

## What's New in the World of Superconductivity (October, 2008)

### Power

#### **American Superconductor Corporation (October 1, 2008)**

American Superconductor Corporation (AMSC) has manufactured and shipped approximately 17,000 meters of second-generation HTS wire (branded as 344 superconductors) for use in Project HYDRA. The order represents the single largest shipment of second-generation HTS wire by any company worldwide. Project HYDRA is focusing on the development and deployment of AMSC's Secure Super Grids™ (SSG) technology in the power delivery network of Manhattan, which is operated by Consolidated Edison Company of New York, Inc. The Department of Homeland Security (DHS) is providing up to \$25 million of the \$39-million project. AMSC is acting as both the wire supplier and the prime contractor for the project, and Ultera™ (a joint venture between Southwire Company and nkt cables) is acting as the cable manufacturer. AMSC's SSG solution utilizes HTS power cables and ancillary controls to deliver up to 10 times more power than conventional copper cables while simultaneously suppressing power surges that could disrupt service. Daniel McGahn, Senior Vice President and General Manager of AMSC Superconductors, commented, "We successfully completed tests of an initial trial SSG cable and have now shipped all of the wire necessary for the first system prototype. We look forward to successfully testing this prototype in 2009 and deploying the full solution in Manhattan in 2010. This solution holds great promise for increasing the reliability and security of power grids in cities around the world."

Source:

"AMSC Manufactures and Ships Superconductor Wire for Project HYDRA Prototype Power Cable"  
American Superconductor Corporation press release (October 1, 2008)

[http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle\\_Print&ID=1204181&highlight](http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle_Print&ID=1204181&highlight)

#### **American Superconductor Corporation (October 8, 2008)**

American Superconductor Corporation (AMSC) has signed a multi-million-dollar contract to provide designs for a 2-MW doubly fed induction wind turbine to China's XJ Group Corporation (XJ Group). In addition to the upfront fee, AMSC also expects to provide core electrical components for the 2-MW wind turbines that will be manufactured by XJ Group, which is one of China's largest manufacturers of power equipment and transmission and distribution technologies for the electric utility market. While XJ Group plans to produce wind turbines for the Chinese market initially, it has the right to sell the 2-MW wind turbine worldwide. The company plans to have its first prototypes installed and commissioned by the end of 2009 and to begin shipping wind turbines to customers in 2010.

Source:

"AMSC Partners with China's XJ Group for Development of 2 Megawatt Wind Turbines"

American Superconductor Corporation press release (October 8, 2008)

[http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle\\_Print&ID=1206758&highlight](http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle_Print&ID=1206758&highlight)

## Zenergy Power plc (October 9, 2008)

Zenergy Power plc has provided an update on the industrial performance of the world's first HTS induction heater, which was installed at Weseralu GmbH in July 2008. Zenergy and its manufacturing partner, Bültmann GmbH, successfully installed the induction heater at Weseralu, and the heater has now been operated consistently and at full capacity for three months. Data collected by Weseralu indicates that the induction heater has enabled a significant increase in industrial output in addition to greatly improving the overall energy efficiency of Weseralu's industrial operations. Zenergy also reported that the heater's performance data has comfortably surpassed any previous expectations of both the customer's and Zenergy's management teams. Since its installation, the induction heater has heated more than 700 tonnes of metal, with one aluminum billet heated to 450 °C every 75 seconds. This increase in throughput has enabled a 25 % increase in the facility's productivity. The HTS technology has also enabled the billets to be heated more evenly, compared with the effects of conventional induction heaters, resulting in a much more malleable billet. This increase in malleability has enabled Weseralu to process the heated metal billets using its existing equipment but at twice the conventional speed. Thus, Zenergy's HTS induction heater has successfully eliminated two major bottlenecks within Weseralu's overall metals operation. Based on the results obtained at Weseralu, Zenergy estimates that the resulting increase in productivity is capable of generating between €200,000 and €2 million of additional operating profit per annum per HTS machine, depending on the intensity of the customers' operations and the size of metal billets used.

