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BATTERY POWER PRODUCTS & TECHNOLOGY

Solutions for OEM Design Engineers, Integrators & Specifiers of Power Management Products

Hybrid Electric Vehicle Reaches 100,000 Miles Using an Advanced Battery System

Photo courtesy of the Advanced Lead-Acid Battery Consortium

Researcher Rosalie Louey prepares components for the UltraBattery in CSIRO laboratories

The UltraBattery combines a supercapacitor and a lead acid battery in a single unit, creating a hybrid car battery that lasts longer, costs less and is more powerful than current technologies used in hybrid electric vehicles (HEVs). The UltraBattery test program for HEV applications is the result of an international collaboration. The battery system was developed by CSIRO in Australia, built by the Furukawa Battery Company of Japan and tested in the United Kingdom through the American-based Advanced Lead-Acid Battery Consortium.

"The UltraBattery is a leap forward for low emission transport and uptake of HEVs," said David Lamb, who leads low emissions transport research with the Energy Transformed National Research Flagship.

"Previous tests show the UltraBattery has a life cycle that is at least four times longer and produces 50 percent more power than conventional battery systems. It's also about 70 percent cheaper than the batteries currently used in HEVs," he said.

By marrying a conventional fuel-powered engine with a battery to drive an electric motor, HEVs achieve the dual environmental benefit of reducing both greenhouse gas emissions and fossil fuel consumption. The UltraBattery also has the ability to provide and absorb a charge rapidly during vehicle acceleration and braking, making it particularly suitable for HEVs, which rely on the electric motor to meet peak power needs during acceleration and can recapture energy normally wasted through braking to recharge the battery.

Over the past 12 months, a team of drivers has put the UltraBattery to the test at the Millbrook Proving Ground in the United Kingdom, one of Europe's leading locations for the development and demonstration of land vehicles.

"Passing the 100,000 miles mark is strong evidence of the UltraBattery's capabilities," Lamb said. "CSIRO's ongoing research will further improve the technology's capabilities, making it lighter, more efficient and capable of setting new performance standards for HEVs."

New Batteries on the Market

EaglePicher Technologies Introduces First Implantable Medical Cell Designed Specifically for Monitoring Applications

EaglePicher Technologies Medical Power group has introduced two new implantable medical batteries to the market. The two batteries, aimed at the rapidly growing implantable monitor market, provide high energy density and low entry cost. Typical applications include implantable cardiac and glucose monitors.

The two Lithium Thionyl chloride cells, available in 350 mAh and 750 mAh formats, join the EaglePicher Medical Power Contego Modular Battery Line. Lithium Thionyl chloride is characterized by a high energy density and low self discharge for maximum reliability.

The cells are fully qualified for implantable applications, manufactured in the US and available immediately. The Contego series of modular implantable batteries is available in a range of capacities from 500 uAh to 3.5 Ah.

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PRODUCTS & SERVICES

DEPARTMENTS

Powering Vehicles

QUALLION

Powering Military

Powering Life

Powering Aerospace

Powering Medicine

Quallion LLC is the proud recipient of the 2007 Frost & Sullivan Award for Technology Innovation in Lithium Ion Power Sources for Medical, Military, & Aerospace Applications.

Quallion's new 48.8 V Matrix™ Module (4.2kg) comes in 7.5Ah, 9.5Ah and 12.5Ah configurations.

This 28V, 38Ah Matrix™ pack offers a drop-in replacement for high power or high energy for military applications.

Since 1998, Quallion has delivered custom battery solutions for demanding applications. From medical implants to high voltage power supplies, Quallion leads the Lithium ion battery industry in safety, reliability and performance. Drawing upon its unique ties to the Japanese Lithium ion battery market, Quallion now offers new battery solutions to the military for vehicles, aircrafts, UUVs, UAVs, and stationary back-up power. Enabling technologies such as the Matrix™ Battery Design, Zero-Volt™ capability and SaFE-LYTE™ offer proven battery solutions that can pass the most aggressive test conditions, including full crush and constant overcharge.

QUALLION

Powering Life.

2007

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North American Lithium Ion Power Sources for Medical, Military, & Aerospace Applications Technology Innovation Award

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New Batteries on the Market

C&D Technologies Introduces the High Rate Max UPS Battery

C&D Technologies, Inc. has released a new model in the High Rate Max series of batteries. The UPS12-475MRLP provides the energy storage capability of C&D's UPS12-475FR battery, but in a case that is almost 2.5 inches shorter.

This new battery is a one-for-one replacement for the UPS12-475FR battery that will make maintenance activities safer by providing more room above the batteries in cabinet and rack applications while meeting or exceeding five through 20 minute discharge rates. As a replacement for UPS12-370FR batteries, the UPS12-475MRLP will supply 24 percent more power or 26 percent longer reserve time in the same size case.

This new model is built using the long life and high current density design features that make the High Rate Max series well suited for use with UPS (uninterruptible power supply) systems. This technology has been proven to meet the reliability and high quality standards required for use in data centers, financial institutions, emergency 911 centers, network operations centers, manufacturing applications and other applications in which operations must continue during a utility power outage. C&D's proprietary long life alloy, fixed orifice pasting, UL recognized venting and thermally welded case-to-cover seal makes these batteries a solution where the highest energy density is required to save floor space without sacrificing reliability.

GC Electronics Expands Product Offering with New Line of Industrial Batteries

GC Electronics has added an extensive line of industrial batteries to its list of product families. The GC sealed lead-acid batteries comprises more than 75 models, with outputs of 4-, 6-, 12- and 24-volts in capacities ranging from 1.2 to 230 Ah (amp hours).

GC Industrial batteries are well suited for use in a variety of industrial applications including backup for uninterruptible power supplies, security, programmable logic controllers, emergency lighting and communications equipment.

Available in six different terminal types, GC Batteries are also offered with flame-retardant cases as well as high-power options on select models that provide 15 percent more capacity than their standard counterparts. The deep-cycle GC batteries provide long service, with enhanced charge characteristics and are UL and CE approved.

Solicore Brings Innovation to Thin-Film Flexion Batteries

Solicore, Inc. has introduced a new high-speed production version of its Flexion batteries, which includes copper/copper battery terminal configurations. This enhancement meets the increased market demand for a product with dual copper battery terminals. Solicore's embedded power solution now simplifies current attachment methods and allows implementation of additional attachment options to platforms and applications.

Solicore's introduction of copper/copper battery terminals will simplify current attachment methods such as ultrasonic welding and the use of conductive adhesives. Many Solicore customers continue to implement new attachment techniques and have requested copper/copper battery terminals to enable these methods. The paper-thin Flexion batteries by Solicore have been met with great demand from the financial and bankcard industries, OTP card industry and in the RFID market. Flexion batteries are designed to be flexible, ultra-thin and heat/pressure resistant, making them well suited for card platforms and applications.

MobileLife Introduces External Battery Power Packs for Wireless Phones and Personal Electronics

MobileLife, a division of Magnadyne Corp., has introduced a line of external battery power packs for wireless phones, PDA's, iPod's, personal electronics and in some cases, laptop computers.

The new models use lithium ion and lithium polymer cells and allow consumers to carry a single external power source. The battery packs range in size from a credit card sized emergency power pack, capable of powering virtually all electronics devices from a wireless phone, to a laptop computer.

All of the battery packs feature attractive designs, a variety of adapters and connection cables that ensure compatibility with numerous devices and can be recharged up to 500 times. Several of the models include voltage-sensing technology that automatically detects and delivers the correct voltage to the device, which greatly reduces the risk of setting the wrong voltage.

The BT5VUSB-0 is a credit-card sized rechargeable battery pack for use with most popular phones and PDA's and features a 600 mAh lithium polymer design with an integrated charging cord.

MobileLife's most powerful external battery pack is the BT5VUSB-V with a 70 Wh lithium polymer design with universal output of 5 V to 18 V of power. Powerful enough to recharge most wireless devices over 20 times, or power a typical laptop for 2 ½ hours. It comes with various tips and adapter cables for most connections.

K2 Energy Solutions, Inc. Releases LFP18650P And 26650P Power Series Batteries

K2 Energy Solutions has released their LFP18650P and 26650P power cells. These batteries are based on the University of Texas licensed, Lithium Iron Phosphate (LFP) chemistry. They compliment K2's existing energy cell product line for use in the highest power demand applications.

With the successful completion of the power cell launch, K2 now has viable batteries available for everything ranging from power tools and high performance EV's to energy storage products. The power series cells are in stock and available for immediate use. These cells were brought to market in response to the increasing need for high performance, rechargeable Li-ion batteries with added safety. Use of LFP chemistry in Li-ion battery cathodes improves safety by eliminating the main cause of thermal runaway, oxide-based cathodes.

The LFP26650P weighs 82 grams, has an average discharge voltage of 3.2 volts, and a capacity of 2,500 mAh. The LFP18650P weighs 40.5 grams and has a capacity of 1,200 mAh. The operating temperature for both batteries is -20°C to 60°C.

AnalogicTech Announces Battery Charger IC for Single and Dual Cell Applications

Advanced Analogic Technologies, Inc. (AnalogicTech) has released the AAT3663, the first in a family of new 1A linear battery charger ICs capable of charging up to two Li-ion cells in series. Designed to operate from either an AC adapter or a USB port, this new device features AnalogicTech's Digital Thermal Loop charge reduction circuit that monitors the internal die temperature and gradually steps down the charge current to avoid thermal shutdown.

The AAT3663 operates across a 4.0 V to 13.2 V input voltage range and supports user programmable charge current from 100 mA up to 1 A via an external resistor. Quiescent current is less than 6 µA.

The device features an intelligent digital thermal loop charge reduction circuit that optimizes battery charge rate by constantly measuring die temperature and adjusting the charge current to compensate for thermal conditions. Unlike many competitive charger ICs, this closed loop thermal management system allows the charger to continue charging even under harsh environmental conditions, therefore minimizing charge time.

The new charger IC also features a programmable charge termination current feature that sends the device into sleep mode if the charging current dips below a pre-defined threshold. An integrated programmable charge timer can be used to shut down charging functions if a defective battery cell or a disconnection to the battery current path is detected.

The AAT3663 continuously monitors battery temperature and charge state for fault conditions. To protect the charging device and the battery under charge, integrated over-temperature, short-circuit, over-voltage and over-current protection circuits automatically shuts down the device if a fault occurs.

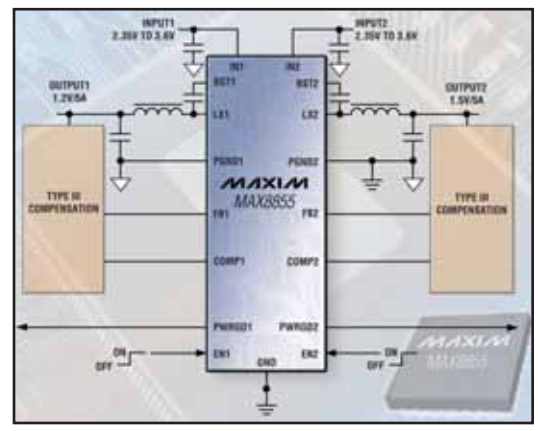
Specified for operation across the -40°C to 85°C temperature range, the AAT3663 is available in a thermally-enhanced 14-pin, 3 by 3 mm TDFN package. It sells for $1.38 in 1,000 quantities.

