math and physics at

Northampton-East, had just told Harold about a competition sponsored by Virginia Power for teams of high school students from the mid-Atlantic region to convert standard automobiles into electric-powered vehicles. And they would get to test their cars at the Richmond International Raceway where drivers like Dale Earnhardt and Richard Petty had made NASCAR history.

The boys and girls enrolled in Auto Tech I and II saw a picture of GM's sleek Impact electric car and thought they would have to build something like that. "We can't!" But Eric told them they and not their teachers would convert a regular car, gut it and rebuild it as an EV. It would have an electric motor and run on batteries instead of gasoline.

Although North Carolina Power was a division of Virginia Power, no schools in their part of the state had been invited to compete. After all, they were poor down there in the northeast and had no industry to speak of, much less high-tech ones. But a local power official went to bat for them and got a four-high-school team, including Northampton-East, entered in the contest under the name ECORV, Electric Cars of the Roanoke Valley.

You'll read just how the team converted a 1985 twice-totaled white Ford Escort they called Shocker, learned to drive it and won the EV Grand Prix, which brought them money and grants, including a \$10,000 "Spirit of Kitty Hawk" award from the North Carolina Technological Development Authority. That was only the beginning.

Published by Carroll & Graf of New York, the book will cost \$24. For information, visit www.avalonpub.com.

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