In addition, the installed HTS induction heater requires half the volume of electricity required by a conventional induction heater. Based on Weseralu's current scale of operations, this energy savings will lead to an additional annual cost saving of over €50,000 for the single unit that has already been installed. Based on this performance, Zenergy estimates that its HTS induction heater can produce energy cost savings of over €300,000 per induction heater for customers, depending on their operational intensity and the size of the billets being used. The reduction in electricity consumption also enables a substantial reduction in CO<sub>2</sub> emissions.

Source:

"HTS Induction Heater Operations Update"

Zenergy Power plc press release (October 9, 2008)

[http://www.zenergypower.com/images/press\\_releases/2008-10-09-hts-induction-heater-update.pdf](http://www.zenergypower.com/images/press_releases/2008-10-09-hts-induction-heater-update.pdf)

## American Superconductor Corporation (October 15, 2008)

American Superconductor Corporation (AMSC) has licensed two of its proprietary wind turbine designs to Hyundai Heavy Industries Co., Ltd. (HHI) in South Korea. The licensed designs are for a 1.65-MW and a 2-MW doubly fed induction wind turbine. HHI plans to commence production of the 1.65-MW wind turbine by the end of 2009 and will initially target the United States market. HHI's marketing and sales rights for both wind turbines extend to dozens of countries around the world. In addition to the upfront license fees for each design, AMSC will receive royalty payments for the first several hundred 1.65-MW and 2-MW wind turbines produced by HHI and will also provide HHI with core electronic components for these turbines. HHI plans to have its first wind turbine prototype installed and commissioned by mid 2009 and to begin shipping wind turbines to customers by the end of calendar 2009.

Source:

“AMSC Licenses Proprietary Wind Turbine Designs to Korea’s Hyundai Heavy Industries”  
American Superconductor Corporation press release (October 15, 2008)

[http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle\\_Print&ID=1209790&highlight](http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle_Print&ID=1209790&highlight)

## **Superconductor Technologies Inc. (October 20, 2008)**

Superconductor Technologies Inc. (STI) and the U.S. Department of Energy (DOE)'s Los Alamos National Laboratory (LANL) announced the signing of a Material Transfer Agreement on October 7, 2008. Under the terms of the agreement, LANL will share coated conductor substrate materials with STI as part of LANL's research program to develop HTS cables for power applications; STI will, in turn, fabricate advanced HTS thin film materials on the substrates provided by LANL. The agreement is part of a previously announced collaborative effort between the two parties to develop HTS coated conductors for advanced power applications. The experimental results gained from these activities are expected to lead to the creation of a Cooperative Research and Development Agreement (CRADA) between STI and LANL for the development of technology intended to commercialize high-performance, low-cost HTS coated conductors.

Source:

“Superconductor Technologies and Los Alamos National Laboratory Sign Material Transfer Agreement”

Superconductor Technologies Inc. press release (October 20, 2008)

<http://phx.corporate-ir.net/phoenix.zhtml?c=70847&p=irol-newsArticle&ID=1213921&highlight>

## **Zenergy Power plc (October 28, 2008)**

Zenergy Power plc has received a €115,000 grant (60 % funding coverage) from the German Environmental Fund to help cover the costs of a €192,000 project to evaluate a number of additional applications for its groundbreaking HTS induction heater technology. The grant was awarded after recent feedback concerning Zenergy's first commercially sold HTS induction heater (reported on October 9, 2008), in which it was announced that Zenergy's HTS induction heater enabled a 25 % increase in productivity while realizing a 50 % reduction in energy consumption. The grant funds will be used to evaluate how the existing HTS induction heater design can be adapted for multiple shapes and sizes of metal billets commonly used within the global metals industry.