Microchip Technology Introduces Li-Ion/Li-Polymer Chargers with Auto USB or AC Power-Source Selection

Microchip Technology, Inc. has introduced the MCP73837 and MCP73838 (MCP73837/8) dual-input, high-current Li-Ion/Polymer charge-management controllers with automatic USB or AC adapter power-source selection. The single-cell, fully integrated chargers enable charge currents of up to 1 A from an AC power source, plus charging currents of up to 100 mA or 500 mA from a USB port. They have several on-chip safety features, and are available in 10-pin MSOP and 3 mm by 3 mm DFN packages, to enable smaller, faster and safer battery-charger designs.

Auto power-source selection from either a USB port or AC adapter means that MCP73837/8-based charger designs can automatically charge from a PC's USB port when no AC power is available. When powered from a USB port, the devices ensure compliance with USB power specifications and adjust outputs accordingly. The result is that one charger design can support multiple power sources. Additionally, with high charge currents up to 1 A from an AC power source, the MCP73837/8 devices enable faster charging cycles and less recharging down time. On-chip safety features, such as thermal regulation, cell-temperature monitoring and charge-timers minimize charger-related system damage, resulting in safer and more efficient charger designs.

In addition to VREG output and safety timeout period, charging parameters available as standard options on the MCP73837/8 devices include preconditioning current threshold and current ratio, charge termination threshold and recharge threshold ratio. The devices are well suited for portable, battery-powered consumer electronic devices, such as PDAs, portable DVD players and personal media players (PMPs), among others.



Highly Efficient, Step-Down Regulators Integrate Low-On-Resistance Switches For Maximum Space Savings

Maxim Integrated Products has introduced the MAX8833 and MAX8855: the industry's first step-down regulators to operate from 3.3 V or 2.5 V inputs, provide dual 3 A or dual 5 A outputs (respectively) and integrate switches that maximize space savings. In addition to saving space, the use of internal MOSFETs enables these devices to operate efficiently from low input voltages, which is not possible with large, discrete MOSFETs.

Internal MOSFETs provide much better performance in low-voltage applications compared to their discrete counterparts, which require higher voltages for full enhancement. With low on-resistances of 49 milliohms and 37 milliohms, respectively, the MAX8833 and MAX8855 are capable of providing efficiencies in the mid-90 percent range while switching above 1 MHz. The low on-resistance, high efficiency and small package of these devices make them well suited for DDR power supplies, processors that require more than one rail, and high-end enterprise equipment.

To increase design flexibility, each device provides a programmable frequency up to 2 MHz and an external frequency-synchronization input. An external reference input enables the implementation of tracking applications, such as DDR power supplies, by allowing one channel to power Vddq while the tracking channel powers Vtt. Programmable soft-start for each channel supports a wide range of outputs, further enhancing flexibility. Additionally, a separate power-good signal and enable input for each output ensure simple sequencing.

The MAX8833 and MAX8855 also combine a high-bandwidth, voltage-error amplifier with high-frequency switching to allow the use of ceramic capacitors that have minimal values.

The MAX8833 and MAX8855 are fully specified over the -40°C to 85°C extended temperature range. Each device is available in a 5 mm by 5 mm, 32-pin TQFN package to allow interchangeability as current requirements change. Pricing starts at $2.59 for the MAX8833 and $3.41 for the MAX8855 (10,000-up, FOB USA).

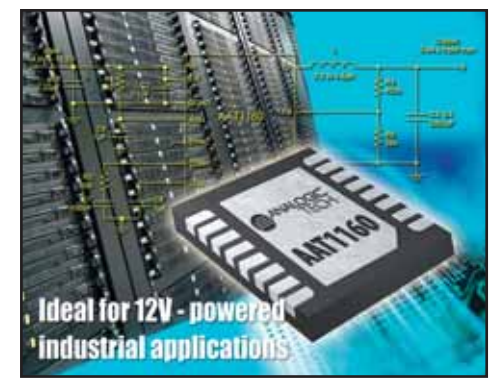
TI's New Microcontroller Families Offer Twice the Performance and Battery Life, Enabling Ultra-Low Power Applications

Texas Instruments, Inc. (TI) has released the availability of five new families of MSP430F2xx high-performance microcontrollers, the industry's lowest-power 16-bit general purpose microcontrollers (MCUs). The new microcontrollers provide a direct upgrade path for corresponding devices in TI's MSP430F1xx generation of ultra-low-power MCUs, easing development and offering complete software and pin compatibility while delivering twice the performance, twice the battery life and increased memory. MSP430F2xx MCUs enable developers of meters, sensors, industrial control systems, handheld instruments and a host of other embedded systems to extend the performance and lifetime of their products with minimal redesign.

With a high level of analog integration, TI's MSP430F2xx MCU architecture is designed for the requirements of a new generation of control systems. The devices integrate on-chip memories of up to 120 KB, and a 20-bit address word increases total addressable memory to 1 MB without paging, supporting the development of more complex programs.

A wide range of analog and digital peripheral options enable enhanced features in end products while reducing system costs and power consumption. For example, almost no battery drain occurs with standby power consumption as low as 0.5 uA, and fast wake up from standby mode further reduces battery load.

The MCUs have a wide operating voltage range of 1.8 to 3.6 V and a flexible clocking architecture that allows the designer to implement their select processing speed versus operating voltage. Battery life and system cost are further optimized by achieving the full processor speed of 16 MHz, at 3.3 V, giving margin for the power supply design requirements.



AnalogicTech Announces 3 A Step-Down Converter for 12 Volt Industrial Applications

Advanced Analogic Technologies, Inc. has released the AAT1160, a synchronous step-down DC/DC converter delivering up to 3 A output from a 12 V input. Combining high power efficiency levels and a very low 150 µA quiescent current, the AAT1160 offers power savings in a variety of industrial applications, especially those using backplanes, as well as portable systems running off two-cell Lithium-ion batteries.

Integrated Circuits and Semiconductors

The AAT1160 current-mode, step-down DC/DC converter operates across a wide 4 V to 13.2 V input voltage range. It supplies a load current up to 3 A with a fixed or adjustable output voltage which can be regulated to as low as 0.6 V.

The device supports efficiency levels up to 96 percent. Leveraging AnalogicTech's expertise in portable applications, the AAT1160 also consumes a low 150 µA no-load quiescent current. The AAT1160 maintains high efficiency over the entire load range. The user can select to operate the device in a forced Pulse Width Modulation (PWM) mode and synchronize the switching to an external signal to control switching noise. The high 800 kHz switching frequency also minimizes total solution size by allowing the use of small external components.

A soft start function limits input surge current and eliminates output voltage overshoot when the device is turned on. The AAT1160 also features short-circuit and overtemperature protection.

The AAT1160's performance and low power consumption is also a product of AnalogicTech's Modular BCD process technology. Compared to linear-IC legacy fabs and generic digital CMOS foundries, ModularBCD provides more cost-effective, modular fabrication of analog, power and mixed-signal ICs by monolithically integrating fully-isolated CMOS at multiple voltages, complementary bipolar transistors and robust power devices. This process avoids complex and expensive techniques such as epitaxy and high-temperature diffusion.

Devices manufactured in ModularBCD offer higher efficiency, smaller size and higher levels of integration than those fabricated in many other processes. They also offer designers better ability to manage power and extend battery life in a wide range of mobile consumer electronics products such as cell phones, portable media players, tablet and laptop computers and digital cameras.

Qualified across the -40°C to 85°C temperature range, the AAT1160 is available in a Pb-free, 16-pin 3 mm by 4 mm TDFN package. It sells for $1.82 in 1,000 quantities.

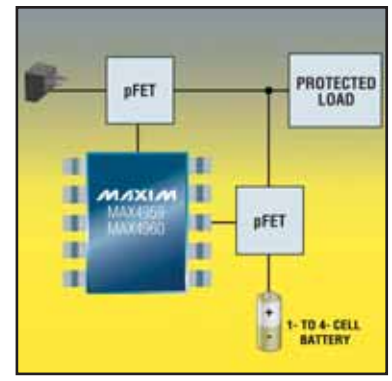
Highly Integrated Power Management ICs from NEC Electronics America Enrich the Mobile Internet Experience

NEC Electronics America, Inc. has expanded its product offering to include highly integrated power management ICs (PMICs). The offering targets the next wave of mobile Internet devices (MIDs) and integrates compelling applications and services such as Internet and cellular network access, multimedia playback, navigation, gaming, social networking and other innovative Web 2.0 applications.

NEC Electronics' PMIC solutions combine power management, logic, audio, user interface, connectivity and communications functions to maximize battery life, support high levels of integration and minimize board space.

High-Voltage, Overvoltage-Protection Controllers with Battery Switchover Protect Low-Voltage Systems Up to 28 Volts

Maxim Integrated Products has introduced the MAX4959 and MAX4960 overvoltage-protection (OVP) controllers with battery-switchover functionality. Designed to protect low-voltage systems up to 28 V, these devices provide resistor-programmable overvoltage (6 V to 28 V) and undervoltage (5 V to 28 V) trip levels. To implement this OVP and prevent damage to protected components, the MAX4959 and MAX4960 turn off an external pFET when the input voltage exceeds the overvoltage threshold. Subsequently, they hold the external pFET off until the input voltage rises above the undervoltage-lockout (UVLO) threshold. These controllers also feature a control-bit pin that switches to the battery when the host system detects a disconnect at the AC adapter. This combination of OVP and battery-switchover functionality makes the MAX4959 and MAX4960 well suited for low-voltage systems such as ultra-mobile PCs, notebooks and camcorders.



The MAX4959 and MAX4960 provide ±15 kV ESD protection (Human Body Model) on the input when the input is bypassed with an external 1 microfarad ceramic capacitor. These controllers are fully specified over the -40°C to 85°C extended temperature range, and are available in 2 mm by 2 mm, 10-pin microDFN and 3 mm by 5 mm, 10-pin microMAX packages. Prices start at $0.90 (1,000-up, FOB USA).

Charging, Testing & Monitoring

Aeroflex Plainview Introduces a Battery Electronic Unit Family

Aeroflex Plainview has released their Battery Electronic Unit (BEU) family of Lithium-ion (Li-Ion) cell balancing products. Aeroflex's BEUs promote and facilitate the safe use of large Li-Ion batteries on spacecraft and aircraft missions of greater than 20 years. Employing DC/DC converter technology integrated with Aeroflex's legacy RadHard MIL-STD-1553 databus and ASIC solutions allows Aeroflex to deliver a low mass, energy conservative sub-system that is well suited for satellite programs that desire the benefits of Li-Ion technology.

"In many long-range space applications using large cell Li-Ion batteries, the need for cell balancing has become obvious," said Joseph Castaldo, director Sales and Marketing. "In the past several years more programs have been gravitating to the benefits of Li-Ion. Our customers came to us to leverage the benefits of Li-Ion (less weight and size than the equivalent NiH battery) and to manage battery safety. At the same time, there was a demand to monitor the health of the cells over a 20 year mission life using a proven standard that meets customer requirements. All of these factors drove us to design a sub-system that promotes the safety and longevity of Li-Ion while minimizing battery losses and providing precision cell measurements via telemetry to the satellite operator."

The four Aeroflex BEU products all offer cell balancing to within +/- 5.0 mV, cell voltage monitoring accuracy +/-10 mV, total battery voltage monitoring accuracy +/-0.3 percent of full scale, MIL-STD-1553B telemetry and discrete output lines for critical signaling.

Aeroflex is already planning an addition to the BEU family and will be offering solutions to support eight cell battery applications. Evaluation boards will be announced in the second quarter of 2008.

Voxred International, Maker of the Turbo Charge Cell Phone Charger

Voxred International has launched a new product, the PowerBuddy. The PowerBuddy is a compact and lightweight rechargeable battery pack designed for cell phones, PDAs, iPod, iPhone and portable gaming devices that uses self-contained 100 percent lithium ion batteries that can be re-charged at any wall outlet. The device features a folding hideaway plug without a bulky cord as well as built-in USB, cell phone and gaming ports. The PowerBuddy can charge up to two electronic devices simultaneously whether it's standing alone or plugged into a wall outlet.

DPI Designs New Battery Charger for Solar-Powered Applications

Diversified Power International (DPI) has developed its first solar-powered battery charger. Featuring patent-pending technology, the new charger uses a solar-powered energy system that distributes electrical impulses generated by a solar panel. DPI began working on the charger in June 2006 and successfully field-tested the product in October 2007.

DPI's solar-powered charger is being applied initially to power automatic gate openers such as those used to operate swing and slide gates on outdoor entrances. The gate charger will be sold by a large network of distributors to major retail outlets such as Tractor Supply Company, Lowe's and The Home Depot in the US and Canada.

DPI executives plan to apply their solar-powered charger to other applications, including but not limited to backup sump pump systems, emergency service vehicles, recreational vehicles, field-powered remote equipment and a host of consumer product applications.

The PowerBuddy comes with 12 adapters designed for popular cell phone and PDAs, portable gaming devices and most devices that charge via USB.

MobileLife Launches Line of Charging Products

MobileLife has released a line of in-car and in-home charging devices for a variety of mobile phones and portable electronics products. The new line includes car chargers and travel chargers that can be used in the home, office with 110 volts or a vehicle's 12 volt power port. They also feature an additional in-line USB charging port for powering or charging a second device simultaneously. The new charging products feature robust charging circuits with circuit protection and the in-home and travel chargers are all UL approved for assured safety.

The VPA17MTMCU is a car charger unit for use with popular phones, PDA's and many consumer electronics products. The VPA17MTMCU-USB adds an in-line USB charging port for charging a second device. The VPAMTV3-USB is also a car charger model with a full 1 amp output to quickly charge portable devices. An extra USB port and Mini-USB connector permits use with Motorola, Blackberry and HTC phones as well as PDA's and other portable electronic devices.

Next is the TCML-MCU Portable Travel Charger for use on the go with most popular

phones, PDA's and portable consumer electronic devices. The TCML-MCU-USB Portable Travel Charger adds a USB charging port.

The Model DVU-2 is a Car Charger Extender which adds two additional cigarette lighter ports and two USB charging ports for multiple charging applications.

The Solio Hybrid 1000

The Solio Hybrid 1000 boasts a powerful solar panel and battery in an compact case, conveniently geared with a built-in rugged carabiner and cable. The Hybrid 1000 accepts power from either the wall socket or sun storing this energy within it's internal rechargeable battery. Solio then uses this energy to power gadgets at the same rate as if they were plugged into the wall. Solio will also hold its charge for up to a year. Plug into the sun and charge Solio through its solar panel or use the included tip to charge from the USB port of any computer.

Solio limits the need to purchase and carry around multiple chargers for each gadget as it can charge cell phones, iPods, digital cameras, game players and GPS.

New Offerings Provide Instant Energy for the Most Popular Mobile Devices

IOGEAR has recently introduced the GearJuice Slim Charger, GearJuice Rescue Charger and Battery Tester.

The lightweight Slim Charger, just over three inches in length, is small enough to fit in a pocket or purse and can power a cell phone twice before requiring a refresh from an external energy source. The product's design and sleek form make it a well suited solution for the busy mobile professional who doesn't have room for extra cables and connectors. The Slim Charger is compatible with mobile phones, Bluetooth headsets and MP3 players that are powered by a USB connection.

The GearJuice Rescue Charger serves as an emergency energy source for on-the-go gadgets. Powered by a single AA battery, the device enables quick and effortless charging on the fly. Its compact form provides instant power to mobile devices with a mini-USB connection.

IOGEAR also introduced its new Battery Tester. The small, environmentally-friendly, portable device allows individuals to gauge how much power is left in 1.5 V, AA, AAA, C, D and 9 V types of regular or rechargeable batteries. With an easy-to-read meter, consumers can identify their battery power levels, helping eliminate unnecessary disposal of usable batteries, further protecting the environment. The compact device contains a key ring hole, attachable to a key chain for easy access and convenient use. It is also an ideal gadget to place in a home's spare drawer or garage to quickly assess battery life.

Industrial Chargers Protect Batteries From Damage During Extended Charging

VxI Power has introduced a new range of battery chargers that have been designed for use in demanding industrial applications. As well as offering environmental protection to IP65, the BCL series chargers produce a regulated and filtered charging voltage that allows them to be connected to a battery for extended periods without overcharging or damaging the battery.

Featuring cyclic three-stage charging, the BCL units start the charging cycle at a voltage of either 14.4 V or 28.8 V, depending on model. After a preset time or current level has been reached, they automatically switch to maintenance charging at a lower voltage.

All models carry the relevant European EMC and LVD approvals. With a switching frequency of 9 kHz, the chargers exhibit very low levels of EMI, unlike many switch-mode power supplies and chargers which operate at frequencies up to 148 kHz and generate comparatively high levels of electromagnetic radiation. This is an important feature when the units are used in advanced industrial systems where control buses and sensor systems could potentially be influenced by EMI.

Operating from an input voltage of 230 VAC, the BCL series can be specified with charging currents of 6 A or 15 A for 12 V batteries or 3 A or 8 A for 24 V batteries.

Battery Components

Kodak to Launch Powerful Charge to Stop Counterfeit on Rechargeable Lithium-Ion Digital Camera Batteries

Kodak aims to pull the plug on counterfeiters exploiting the consumer electronics industry by deploying the Kodak Traceless System for Anticounterfeiting on Kodak Li-Ion rechargeable digital camera batteries.

The worldwide consumer electronics industry is struggling to fend off the growing threat of counterfeit batteries. As consumer use of handheld electronic devices soars, demand for rechargeable batteries is growing rapidly, and so are the problems caused by counterfeiters who are inserting fakes into legitimate sales outlets everywhere. Counterfeit batteries can lead to poor product performance, damage to electronic devices, and overheating that can create the risk of chemical leakage, burns, and even fires.

With the Traceless System in place, Kodak will be able to quickly distinguish fakes from genuine Kodak lithium-ion batteries. The Traceless System uses forensically undetectable markers that can be placed into printed materials, product packaging or components of the actual products. The markers can only be detected using secure, handheld Kodak readers.

The Traceless system is especially suited for the electronics industry, because the covert markers can be embedded into widely used thermal transfer ribbons, a common method for printing barcode labels on electronic goods.

AVX Releases Capacitor Simulation Software

AVX has released a new version 1.5 of SpiTanII, the company's simulation program for its tantalum and Oxicap niobium oxide capacitor ranges.

SpiTanII is an application software that enables the designer to view all basic characteristics and parameters for tantalum and Oxicap capacitors. The designer can select a desired component by part number or by reference to capacitance, rated voltage, case size or series. For the selected capacitor all basic parameters such as frequency characteristics of capacitance, ESR, impedance, DF and ripple current and ripple voltage ratings - are displayed.

Version 1.5 of the software includes 471 new part numbers from various series such as low profile standard tantalum TAJ products, low profile standard Oxicap (niobium oxide) NOJ devices, and high CV consumer tantalum TLJ series. New for the first time in V 1.5 are TCJ series polymer capacitors, TAZ high reliability military components and Corecap NPV parts.

Application Profile

ExxonMobil Chemical's Battery Separator Film Technologies Help Put Electric Vehicles on the Road

ExxonMobil Chemical has released that its new battery film technology will be an integral part of Electrovaya's new all electric vehicles.

ExxonMobil's battery separator films enhance the power, safety and reliability of lithium-ion batteries, thereby helping speed the adoption of these smaller and lighter batteries into the next wave of lower-emission vehicles. Electrovaya recently announced the launch of its Zero Emission Low Speed vehicle, Maya-300.

"ExxonMobil is pleased to collaborate with Electrovaya," said Jim Harris, senior vice president, ExxonMobil Chemical. "ExxonMobil's film technologies allow lithium-ion batteries to meet hybrid and electric vehicle requirements, helping to make vehicles like the Maya-300 lighter and more efficient."

The Maya-300 electric vehicles will have an extended range of up to 120 miles and are designed for urban and neighborhood driving patterns.

"Electrovaya's innovative lithium-ion battery system has made the low-speed electric vehicle a viable commercial product," said Sankar Das Gupta, CEO, Electrovaya. "We are pleased to launch the Maya-300 and believe this zero emission vehicle marks a new era where affordable clean transportation solutions become available with sufficient range for daily local driving."

BATTERY POWER 2008

September 4-5
New Orleans, La.

Battery Power 2008, an international conference highlighting the latest developments and technologies in the battery industry, will be held September 4-5 in New Orleans, La, in the heart of the French Quarter. This sixth annual event will feature more than 40 presentations on portable, stationary and automotive battery technology, as well as battery manufacturing, materials and research & development. Topics will include new battery designs, emerging technologies, battery materials, circuit protection, charging and testing systems, battery health, as well as the latest market trends affecting the industry. The conference is designed for battery manufacturers, distributors, OEMs, design engineers and power integrators to learn the latest capabilities, design issues, trends and market forecasts in batteries and battery-powered products and systems.

Battery Power 2008 will feature:

- Battery Safety Standards and Regulations
- Current and Future Battery Cost and Performance
- Understanding Industry Roadblocks
- Global Activity from Leading OEMs
- Hands-on Product Demonstrations

Benefits of Attending:

- Optimize your system performance and dependability
- Assure compliance with latest safety requirements and best practices
- Discuss your specific system needs with technology experts
- Improve system longevity and power delivery
- Maximize return on battery technology system investment
- Find out the latest market, pricing and manufacturing trends worldwide

Who Needs to Attend:

- CEOs interested in leaning the latest investment and market trends
- OEM design engineers of electronic products and battery powered systems
- Developers and integrators of battery products and systems
- System engineers of standby, backup and UPSs
- System integrators, vendors, distributors
- Manufacturers of batteries and battery packs
- IC and chipset providers
- Manufacturers of charging, monitoring and testing equipment
- System engineers of electric vehicles
- Product managers seeking new applications and partnering opportunities
- Charging and testing system component providers
- Specialized energy materials suppliers
- Battery component providers

Preliminary Program

The preliminary program is available online at www.batterypoweronline.com/bp08_program.htm, featuring more than 20 presentations from industry leading companies. Speaking opportunities are still available. For information on submitting an abstract, please **www.batterypoweronline.com/bp08_index.htm** or contact Shannon Given, program manager at shannong@infowebcom.com.

Register Early and Save $$$

Register by May 9th for a reduced rate of $695, that is a savings of $300! Battery Power 2008 also offers team discounts. Register two attendees and $100 is automatically deducted from each attendee's registration fee; register three or more attendees and $200 is automatically deducted from each attendee's registration fee. Government and military discounts are also available.

Register online at **www.batterypoweronline.com/bp08_reg.php**

Pre-Conference Workshop

Texas Instruments will be hosting a half-day work on September 3rd titled **Li-Ion Battery Safety, Maintenance, Charging and Fuel Gauging.** The workshop will start by covering Li-Ion battery characteristics including self-discharge, useable capacity and battery impedance, Li-Ion battery cell safety and UL testing and Li-Ion battery safety requirements. Basic battery maintenance and transportation will be discussed, as well as Li-Ion battery pack electronics safety and design. Attendees will also learn about front-end safety and power path management charging, which allows to charge the battery while powering the system simultaneously. TI will present how to charge the battery faster from USB and support USB On-The-Go by using a 3MHz bidirectional switching charger. Finally, we will review voltage based on coulomb counting fuel gauges and also talk about the system-side fuel gauging techniques and design challenges in battery powered portable devices.