Source:

“German Environmental Fund Grant”

Zenergy Power plc press release (October 28, 2008)

[http://www.zenergypower.com/images/press\\_releases/2008-10-28-gef-grant.pdf](http://www.zenergypower.com/images/press_releases/2008-10-28-gef-grant.pdf)

## **American Superconductor Corporation (October 29, 2008)**

American Superconductor Corporation (AMSC) has received an order for four distribution voltage Static VAR Compensator (SVC) solutions from a major North American energy company. The solutions will be used to improve the performances of pumping stations for a major crude oil pipeline. The motors utilized by these pumping stations are rated at 4,000 to 5,000 hp; starting motors of this size often causes momentary voltage drops that can shut the pipeline down and possibly cause power disturbances for other power customers connected to the same local power grid. AMSC's SVC solution will eliminate these voltage sags and flickers, enabling large electrical loads to be safely connected to the local power grid. Timothy Poor, AMSC's Vice President of Global

Sales and Business Development, commented, "Reliable, high-quality electric power is critical to the operation of oil and gas pipelines. Our compact SVC allows pipeline operators the freedom to place large motors where required, avoid voltage sags and flicker and improve overall pipeline operating reliability. This technology requires minimal maintenance and is capable of operating in areas with extreme temperature conditions, making it ideal for the remote locations where oil and gas pipelines are typically sited." AMSC plans to deliver the SVC solutions during the first half of 2009 and will also provide start-up services and staff training.

Source:

"Major North American Energy Firm Adopts AMSC's Static VAR Compensator Solution"

American Superconductor Corporation press release (October 29, 2008)

[http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle\\_Print&ID=1218899&highlight](http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle_Print&ID=1218899&highlight)

## Electronics

### National Institute of Standards and Technology (October 15, 2008)

Researchers at the National Institute of Standards and Technology (NIST) and JILA, a joint institute of NIST and the University of Colorado (CU) at Boulder, have constructed a tunable "noiseless" amplifier. This amplifier is expected to boost the speed and precision of quantum computing and communications systems. While amplifiers that theoretically add no noise have been demonstrated previously, the JILA/NIST technology offers better performance and is the first such amplifier to be tunable, with an operation range of between 4 and 8 GHz. Of practical importance, the amplifier is also the first to sufficiently boost signals to overcome noise generated by the next amplifier in a series along a signal path. The JILA/NIST amplifier consists of a 5-mm-long niobium cavity lined with 480 SQUIDs. This line of SQUIDs acts as a "metamaterial"—a structure not found in nature that has strange effects on electromagnetic energy. The wave velocity of microwaves ricocheting through the cavity can be tuned by manipulating the magnetic fields in the SQUIDs and the intensity of the microwaves. The injection of an intense pump tone at a particular frequency causes the microwave power to oscillate at twice the pump frequency; only the portion of the signal that is synchronous with the pump is amplified. The research is described in an advanced online publication of *Nature Physics*, posted on Oct. 5, 2008.

Source:

"First tunable, 'noiseless' amplifier may boost quantum computing, communications"

National Institute of Standards and Technology press release (October 15, 2008)

[http://www.nist.gov/public\\_affairs/techbeat/tb2008\\_1014.htm#amp](http://www.nist.gov/public_affairs/techbeat/tb2008_1014.htm#amp)

### Hypres Inc. (October 20, 2008)

Hypres Inc has successfully demonstrated the operation of its high-performance superconducting circuits in a modified Lockheed Martin compact four-stage, pulse tube cryocooler operating at 4 K. The prototype cryocooler was developed based on a proven Lockheed Martin 6-K pulse tube design originally developed for space applications; importantly, the new prototype confirms the feasibility of applying pulse tube technology to high-speed digital superconductor circuitry. Hypres and Lockheed Martin worked together closely to develop the field-ready prototype, which will likely be used in applications such as military satellite communications, signals intelligence,

RADAR, electronic warfare, and software-defined radio. In addition, the demonstration also confirmed the effectiveness of Hypres' small, modular cryopackaging. Reliable, environmentally rugged cryocoolers and cryopackaging are essential components of the Digital-RF™ product line that Hypres is presently developing. The project was sponsored by the U.S. Army Communications—Electronics Research, Development, and Engineering Center.