Complete workshop details, including registration, can be found online at **www.batterypoweronline.com/bp08_workshop.htm.**

Hotel Information

Battery Power 2008 will be held at the Astor Crowne Plaza located in the heart of the French Quarter. A special room rate of $169 is available for Battery Power 2008 attendees. Be sure to reserve your room by August 13, 2008, to receive this special rate. Be sure to mention Webcom Communications when reserving.

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Battery Power for the Future

Is the Energy Output of Batteries Reaching its Limit?

David Linden and Thomas B. Reddy, Ph.D.
Co-Editors Handbook of Batteries (McGraw-Hill)

Small portable batteries have become a key consumer commodity. Just 50 years ago, flashlights were the main application for such batteries; now there is an almost uncountable number of portable battery-operated applications, such as laptops, cellphones, medical devices, audio and security equipment and toys, to name just a few. It is not unusual for a household to have more than a dozen such devices, free from the power cord, requiring batteries for their operation.

While very dependent on batteries, the consumer is not satisfied with their size and weight and short operating life. The "need to press on with battery research" was highlighted by President Bush in his 2007 State of the Union address. Companies, such as Google, announced multimillion dollar programs in support of battery research. Critics point to the chip industry, to Moore's law and the doubling of performance every 18 months. Although advances have been made (as illustrated in Figure 1 that level of improvement cannot be achieved with batteries. To deliver their energy, the active materials in the battery must be consumed and there are limits to the amount of energy that is contained in these chemicals.

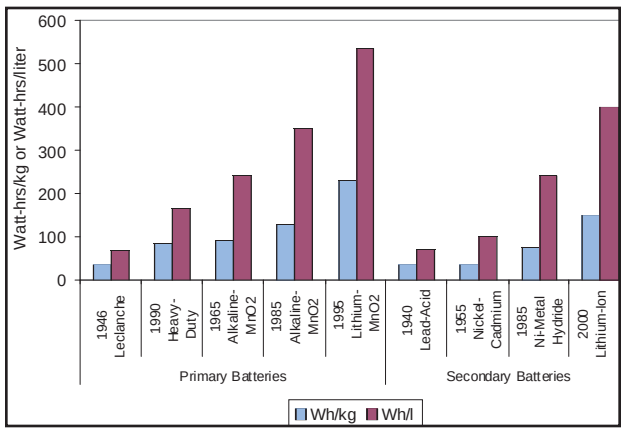

Figure 1. Advances in Battery Performance

What can realistically be accomplished? A look at the factors influencing battery performance will help.

The operation of a battery is simple. A battery consists of two major components: the anode electrode or "fuel" and the cathode electrode, the source of oxygen. In addition, a separator is needed to separate these two components and prevent the formation of an internal short circuit. An electrolyte is needed to provide the means for transfer of ions between the two electrodes for the reaction to take place. When the battery is being used, an electrochemical reaction takes place; the fuel is oxidized and the battery delivers its energy to the device it powers. The total amount of energy delivered is equal to the energy released by the reaction.

	Material	Standard Reduction Potential (volts)	Electrochemical Equivalence (ampere-hours/gram)
Anode Materials	Hydrogen	0.00	26.590
	Lithium	-3.01	3.866
	Magnesium	-2.38	2.200
	Zinc	-0.76	0.820
	Cadmium	-0.40	0.480
	Lead	-0.13	0.266
	Metal Hydride (MH)	-0.83	0.590
	Carbon (LiC_6)	-2.80	0.372
	Methanol	—	5.020
	Sodium Borohydride	—	3.000
Cathode Materials	Oxygen	1.23	3.350
	Fluorine	2.87	1.410
	Chlorine	1.36	0.756
	Manganese Dioxide	1.28	0.308
	Nickel Oxyhydroxide	0.49	0.292
	Lead Dioxide	1.69	0.224
	Lithium Cobaltoxide (Li_xCoO_2)	1.25	0.150
	Lithium Iron Phosphate ($LiFePO_4$)	0.42	0.170
	Lithium Mixed Transition Oxides ($LiMn[1.5]Ni[0.5]O2$)	2.00	0.130
	Carbon Monofluoride ($(CF)_1$)	1.50	0.864
	Bismuth Fluoride	1.20	0.302
	Copper Fluoride	0.54	0.528
	Iron Fluoride	-0.27	0.712

Figure 2.

Historically, zinc for primary and lead for rechargeable batteries have been and still are the most popular materials of choice for the anode. They are stable, low cost and when used as recommended, provide reliable service. The zinc Leclanche cell, originally developed more than 130 years ago, is still in use in its more recent heavy-duty design. In the early 1960s, the zinc/alkaline battery was developed, doubling the specific energy, providing higher power capability and having a much longer shelf life. This improved battery, with the development of the transistor, encouraged the growth of battery-operated radios, medical equipments and many other portable electronic devices. At the same time, a demand arose for portable rechargeable batteries to reduce operating costs and take advantage of their higher power capability. The lead-acid battery was found inadequate for the small sizes that were required for these applications. This led to the development of nickel-cadmium and later, nickel-metal hydride batteries.

But these improvements were not enough to meet the energy needs of laptops, cells phones and other devices as many new power consuming functions were added with the continued demand for smaller size, lower weight and longer operating times.

Materials for Maximizing Energy Output

Lithium was always attractive as an anode material because of its high voltage and the highest electrochemical equivalent of any anode material, except for hydrogen. It was not used, however, because it was reactive with the aqueous electrolytes then available. In the 1960s, fairly low resistance organic electrolytes, providing adequate conductivity that were compatible with lithium were developed and the first lithium primary batteries were produced. As shown in Figure 1, these batteries delivered about twice the energy output of the zinc batteries and the advantage of a long shelf life of up to 10 years. Metallic lithium, however, proved to be unsatisfactory as the anode for rechargeable lithium batteries as a high surface area, very reactive form of lithium formed during recharging. This reactivity was reduced by the development of the lithium-ion battery in which the lithium is contained in an intercalation compound, with the lithium bound to a host. The battery, on charge, operates by transferring a lithium ion from the cathode host, typically a metallic transition metal, to the anode, most commonly a carbon. On discharge, the lithium ion is transferred from the anode to the cathode. They were initially called "rocking-chair" batteries as the lithium ions rock back and forth between the two electrodes. While the anode used in the lithium-ion battery does not have as attractive electrochemical properties as lithium, it delivers more than twice the energy output of the earlier rechargeable batteries (Figure 1). More recently, the use of alloy anodes for these lithium batteries now offers significant hope for improvement in energy output Silicon-graphite matrix anodes have demonstrated a reversible capacity of 640 mAh/gram verses 372 mAh/gram for carbon.

The lithium primary battery has been successful only in niche markets because of its higher cost. The lithium-ion battery, however, has been very successfully used in the tens of millions in cell phones, laptops and other portable electronics. It is being considered for use in applications requiring larger batteries and is the subject of much research and development to improve its performance.

Hydrogen also has attractive electrochemical characteristics. It the subject of much R&D effort as part of the Hydrogen Economy program and the interest in a non-polluting hydrogen fuel cell for electric vehicles and other applications. It is now used in portable batteries as the anode active material in the nickel-hydrogen and nickel metal hydride batteries. The problems of handling hydrogen, because it is a flammable gas, are well known. For portable applications, while used in much smaller quantities, it still has to be contained in a pressure vessel, absorbed or chemically bound in a metal hydride to be used effectively. But, as shown in Figure 2, its attractive energy output is reduced considerably because of the need for a "container" as, for example, the metal hydride electrode.

The energy output of the cathode materials must also be considered in determining the energy output of the battery. Oxygen has very attractive values for electrochemical equivalence, but as a gas like hydrogen, it is used in most batteries as an oxygen containing compound. The values for these materials, some of which are listed in Figure 2, are much lower, which reduces the specific energy as well as the energy density that can be expected for these battery systems research on mixed transition metal oxides, such as $LiMn(1.5)Ni(0.5)O_2$, which provides 4.7 volts verses a lithium anode, indicates that still higher voltages can be obtained with lithium-ion batteries. The higher voltage and conductivity of these materials could result in higher energy, higher powered batteries.

Fluorine also has attractive electrochemical properties but, similar to oxygen, has to be used in the form of solid fluorine-containing solids. These metallic fluorides, such as CuF_2, FeF_3,and BiF_3, have favorable characteristics but because of their poor electrochemical activity have not been used successfully. Recently, nanocomposites of these metal fluorides with conductive matrices have been shown to possess electrochemical activity and offer the opportunity for the development of batteries with higher energy output than currently available.

While most batteries are closed systems, some batteries, such as in the zinc/air battery, are open to the air and use ambient air for the oxidant. This potentially can reduce the size and weight of the battery as the active cathode material is not contained in the battery and introduced only as required. However, catalyzed electrodes, adequately sized to handle the required power, are needed to support the oxygen reaction. This adds to the volume and weight reducing some of the advantage.

Air electrodes, limited by the flow of air (unless forced by a fan or other means) even when catalyzed with precious metals, tend to operate at low rates. Direct exposure to the ambient environment, e.g. humidity, carbon dioxide, etc, also adversely affects performance. As a result, commercial ambient air batteries are mainly used in special low rate applications, such as hearing aids.

Over the last 200 years since Volta's invention of the voltaic pile, most, if not all, of the relatively large number of materials that can be used as anodes or cathodes in batteries have been explored. But only a few, mainly those listed in Figure 1, have attained wide commercialization and are in use today. Several others are used in limited quantities in niche markets. Most of the others failed to achieve successful commercialization. It will be difficult to find new materials that can be used successfully in batteries and have significantly higher theoretical energy content than those now in use. The values now attained for theoretical specific energy or energy density should be considered as close to the maximum, although continuing research may find new materials that will lead to batteries with higher energy content.

Designs for Optimizing Energy and Power Output

A practical battery must also have a container and other materials of construction, such as seals, terminals, anode and cathode current collectors, electrolyte, separators and protective devices that add to the size and weight of the battery. Usually, the active anode and cathode materials are not electrochemically balanced and an excess of one is used to limit gassing and enhance safety, charging or other performance characteristics. Space has to be allowed in the cell for expansion of materials and to prevent leakage, increasing volume and lowering energy density. The weight and volume of these non-energy delivering materials can be at least equal to that of the active materials, reducing the specific energy and energy density to less than half of the theoretical values. For comparison, the theoretical values of the specific energy of a "practical" battery are also shown in Figure 3. The values are about 50 percent of the values shown for the active materials alone. For multi-cell batteries, these values can even be lower because of the weight and volume taken by the battery container and by the protective devices that may be included.

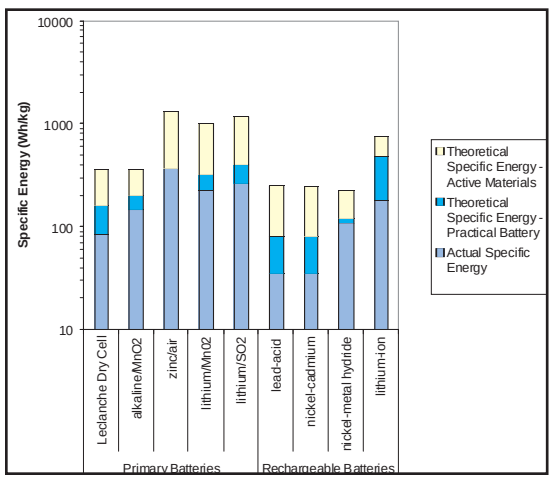

Figure 3. Theoretical and Actual Specific Energy of Battery Systems

Further, batteries do not operate at 100 percent efficiency. When a battery is discharged, the voltage is lower than its theoretical voltage. The difference is caused by losses due to cell and battery resistance and polarization of the active materials during discharge as illustrated in Figure 4. In the ideal case, the discharge proceeds at the theoretical voltage (Curve A) until the active materials are consumed and the voltage drops to zero. In practice, the discharge curve is similar to Curve B. The initial voltage is lower than the theoretical voltage due to internal cell resistance and polarization effects at both electrodes. During discharge, the voltage drops further as the cell resistance increases due to accumulation of discharge products, activation and concentration polarization and related factors. The discharge is terminated at some practical "end" voltage, a value well above zero volts. Thus, not all of the available active material is used, further reducing the energy output.

The actual specific energy output of the various battery systems, based on the batteries being discharged under moderate or mostly optimum conditions is also shown in Figure 3. In practice, less than 30 percent of the original theoretical specific energy is available for most systems

Under more stringent discharge conditions such as high discharge rates and lower temperatures, the useable energy output is further reduced. This is also illustrated in Figure 4 as Curve C, which is similar to Curve B but rep-

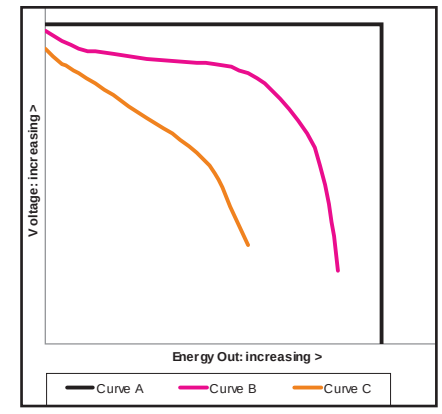

Figure 4. Characteristic Discharge Curve

Article continued on page 12

resents a discharge under more severe conditions. The voltage is lower throughout the discharge and the end voltage is reached earlier. The net result is that only about 25 percent or less of the theoretical specific energy of the active materials is actually delivered.

During the lifetime of a battery system as manufacturers and users gain experience with the product, there are many options to modify designs and chemistry to improve performance. As non-active materials account for about 50 percent of the weight and volume of the battery and internal cell resistance is responsible for a significant amount of energy loss, the focus is to reduce these components without impairing other performance characteristics such as safety, cycle life, shelf life and capacity loss.

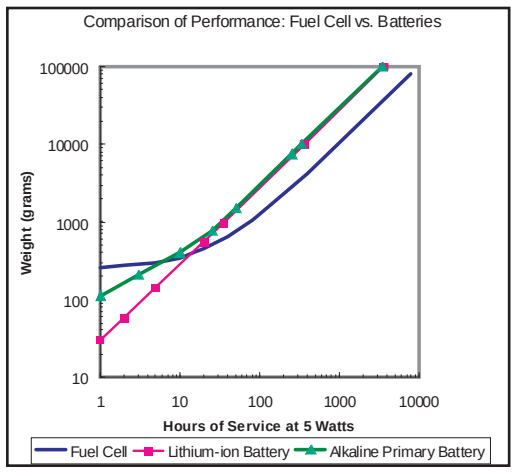

Figure 5. Comparison Performance: Fuel Cells vs. Batteries

Manufacturers are using thinner-walled containers and enclosing batteries in foil laminate packaging to reduce the weight and volume associated with the inert components. Other light-weight components, such as metal foam current collectors, are also being utilized. Batteries can be designed to enhance certain characteristics like high capacity, high power capability and high temperature operation. Batteries designed for low rate applications (as are most of the standard primary batteries) generally use a bobbin construction to maximize the amount of active materials that can be put into the battery. This maximizes the amount of available energy but limits the rate at which this energy can be efficiently discharged. Batteries designed for high power applications, including those designed for rapid charging, must use structures that minimize internal resistance and provide more sites for chemical reaction. To do this, these batteries may use a spiral-wound (jelly-roll) construction, a multiple parallel plate structure or other techniques to minimize the space between the electrodes and maximize surface area. High conductivity electrolytes, additives such as carbon blacks or graphite in the electrodes, current collectors and tabbing can be chosen to further minimize internal resistance and heating effects.

The biggest challenge is meeting the demand for safe, lightweight, high power batteries, packed to deliver maximum service with thin separation between electrodes. The thin internal constructions have to be designed to prevent internal shorting. High rate charging and discharging cause the batteries to operate at high temperatures and require controls, fusing or means to cut-off cell reaction to prevent overheating, thermal runaway or fire. New designs and techniques are being proposed to overcome these problems, such as using nanotechnology or newer materials such as the lithiated olivine compounds (e.g. lithium iron phosphate), which decompose at much higher temperatures than the transition metal oxides and thus enhance safety. But, the need to run batteries at high power levels because of the requirements of the equipment and exacerbated by the demand for smaller and lighter batteries, results is their operating under very inefficient conditions.

Significant improvements in performance can be attained during the life time of a battery system, but as a system matures, the improvement in performance levels off. While there are opportunities to improve certain performance, particularly in the area of high power batteries for specific applications, significant advances in energy density or specific energy of a battery system are unlikely to occur with mature technologies.

Fuel Cells

Though still under development, fuel cells are also being considered for portable applications, in place of batteries, offering the possibility of longer service life. For these small applications, the use of hydrides as a source of hydrogen or other "fuels", such as methanol, are being considered. Ambient air is used as the source of oxygen. A fuel cell differs from a battery, which is self-contained. In the fuel cell, the fuel is fed into the fuel cell as it is used. Thus, a fuel cell consists of two parts: the electrochemical converter and the source of fuel. This design is penalized as the converter, sized to handle the required power level, must be part of the device regardless of how long the device has to operate. The fuel cell becomes advantageous for longer service times as only fuel, which should have a more favorable specific energy density than the battery, has to be added to extend operating time.

This is illustrated in Figure 5, which compares the weight of the fuel cell with the alkaline primary battery and the lithium-ion rechargeable battery, each system delivering 5 watts for various periods of time. At short service time, the weight of the fuel cell converter (projected at 250 grams) predominates and the fuel cell system has the highest weight. For longer service, the performance of the fuel cell depends mainly on the weight of the "fuel" (projected, in this case, for methanol at 500 mWh/gram) and the advantage of the fuel cell over the batteries becomes evident, provided that the specific energy of the fuel is greater than that of the battery with which it is compared). The performance of the lithium-ion battery (estimated specific energy of 180 mWh/gram) plots with a steady slope as it maintains about 90 percent of its specific energy even as the discharge rate increases to higher power levels The performance of the general purpose alkaline primary battery, designed to optimize performance at the lower discharge rates with a specific energy of 170 mWh/gram, tapers off at the higher rates.

Specific batteries and fuel cells, having characteristics different from those plotted, may result in different cross-over points but the same relationships should hold. Similarly the relationships are the same if the comparison is considered on the basis of volume or energy density. The design of a fuel cell, for example for cellphones, with the emphasis on small size and weight may prove to be difficult unless the user is willing to accept a larger unit to obtain the longer service. A more acceptable trade-off may be found for larger portable devices, such as the lap-top, once the development of these portable fuel cells is completed.

The Future

While not meeting all of the desires and demands of consumers, who are seeking smaller size and longer service time, batteries will continue to be a major factor contributing to the success of portable electronic devices. There is no other viable alternative power source for these portable applications that is available today.

Realistically, it is becoming increasingly difficult to develop new battery systems that will have significantly higher energy output and still meet the requirements of a successful commercial product including availability of materials, reasonable cost, safety and environmental acceptability. The introduction of the lithium primary battery systems more than 25 years ago and the lithium-ion rechargeable battery technology in the 1990s were the last major advances in battery technology. These may represent the best that can be achieved with battery systems. Most materials that can be used as the active materials have been investigated and further improvements in battery technology will require breakthrough discoveries. The impact of the fuel cell on the design of portable electronic devices awaits its successful development.

For this time, then, the values listed below are close to the maximum that can be expected for the energy output of portable batteries:

	Primary Batteries-closed systems (30 hour rate)	Primary Batteries-using ambient air (100+ hour rate)	Rechargeable Batteries (5 hour rate)
Specific Energy (Watthours/kilogram)	720	400	225
Energy Density (Watthours/liter)	1,270	1,300	525

It must also be recognized that even if the breakthroughs occur through the development of new materials, designs that utilize a higher percentage of the available theoretical energy or other advances, because of the thermodynamic limitations to battery performance, these values will probably not be exceeded by more than 50 to 100 percent.

For further improvement of battery performance in small electronics, it defaults to the electronic industry to continue their remarkable advances that do not have such limitations, at least in the immediate future. Power demands of their electronics must be reduced. In fact, Intel and IBM recently announced improvements in the insulating material used in integrated circuits that will reduce their power requirements.

Efficiency of power supplies must be increased. Devices must be designed to insure that the batteries are used optimally and accept the trade-offs that are needed to utilize the energy output of batteries safely and optimally.

Battery Runtime Demystified

Sara Bradford, Industry Director
Frost & Sullivan's Energy & Power Systems Practice

Battery runtime can be a mystery to some; a backup system battery's fixed runtime and life span, a mobile device's fortuitous shutoff, a car battery's limited life. Unfortunately, all good things must eventually come to an end. Luckily, many technological innovations and practices are continually working towards extending battery life by improving capacity, one of the key measurements for battery runtime. From the bottom up, battery materials, manufacturing processes, ICs and advanced technology are all currently evolving at a rapid pace to improve battery capacity. This has created a dynamic industry with increased market potentials across the globe.

Battery Materials and Components

Batteries utilize a set of raw materials and components to operate including the anode, cathode and electrolytes. These components vary by battery type, but are all comprised of naturally occurring metals and chemical combinations. Each battery cell is created with a precise quantity of the material and chemical combination. Any slight variation can affect the amount of produced electricity, voltage rate or overall ability to function properly, including negatively affecting battery runtime.

Battery material innovations have resulted in extended runtimes and nanotechnology is expected to play a big role in this advancement. By using nanotechnology in the manufacturing process, increased surface area can be created to provide high power and energy density, long shelf life and decreased manufacturing cost. For example, many start-up companies, battery suppliers, national laboratories, university research teams and other companies are utilizing nanotechnology to develop battery materials expected to extend runtime. An innovative type of anode based on silicon nanowires was recently introduced that is expected to benefit the industry.

Battery Management ICs

Primary functions of battery management ICs are battery charging, protection and monitoring. Rechargeable batteries require charge control circuits for safe, efficient and rapid recharge capabilities. In addition, lithium-ion and lithium-ion polymer battery packs require a built-in protection circuit that protects the cell from improper use. The growing need for a more accurate fuel gauging, heat dissipation reduction and related risks and gathering data on battery voltage, current and temperature has become an important trend in battery management ICs market.

Fuel gauges incorporate software packages to check data, reprocess algorithms at any point of time based on age of the battery, number of discharges and much more. This is one of the most important trends in the battery management industry and is expected to increase.

Alternative Energy Solutions

Several alternative energy solutions are being developed and a common goal is to extend application runtimes. Whether the technology supplements or replaces the existing battery, the goal remains to extend runtimes.

Ultracapacitors

An increase in automotive luxury features has spurred technology development on the power side. As existing battery chemistries are challenged to keep pace with the electrical demands of these additional features and provide the required runtime, ultracapacitors are being reviewed as a potential solution. When combined with traditional batteries, the ultracapacitor/battery combination can become an energy storage solution that can provide instant release of power and charge. Additionally, by implementing a distributed power architecture, battery strain will decrease and ultimately provide extended runtimes. Hybrid vehicles, regenerative braking and stop-and-go (ignition acceleration and starting) applications also impact the demand for ultracapacitors.