Source:

"Hypres Demonstrates Pulse Tube Cryocooler Technology for Digital RF Applications"

Hypres Inc. press release (October 20, 2008)

[http://www.hypres.com/pages/new/bnew\\_files/lockheedcooler.pdf](http://www.hypres.com/pages/new/bnew_files/lockheedcooler.pdf)

## Accelerator

### CERN (October 2, 2008)

CERN has announced that the Large Hadron Collider (LHC), the world's largest and most complex scientific instrument, will be officially inaugurated on October 21, 2008. Several governmental representatives of CERN's Member and Observer States and other participating nations have been invited to the inauguration. The inauguration follows the successful start-up of the LHC on September 10, 2008, when the first beam was successfully circulated through the accelerator. After ten days of operation, the LHC was placed on stand-by because of a fault in one of the device's eight sectors. The sector containing the fault will need to be warmed to enable investigation and repair. This lengthy process will be performed in November, when CERN's entire research infrastructure is shut down for annual maintenance. The LHC will likely be restarted in the spring of 2009. CERN Director General Robert Aymar commented on the fault by saying that "While the timing is undoubtedly a disappointment, a few extra weeks on a project that has been over two decades in the making is not very much. It is simply a fact of life in experimental physics at the frontiers of knowledge and technology."

Source:

"LHC to be inaugurated on 21 October 2008"

CERN press release (October 2, 2008)

<http://press.web.cern.ch/press/PressReleases/Releases2008/PR12.08E.html>

### CERN (October 3, 2008)

CERN has reported that the Worldwide LHC Computing Grid has received its first data from the Large Hadron Collider (LHC). The computing grid, which comprises more than 140 computer centers in 33 countries, will be faced with the challenge of analyzing and managing more than 15 million Gigabytes of data every year. A dedicated optical fiber network distributes data from CERN to eleven major computing centers in Europe, North America, and Asia. From these centers, the data is then dispatched to more than 140 smaller computing centers worldwide. An estimated 100,000 processors are needed to handle all the data collected from the LHC experiments. Ian Bird, leader of the Worldwide LHC Computing Grid project, commented, "Our ability to manage data at this scale is the product of several years of intense testing. Today's result demonstrates the excellent and successful collaboration we have enjoyed with countries all over the world. Without these international partnerships, such an achievement would be impossible."

Source:

“Let the number-crunching begin: the Worldwide LHC Computing Grid celebrates first data”

CERN press release (October 3, 2008)

<http://press.web.cern.ch/press/PressReleases/Releases2008/PR13.08E.html>

## CERN (October 16, 2008)

CERN has released an incident report describing the large helium leak into sector 3-4 of the Large Hadron Collider (LHC) tunnel that occurred on September 19, 2008, and led to the device being placed on stand-by. The report confirms that the incident was caused by a faulty electrical bus connection in the region between a dipole and a quadrupole magnet; this fault led to mechanical damage and the subsequent release of helium from the magnet's cold mass into the tunnel. All safety systems performed as expected, and no one was put at any risk during the incident. CERN is in possession of the necessary spare components needed to repair the device; in addition, new measures (such as measurements to generate early warnings and interlocks, improvements in pressure relief devices, and the external anchoring of the quadrupole cryostats with a vacuum barrier) will be incorporated to prevent a similar incident in the future. Investigations are presently ongoing, and the complete findings will be reported at a later date. At present, however, it appears that 5 quadrupoles and 24 dipoles from three subsectors will need to be repaired and more magnets may have to be removed from the tunnel for cleaning and replacement of the multilayer insulation. A plan for the removal/reinstallation, transport, and repair of the magnets is now being established and will be integrated into the annual maintenance that is performed throughout CERN during its winter shutdown period.

Source:

“CERN releases analysis of LHC incident”

CERN press release (October 16, 2008)

<http://press.web.cern.ch/press/PressReleases/Releases2008/PR14.08E.html>

## CERN (October 21, 2008)

The Large Hadron Collider (LHC) was inaugurated on October 21, 2008, at a celebration attended by Swiss President Pascal Couchepin and French Prime Minister François Fillon as well as science ministers from CERN's Member States and around the world. CERN Director General Robert Aymar commented, “Today is a day for CERN to thank its Member States for their continued support for basic science, and for providing the stable framework that makes science of this kind possible. It is also a day for CERN and the global particle physics community to take a sense of pride in the achievement of bringing this unique facility from dream to reality, a process that has taken over two decades of careful planning, prototyping and construction, culminating with the successful circulation of the machine's first protons in front of a global audience on 10 September this year.” The inauguration ceremony consisted of speeches, exhibitions and a new audiovisual concert, followed by a buffet.