Uninterruptible power supplies (UPS), DC power systems and renewable energy applications currently use lead acid batteries. Unlike the automotive market, the industrial market largely deals with product reliability and quality issues, especially the current battery technology. The major issues identified with traditional batteries used in industrial application is poor power density, cycle life, runtime and thermal susceptibility. Original equipment manufacturers are exploring the possibilities of enhancing power reliability by implementing ultracapacitors as an additional energy storage solution either in conjunction with batteries or fuel cells as a power conditioner, which could extend the battery life and runtime.

Although ultracapacitors initially emerged as a memory backup technology for consumer electronic devices, its discovery as an energy storage solution has expanded the possibility for diverse applications in the consumer electronic markets. Mobile devices are seen to be one of the keen areas of focus. Portable electronic devices have steadily moved toward higher performance that requires additional power, lower cost, smaller size, longer runtime and lighter weight. These technology trends impact the existing power source and put considerable strain on rechargeable batteries. Additionally, portable applications require instantaneous power to operate their various features. Ultracapacitors are a solution, as this technology has the ability to instantly charge and recharge for numerous charge-discharge cycles.

Fuel Cells

Fuel cell technology is considered a niche or a special need type of market. Similar to any new technology, the end-result products take time to truly penetrate the market. For mass-market commercialization to occur, a product must typically start small, be adopted by a small percentage and then blossom into full growth. Fuel cells are expected to follow this time line curve closely.

Fuel cells offer a wide range of benefits. A single fuel cell can produce water, electricity or heat and it is inherently clean, efficient and safe. Furthermore, these cells possess the unique ability to address environmental degradation and energy security challenges.

Fuel cell development began more than 25 years ago as a result of the need to find a reliable, lightweight power source for sophisticated military and space applications. Fuelled by pure hydrogen, these cells produce zero emissions of carbon dioxide, oxides of nitrogen, or any other pollutant. Fuel cells used in applications ranging from backup equipment to portable electronic devices all maintain a similar goal, to extend runtimes.

Conclusion

Extending battery runtime is a key industry focus at this time. A high level of R&D and technology advancement is focused on this trend and several areas have witnessed a positive improvement. This is expected to be an ongoing trend in the energy industry as applications continue to evolve and demand increased power and capabilities. Time will tell if this insatiable desire for extended battery runtimes will ever truly be fulfilled.

Sara Bradford is industry director for the Frost & Sullivan North American Energy and Power Systems Practice. She focuses on monitoring and analyzing emerging trends, technologies and market dynamics in the battery, alternative energy, fuel cell, power supplies/power quality and energy industries worldwide.

For more information contact Johanna Haynes at johanna.haynes@frost.com.

The Impact of the Recent DOT Rule

Todd Sweetland, Robin Tichy
Micro Power Electronics

The regulations regarding the shipment of Li-ion batteries are confusing for a developer of portable products. For several years, the United States' regulations were distinct from those dictated by international governance. Finally, the discrepancy has been resolved and manufacturers can now be assured of consistent rules for the shipment of Lithium based batteries. The US Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) lithium battery final rule was published on August 9th, 2007 in the Federal Register. This long awaited rule will harmonize the US lithium battery hazardous materials regulations (HMR) with the regulations that have been in effect internationally since 2003.

The publication of the final rule incorporates many of the dictates from the Agency's previous proposed rule as well as changes from the 2004 interim final rule on lithium metal (Li-primary) batteries. Substantial regulatory and formatting changes to the Li-primary (disposable) and Li-ion (secondary, rechargeable) battery provisions in US HMR have been unveiled. The effective date of the rule is January 1, 2008; however, some of the special provisions will go into effect later.

All Li-primary and Li-ion battery packs, regardless of their size, will need to be tested according to the UN manual of Tests and Criteria prior to their production shipments. The requirement for testing small battery packs does not go into effect and become mandatory until October 1st, 2009. However, it is prudent to begin this testing on products currently in development. As summarized in the chart, three categories of batteries are defined in the US DOT's rule based on their "size," or a calculation of equivalent lithium content (ELC). ELC is calculated in grams on a per cell basis to be 0.3 times the rated capacity in ampere hours. For example, a battery pack consisting of 12 cells with a rating of 2.2 Ah each would just barely make it under the small/medium cut-off.

Battery and cell category definitions

		Small (no more than)	Medium (between)	Large (more than)
Cells	Primary	1 g Li	1 g and 5 g Li	5 g Li
	Secondary	1.5 g ELC*	1.5 g and 5 g ELC	5 g ELC
Batteries	Primary	2 g Li	2 g and 25 g Li	25 g Li
	Secondary	8 g ELC	8 g and 25 g ELC	25 g ELC

*ELC (Equivalent Lithium Content)

"Small" battery packs that have passed the UN testing requirements, including batteries packed with or installed in equipment, can be transported "non-restricted." "Medium" size battery packs that have passed the UN testing requirements, including batteries packed with or installed in equipment, can be transported non-restricted by motor vehicle or rail only. If these batteries are to be transported by passenger or cargo aircraft they must be shipped as fully-regulated Class 9 hazardous materials. "Large" size battery packs that have passed the UN testing requirements, including batteries packed with or installed in equipment, must be shipped as fully-regulated Class 9 hazardous materials. One of the more significant issues addressed in the US DOT's rule is confirmation that single-cell lithium battery packs do not require UN testing provided that the cell was previously tested and passed the UN testing as outlined in the Manual for Tests and Criteria. This ruling is very important for the makers of portable equipment because hazardous material shipments are costly and add to the shipping time.

The US DOT certainly has not finished their work on lithium batteries because there are further international regulations yet to take effect. Expect the agency to publish a new proposed lithium battery rule in late 2008 to harmonize its regulations with the changes recently adopted, but not yet implemented, at the international level. For example, as of January 1, 2009 under the international regulations, Li-primary batteries and Li-ion batteries will be assigned separate identification numbers, also known as UN numbers. UN3480 will be assigned to Li-ion batteries (including Li polymer rechargeable batteries), while the existing number UN3090 will only cover Li-primary battery packs. In addition, there are numbers assigned to Li-ion and Li-primary batteries contained in or packed with equipment. Those numbers are UN3481 and UN3091, respectively. Also, for international shipments the size determination will change to a watt hours (Wh) basis. Wh are defined as the rated capacity multiplied by the nominal voltage. The new limits for batteries to ship unrestricted are 20 Wh for cells and 100 Wh for battery packs. The Wh rating must be placed on the label of these battery packs, so it can be seen by users of the product. The US DOT is expected to issue a proposed harmonization ruling within a few days of the international change. This will allow all shippers in the US to use this method for air and sea shipments. Ground and rail shipments within the US will still be required to use the ELC method of determining the size of the battery pack.

While the US DOT is moving to remedy the confusing differences between the US and international regulations, the rules remain abstruse. In addition, the changes are not yet complete, so the manufacturers of portable devices will need to continuously monitor the rulings. Battery manufacturers offer expertise in this area for their customers, so a device designer should consult their battery developer before making any assumptions regarding shipping requirements.

Contact Micro Power Electronics at www.micro-power.com.

Battery Management System Helps Supermarket Distribution Center Save More Than $400,000

In 2003, a large distribution center for one of the United Kingdom's largest supermarket chains began to experience problems with the batteries on its forklift trucks. Through trial, error and eventually the installation of a robust battery management system, the center solved the problems, resulting in a total savings of more than $400,000.

William Morrison Supermarkets is the fourth largest supermarket chain in the UK. The company's namesake, an egg and butter merchant in Bradford in the North of England, opened a market stall in the city in 1899, a modest start to a chain that now includes more than 370 supermarkets including stores acquired in the company's acquisition of Safeway's UK stores in 2005.

The company operates distribution centers throughout the UK including a frozen food distribution center in Wakefield, about 50 kilometers northeast of Manchester. The Wakefield facility also provides storage for fresh produce, bread, soft drinks and wine. Approximately 100 lift trucks are used within the facility: about 65 to 70 order pickers, which each use 24 volt 465 ampere-hour (Ah) batteries; about 25 reach trucks using 48 volt 750 Ah batteries; and the remainder are pallet trucks using 24 volt 345 Ah batteries.

The problem of shortened battery life came to light when truck drivers discovered the batteries they were using were only getting about six hours of service per charge versus the eight hours they expected, requiring that the drivers change batteries more frequently. Interestingly, the problem appeared to be limited to the order pickers. So, were the battery problems related to the function of the trucks using them?

Without any other information to explain the reason for the reduced battery life, the problem was blamed on the cold temperatures to which the order picker trucks were subjected. In order to remedy the problem, it was decided to split the pool of batteries into two groups: one for the order pickers and one for the pallet trucks. However, this made the problem even worse.

Duncan Jones, managing director of Philadelphia Scientific Europe, notes that while the solution to a battery performance problem typically is not complex, identifying the problem isn't always as easy as it seems.

"Despite the rapid growth in the development of battery maintenance tools that help battery room managers do their jobs, the fact is that most facilities utilizing forklifts aren't taking advantage of today's technologies," said Jones. "Tools that can be used to prevent battery problems or quickly identify specific problems when they occur aren't used by most warehouse or distribution center battery rooms in the UK and Europe. And they are even less common in the US."

Frustrated at not being able to identify the source of the problem and realizing that the undercharged batteries were costing time and money, the battery supplier, Chloride Motive Power, investigated an intelligent battery organizing system, iBOS, from Philadelphia Scientific.

iBOS Display and Shouter: The iBOS Display eliminates truck operator confusion by identifying which battery should be taken next. The Shouter sounds an alert when an incorrect battery has been taken.

Battery organizing systems act as battery sequencers and organizers for battery changing rooms. Since most warehouse or distribution centers don't have battery organizing systems, it begs the question: "How does a fork truck driver know which battery to take when entering a battery room to get a replacement?" The answer is that without guidance, drivers will take the most convenient one. And site tests have shown that if battery selection is left to a truck operator, 30 percent of a pool of batteries will be underutilized and 20 percent will be overused.

Over time, this leads to uneven usage of batteries with expensive consequences such as diminished capacity, uneven wear and tear and premature battery failure. Other assets are wasted because the less convenient batteries go unused.

An intelligent battery organizing system eliminates these battery room problems by

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determining precisely which battery has had the longest cooling time since charging. It organizes the battery-changing operation, in real time, to ensure that all batteries are used in strict rotation, preventing battery abuse and its related problems down the road.

Wakefield Battery Room: Chargers (top) and batteries (bottom); a manual battery changer is used to exchange batteries.

The iBOS collects charger data through electronic monitors called Sentinels. The Sentinels send this information to the organizing system's central brain called a Controller. The Controller processes the data and sends it to a display, which informs the forklift operator specifically which battery to take. Depending on the application, the display can be a scrolling LED screen or a flat touch screen.

The battery room activity data collected by the Controller can be analyzed and used to produce three kinds of management reports: availability, mispick and utilization. Availability reports provide daily maximum and minimum battery utilization information, which can be used to determine if there are too many or too few batteries in the pool. Mispick reports display the day, date and time of each mispick, helping to identify the different types of mispicks and allowing for efficient supervisory attention. Utilization reports detail utilization by charger, identify uneven charger usage and pinpoint equipment problems with chargers, roller beds or cables.

After installing the iBOS system in the Wakefield facility's battery room and allowing it to run for several days, the diagnostic reports began highlighting some problems. The site efficiency report showed that the drivers were clearly running out of batteries every day on both the reach trucks and the order pickers. The diagnostics analysis monitored all the chargers and highlighted those that were not functioning. It was found that nine chargers and/or batteries had faults that had not been previously recognized. A Chloride Motive Power engineer discovered that some of the chargers had been consistently stalling during the charging process and had stopped charging when the battery was at about 50 percent capacity. When a driver saw that the battery apparently was still charging, he went on to the next battery, leaving a battery connected to a faulty charger, unused.

The faulty chargers were quickly repaired and after a few days, another diagnostics report was generated. With all the chargers now functioning correctly, it became clear that the only battery group that was running out of power were the reach trucks. This was a surprise because it had never been previously reported. This problem was solved by evaluating the reports, which identified that even with all of the charging equipment working correctly, the drivers were still running out of reach truck batteries on a daily basis. The issue was resolved by adding two new batteries to the reach truck pool.

As for the order picker batteries, which had been placed into a separate battery pool to improve availability and performance, it was found that battery performance was not better with two separate pools than when they were all in one pool. There were still not enough batteries available throughout the day even when divided into two pools. It was theorized that putting the two pools back together and using the battery management system would result in higher numbers of available batteries. When both pools were combined, the resulting data indicated that the pool now had plenty of spare batteries and the number available was more consistent throughout the day.

There are a number of ways to calculate the cost savings of better battery management at the Wakefield facility; savings due to improved battery maintenance, savings due to improved driver productivity and savings due to battery purchase avoidance. According to Jones, the savings are astonishing no matter how you figure them.

"Good battery maintenance can result in the need to purchase batteries approximately 20 percent less often," said Jones. "At Wakefield, that represents a savings of about $100,000.

"A battery organizing system improves driver efficiency too," he continued. "At Wakefield, we calculated that charging batteries every six hours rather than every eight hours results in 22 wasted minutes per truck per day. With 100 trucks in service and at a wage of $20 per hour, this represents $292,000 in savings in one year."

Finally, once the real problem was identified at the Wakefield center, it became apparent that the batteries the facility was planning on purchasing were not required, saving an additional $40,000. According to Jones, That's a total savings of $432,000.

"In today's economic climate, many companies are reluctant to purchase capital equipment unless it's absolutely necessary. But the intelligent battery organizing system installed at Wakefield really opened the customer's eyes. In fact, the company has now approved the installation of another system twice the size of the Wakefield system to manage their Gadbrooke distribution center."

Boston-Power Fuels Next Stage of Growth with One of the Largest Portable Power Venture Investments

Boston-Power, Inc. has received $45 million in new funding. The Series C round was led by Oak Investment Partners and included existing blue-chip investors Venrock Associates, Granite Global Ventures and Gabriel Venture Partners.

Boston-Power will use the new capital to scale business development, marketing, research and development and manufacturing operations to meet strong global demand for Sonata, the company's next-generation Lithium-ion battery technology. Sonata initially targets notebook computers. Eventually, the company's products could be used to power an extensive range of end-applications, from consumer electronics devices to hybrid electric vehicles.

Demand for safe, high-performance, environmentally responsible Lithium-ion notebook computer batteries is substantial. IDC reported 37 percent growth worldwide in portable PC shipments in the third quarter of 2007, the fastest in more than a decade. This exceeded growth in desktop PCs by 33 percent in the same quarter. Moreover, Gartner reported that third quarter notebook computer shipments surpassed desktop PC shipments, at 52 percent.

Sonata redefines the portable power space by establishing new benchmarks in safety, cycle life, performance and environmental sustainability. Initially targeting notebook computers, Sonata delivers the longest cycle life ever available from any lithium-ion battery. That translates to longer and more usable power, like-new performance for three years versus current batteries that start to fade in three to six months. Sonata's "drop-in" design enables it to be used with existing notebook computers, requiring no design changes on the part of notebook computer original equipment manufacturers (OEMs) such as HP.

Boston-Power's patent-pending, whole-system approach means its technology can be applied to a vast range of end-applications. As a result, total cost of ownership benefits inherent in its notebook computer batteries prove increasingly impressive in cases where even greater power is required.

VIASPACE Receives Initial Order for a Lithium Battery Test Station from Battelle

VIASPACE, Inc. has received the initial order for its new Electrochemical Thermodynamics Measurement System (ETMS) from Battelle Pacific Northwest Division.

VIASPACE CEO Dr. Carl Kukkonen said, "Our newest Caltech license grants VIASPACE the exclusive rights to several new patents covering an instrument that can accurately measure the electrochemical thermodynamics in batteries. The initial ETMS instrument that we have developed and will introduce in the near future will be focused on measuring the thermodynamics as they develop in the charge and discharge cycles of Lithium batteries.

"Lithium based batteries are the main battery technology utilized in most portable electronic devices today. Currently battery manufacturers are struggling to find new formulas of Lithium based chemistry that will satisfy the increasing power needs of devices including notebook computers, cellular/converged phones and personal digital assistants (PDAs), while maintaining a formula that is also stable enough to pass rigorous safety tests."

Valence Technology and The Tanfield Group Plc Sign a Supply Agreement for Lithium Phosphate Battery Packs

Valence Technology, Inc. has entered into a contract with The Tanfield Group Plc to manufacture and supply safe, Lithium Phosphate energy storage systems to power zero emission, all-electric commercial delivery vehicles. The Valence battery systems will be installed in leading-edge vans and trucks produced by Tanfield's UK-based trading division, Smith Electric Vehicles, the world's largest manufacturer of electric vans and trucks.

Under the agreement, Tanfield will purchase up to $70 million of Valence products in the contract's first phase and Valence has already received a firm purchase order for the first calendar quarter.

The agreement will also result in Tanfield becoming the first volume customer for Valence's third generation Lithium Phosphate Epoch technology, a battery system equipped with an advanced management system that monitors and automati-

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cally adjusts cell performance so battery packs operate at their optimum performance capacity. Epoch benefits include a fail-soft capability that is designed to eliminate system failure caused by a single cell and to have a life cycle comprised of more than 2000 charge cycles when deep discharged in demanding electric vehicle applications.

US Navy Plans Launch of First Battery Backup System for Naval Applications

Altair Nanotechnologies, Inc. has signed a $2.5 million contract with the US Navy for the development of battery backup power systems in Naval applications.

Under the terms of the contract, Altair will develop an optimized battery cell employing its nano-sized lithium titanate (n-LTO) electrode materials and then demonstrate the performance and safety attributes of the cell. Altair will also develop and demonstrate a modular system design for utilization of the product technology in multiple military applications, including energy and power storage for Naval applications. The $2.5 million contract is funded as part of a $3.3 million United States Navy program that includes independent product testing by the Navy.

“This is a validation test program for our new disruptive battery technology,” said Altairnano CEO and president Alan J. Gotcher, Ph.D. “We are proud to be working with the U.S. Navy and assisting in the launch of a new class of battery backup systems for its fleet performance application. Warships, in particular, run two generators continuously, one to supply energy and one to provide a backup energy source. The fuel cost for the backup is staggering. We look forward to working with the Navy team in developing and commercializing our product technology.”

Johnson Controls to Implement Price Increase for Batteries

Johnson Controls, Inc., will institute a 4 percent price increase across the board to its lead-acid battery customers, effective March 1, 2008.

"As a global leader in the industry, Johnson Controls continues to drive innovation and productivity improvements to keep costs down for our customers," said Alex Molinaroli, president of Power Solutions for Johnson Controls. "However, over the past year we have seen unusual increases in the price of raw materials and other costs associated with production and recycling. For example, costs of key raw materials such as sulfuric acid and polypropylene have increased as much as 200 percent in the last six months."

While instability in the lead market has also been a challenge over the past year, the company reports that this price increase is not associated with lead.

"We have worked closely with our customers to develop programs that fairly address volatility in the lead market. This increase reflects other extraordinary cost increases that we simply can no longer absorb," Molinaroli said.

Ultralife Forms Technology Partnership with Mississippi State University to Develop Fuel Cell-Battery Portable Power Systems

Ultralife has entered into a technology partnership with Mississippi State University (MSU) to develop fuel cell-battery portable power systems enabling lightweight, long endurance military missions. The development of this power system is to be performed under a $1.6 million program that was awarded by a US Defense Department agency to MSU as the prime contractor. MSU has awarded Ultralife a $475,000 contract to participate in this program as a subcontractor.

Under the contract, Ultralife will oversee the development, testing, approval and manufacturing of prototypes of a new compact military battery to be used with handheld tactical radios, building on its ongoing development work under the Land Warrior System Stryker Interoperable Program. In addition, Ultralife will provide engineering support, encompassing defining system requirements and performing design integration and testing tasks, to ensure successful demonstration of the system.

Finally, under the technology partnership with MSU, Ultralife is establishing a development and assembly operation in a 14,000 square-foot facility located in West Point, Miss. The city will be responsible for preparing the facility for occupancy; Ultralife will enter into a three-year lease agreement with the city and will receive job training subsidies. The development and assembly facility is expected to create at least 30 jobs to manufacture products coming out of the technology partnership and other Ultralife products. The company plans to commence operations in the first half of 2008.

Lithium-Ion Batteries Increase Opportunity for Secondary Lithium-Ion Market

On a global level, the secondary lithium-ion battery market is set to achieve significant growth from features of lithium-ion batteries, which are superior in comparison to existing battery chemistry. Currently, the battery market experiences increased investments in technological developments and innovations that are likely to make these batteries more efficient.

New analysis from Frost & Sullivan, *World Secondary Lithium Ion Battery Market*, finds that the market earned revenues of $5.89 billion, and unit shipments of secondary lithium-ion batteries were pegged at nearly 1.76 billion. This estimates to reach nearly 3.99 billion units in 2013.

"Technical innovations such as thin-film batteries and high energy density lithium-ion batteries create bright growth prospects for lithium-ion batteries," said Frost & Sullivan research analyst Suba Swaminathan. "High energy and power density, along with low weight of these batteries, are some of the key factors that propel market demand."

In addition, the increased use of sophisticated multi-tasking consumer electronic gadgets in recent years fuels the need for high-power batteries that are also low in weight. This is set to bolster growth in the secondary lithium-ion battery market.

Meanwhile, the surge in demand for high efficiency power source for portable industrial applications augments the need for lithium-ion batteries. The performance of these batteries in consumer applications creates significant awareness of the features of lithium-ion batteries and is likely to find greater utilization in industrial applications. The market is in the maturity stage with regard to consumer applications, with pronounced growth expected in the industrial and automotive applications in the next five to seven years.

Despite these positive trends, existing safety concerns related to the utilization of lithium-ion batteries in high temperatures are likely to dampen growth in the market. "Lithium-ion batteries have an inherent ability to become unstable at temperatures above 130°C," said Swaminathan. "When these batteries reach such high temperatures, they can cause an explosion and result in severe damage to the application device and the user."

In view of this situation and the consequent increased focus on research activities, lithium-ion batteries that can withstand high temperatures without causing thermal runaway expect to hit the market in the next two to three years.

Microchip Technology Launches Web Site Personalization

Microchip Technology, Inc., a provider of microcontroller and analog semiconductors, has unveiled the personalization of its Web site, which enables users to tailor the delivery of content to their needs. Users opt in via an application form at www.microchip.com/myMICROCHIP to set up their profile and preferences. They can then quickly find the exact content they need whenever they log on, without having to search for it. Users are also able to track their sample and purchase-order histories, and receive notification by e-mail when something they are interested in has been updated.

"Web site personalization represents another way in which Microchip is here to help," said Mitch Little, vice president of Worldwide Sales and Applications with Microchip. "Making key tasks easy for users to accomplish helps them to be more effective at their jobs."