Source:

“CERN inaugurates the LHC”

CERN press release (October 21, 2008)

<http://press.web.cern.ch/press/PressReleases/Releases2008/PR16.08E.html>

## Basic

### Brookhaven National Laboratory (October 8, 2008)

Researchers at the U.S. Department of Energy (DOE)'s Brookhaven National Laboratory and colleagues have successfully produced a two-layer thin film in which a nanometer-thick region of superconductivity was formed at the interface of two non-superconducting layers. Importantly, the critical temperature at this interface exceeded 50 K. Physicist Ivan Bozovic, who leads the Brookhaven thin film research team, stated that the achievement "... opens vistas for further progress, including using these techniques to significantly enhance superconducting properties in other known or new superconductors." The group had previously reported (in 2002) that the critical temperature could be enhanced by as much as 25 % using bilayers of two dissimilar copper-based materials. At that time, however, the mechanism responsible for the enhancement and the localization of the superconductivity in the sample remained unknown. The group subsequently prepared more than 200 single-phase, bilayer and trilayer films using insulating, metallic, and superconducting blocks to further investigate this phenomenon. While the research remains at an early stage, the results could be practically used for the fabrication of three-terminal superconducting devices, such as a superconductive field-effect transistor. Circuits built from such a device would be much faster and use less power than conventional ones based on semiconductors. The group's results were published in the October 9, 2008, issue of *Nature*.

Source:

"Scientists engineer superconducting thin films"

Brookhaven National Laboratory press release (October 8, 2008)

[http://www.bnl.gov/bnlweb/pubaf/pr/PR\\_display.asp?prID=822](http://www.bnl.gov/bnlweb/pubaf/pr/PR_display.asp?prID=822)

### Ames Laboratory (October 10, 2008)

In the first run of a new instrument at the U.S. Department of Energy (DOE)'s Spallation Neutron Source (SNS), researchers from the DOE's Ames Laboratory and other institutions have utilized a pulsed neutron beam to obtain information on iron-arsenic compounds. The SNS is a new \$1.4-billion facility operated by Oak Ridge National Laboratory. The facility can be used to obtain structural and dynamic information on materials that cannot otherwise be obtained using X-rays or electron microscopes, including detailed information regarding the positions and motion of nuclei and spins within a material. One of the instruments at the SNS facility is ARCS, a wide angular-range chopper spectrometer that will be used to measure the vibrations of atomic nuclei. During the testing phase of this instrument, it was used to examine the new iron-based superconducting materials (specifically, lanthanum-iron-arsenide [LaFeAsO<sub>0.89</sub>F<sub>0.11</sub>]) that have recently been receiving much attention. Since neutrons are capable of measuring both lattice vibrations and spin fluctuations, they are ideal probes for obtaining information on the mechanism of superconductivity. The present series of experiments focused on understanding the role of lattice vibrations in iron-based superconductors. The experimental results did not support the conventional mechanics of electron-phonon mediated superconductivity, although theoretical calculations matched the measurements obtained with ARCS fairly well. The group is continuing to examine phonons and spin excitations in this new class of superconductors. Their present findings were published in the Oct. 10 issue of *Physical Review Letters*.

Source:

# Superconductivity Web21

Published by International Superconductivity Technology Center  
1-10-13 Shinonome Koto-ku, Tokyo 135-0062, Japan Tel:+81-3-3536-7283, Fax:+81-3-3536-7318

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"New instrument puts new spin on superconductors"

Ames Laboratory press release (October 10, 2008)

[http://www.external.ameslab.gov/final/News/2008rel/Iron-arsenic\\_superconductors.html](http://www.external.ameslab.gov/final/News/2008rel/Iron-arsenic_superconductors.html)

(Akihiko Tsutai, Director, International Affairs Division, ISTEC)

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