Subsequent releases of Microchip's personalization service are expected to include RSS feeds, training resources and history, support tracking and history, social networking, lists of recent searches and enhanced order-history tracking.

Johnson Controls-Saft Opens Production Facility for Lithium-Ion Hybrid Vehicle Batteries

Johnson Controls-Saft Advanced Power Solutions has officially opened its new lithium-ion automotive battery manufacturing facility.

The plant, based in Nersac, France, is used to manufacture advanced lithium-ion batteries for hybrid, plug-in, fuel cell and electric vehicles.

Johnson Controls-Saft initially invested $22.3 million in the facility, which is producing batteries for global automotive customers. It has been built to be scaleable, so that as demand increases it can increase production capacity to meet customer and market demands.

In addition to the plant in Nersac, Johnson Controls-Saft has research and development centers in Milwaukee, USA and Bordeaux, France; as well as system engineering, testing and integration centers in Milwaukee, USA, Hanover, Germany and Shanghai, China.

Electrochem Lithium Batteries Selected By Aircraft Engine Manufacturer to Power Critical Datalogger

Electrochem Commercial Power, Inc., a manufacturer of primary lithium battery packs and cells used in extreme environments, including downhole oil and gas drilling and military and aerospace equipment, has been chosen to provide its

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lithium batteries to power the MS1520 commercial aircraft datalogger. Developed by a world-leading aircraft engine manufacturer, the MS1520 is used to monitor engine thermocouple temperatures throughout the flight envelope. Electrochem was determined to be the cell of choice in this application after other battery manufacturers could not guarantee operation at altitudes where the datalogger would be in use. The data gathered in flight is vital as thermocouple temperatures help determine the life and health of the engine. Utilization of the Electrochem product ensures the device will work reliably and for long durations under severe conditions as required. A battery pack comprised of Electrochem's moderate rate D size cells, rated to 150°C, was chosen for the application due to its persistent ability to withstand extreme shock and vibration in the engine compartment on the commercial aircraft. The product offers high capacity in a small, light weight package that fits into the restricted engine area. The battery pack also contains built in lightning protection that prevents currents from reaching the battery cells in the event of a strike.

Millennium Cell and Horizon Fuel Cell Provide Detailed Plans for HydroPak Portable Power Product

Millennium Cell, Inc. and Horizon Fuel Cell Technologies have completed a pre-production version of the HydroPak portable power generator that incorporates a unique water-activated cartridge system. The HydroPak product combines Horizon's fuel cells with Millennium Cell's Hydrogen on Demand storage technology to offer a clean and quiet power generator for use by consumers and professionals for emergency and recreational purposes.

This power source is a high energy alternative to lead acid battery packs and portable generators. The HydroPak system, together with each cartridge, provides infinite shelf life and enough energy to recharge an average notebook computer eight to 10 times.

The HydroPak is designed with a common AC outlet and two USB connectors to charge or operate low power devices such as portable lights, notebook computers, portable televisions and ad hoc communications networks for more than 14 continuous hours when needed.

Beginning in February 2008, Horizon and Millennium Cell plan to demonstrate and sample limited numbers of the current pre-production units to OEM's, distributors, and key military decision makers. The current design of the unit is in the process of evaluation by Underwriters Laboratories (UL) and it is expected that listing will be received by mid 2008 on this product.

Subsequently, several thousand units will be manufactured by Horizon for sale in the second half of 2008. Millennium Cell will have sole responsibility for all sales of the HydroPak power generation system in the US.

Additional products have been identified for development and are expected to be shipped to commercial and government customers for evaluation in 2008 and 2009. A HydroPak Mini product prototype for use in consumer devices such as cell phones, PDA's and portable media players was also demonstrated for the first time in January. The objective of showing this unit is to gauge interest for a less expensive, smaller power source with unlimited shelf life and silent power for smaller portable communications and electronics devices.

"Millennium Cell considers the HydroPak product line as a cornerstone in our product strategy and we are dedicating significant resources to support product introduction into the marketplace beginning in 2008. The initial reaction from OEM's and potential distributors for this product has been very positive and we plan to generate our first commercial revenues through aggressively marketing and selling this innovative family of products," commented Adam Briggs, president of Millennium Cell.

Send New Product Announcements and Company News Items to Shannon Given, Director of Content, at shannong@infowebcom.com

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Calendar of Events

March
- *17-20* - **The 25th International Battery Seminar & Exhibit**, Fort Lauderdale, Fla.
- *18-20* - **Aviation Industry Expo**, Dallas, Texas

April
- *9-11* - **ENTELEC 2008**, Houston, Texas
- *27-30* - **BCI 120th Convention & Power Mart Trade Fair**, Tampa, Fla.

May
- *4-7* - **UTC**, Orlando, Fla.
- *5-7* - **BATTCON 2008**, Marco Island, Fla.
- *12-16* - **The 8th International Advanced Automotive Battery and Ultracapacitor Conference**, Tampa, Fla.

June
- *9-12* - **7th International Lead Acid Batteries Conference (LABAT)**, Varna, Bulgaria
- *16-19* - **NXTcomm**, Las Vegas, Nev.

July
- *7-10* - **43rd Power Sources Conference**, Philadelphia, Penn.

September
- *4-5* - **Battery Power 2008**, New Orleans, La. www.BatteryPowerOnline.com
- *14-18* - **Intelec 2008**, San Diego, Calif.
- *23-26* - **11th European Lead Battery Conference**, Warsaw, Poland

Send Calendar of Event Items to Shannon Given at ShannonG@infowebcom.com

Nanowire Battery Can Hold 10 Times the Charge of Existing Lithium-Ion Battery

Stanford researchers have found a way to use silicon nanowires to reinvent the rechargeable lithium-ion batteries that power laptops, iPods, video cameras, cell phones and countless other devices. The new technology, developed through research led by Yi Cui, assistant professor of materials science and engineering, produces 10 times the amount of electricity of existing lithium-ion, known as Li-ion, batteries. A laptop that now runs on battery for two hours could operate for 20 hours, a boon to ocean-hopping business travelers.

"It's not a small improvement," Cui said. "It's a revolutionary development."

The greatly expanded storage capacity could make Li-ion batteries attractive to electric car manufacturers. Cui suggested that they could also be used in homes or offices to store electricity generated by rooftop solar panels.

"Given the mature infrastructure behind silicon, this new technology can be pushed to real life quickly," Cui said.

The electrical storage capacity of a Li-ion battery is limited by how much lithium can be held in the battery's anode, which is typically made of carbon. Silicon has a much higher capacity than carbon, but also has a drawback.

> "It's not a small improvement. It's a revolutionary development."

Silicon placed in a battery swells as it absorbs positively charged lithium atoms during charging, then shrinks during use (i.e., when playing your iPod) as the lithium is drawn out of the silicon. This expand/shrink cycle typically causes the silicon (often in the form of particles or a thin film) to pulverize, degrading the performance of the battery.

Cui's battery gets around this problem with nanotechnology. The lithium is stored in a forest of tiny silicon nanowires, each with a diameter one-thousandth the thickness of a sheet of paper. The nanowires inflate four times their normal size as they soak up lithium. But, unlike other silicon shapes, they do not fracture.

Research on silicon in batteries began three decades ago. Chan explained: "The people kind of gave up on it because the capacity wasn't high enough and the cycle life wasn't good enough. And it was just because of the shape they were using. It was just too big, and they couldn't undergo the volume changes."

Then, along came silicon nanowires. "We just kind of put them together," Chan said.

For their experiments, Chan grew the nanowires on a stainless steel substrate, providing an excellent electrical connection. "It was a fantastic moment when Candace told me it was working," Cui said.

Cui said that a patent application has been filed. He is considering formation of a company or an agreement with a battery manufacturer. Manufacturing the nanowire batteries would require "one or two different steps, but the process can certainly be scaled up," he added. "It's a well understood process."

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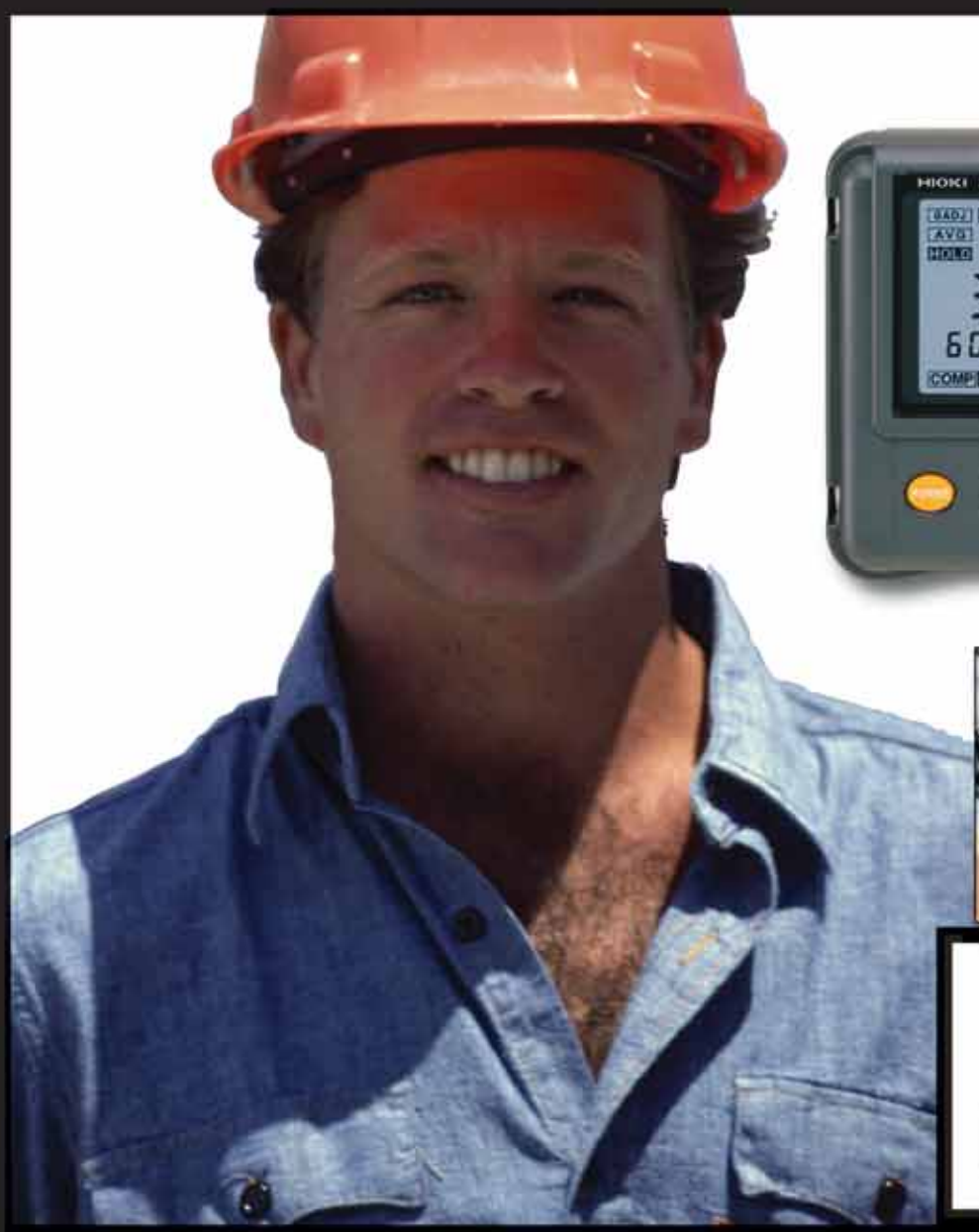

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