

Putting Science to Work

SUMMER 2006

# Newsletter

**BUILDING**

## ECONOMIC DEVELOPMENT

### First-of-its-kind Technology Park Created in Oak Ridge

Federal, state, and local officials have dedicated a new technology park at ORNL that proponents predict will bring new companies and jobs to East Tennessee.



At the park dedication are, L to R: ORO Manager Gerald Boyd, U.S. Rep. Zach Wamp, ORNL Director Jeff Wadsworth, TTED Director Alex Fischer, Oak Ridge Mayor David Bradshaw, and Pro2Serv's Barry Goss.

Oak Ridge Office. "One of our priorities is to help make those technologies available for new companies and new jobs."

Over the last 5 years, ORNL has constructed nearly \$2 billion in new facilities, including the Spallation Neutron Source and the Center for Computational Sciences.

The technology park is located on land on the ORNL campus that is no longer used for research. The property was transferred to the Community Reuse Organization of East Tennessee, which will manage the technology park. CROET Director Lawrence Young said the transfer is "a perfect example of how federal and local partners can work together to benefit of economic growth."

The technology park will be modeled after the Association of University Research Parks (AURP). The nation's first university-related research park was at

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**USER FACILITY**  
*Insert inside.*

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MESSAGE FROM THE DIRECTOR



Alex Fischer

With just a few months remaining in FY 2006, we are continuing our tradition of successfully commercializing ORNL technologies, perhaps to a record level of royalty income, while at the same time fostering enhanced connections between our laboratory and organizations around the South. It's all about planning your work and working your plan.

In this newsletter, you will read about:

- The transfer of land within the central part of the ORNL campus to a local organization – the Community Reuse Organization of East Tennessee – that will develop it as a science and technology park. This unparalleled opportunity is a first among DOE laboratories and will greatly increase our ability to link ORNL researchers and entrepreneurial management teams in ways that create new companies and high-paying jobs in the area.
- An exciting partnership launched under the leadership of the University of Tennessee to accelerate the number of applications submitted and the “win record” in the area of Small Business Innovation Research grants. This effort should help accelerate the growth of technology-based companies in the region.

- Another partnership with the Southern Growth Policies Board and its Southern Technology Council that has produced a benchmarking and knowledge map study of how the South ranks in the area of nanotechnology. This study is the launching point for creation of the Southern Nanotechnology Network to complement the existing Innovation Valley Nano Alliance.
- The reorganization of ORNL's intellectual property group so we can better serve our researchers who want to patent inventions and those who want to license our technologies.
- The hiring of two new licensing associates who continue our commitment to building the best TTED team.
- The implementation of initiatives in homeland security and automotive R&D that really bring to life the concept of ORNL as the “Lab of the South.”

During my nearly four years at ORNL, I have embraced the philosophy of getting the right people on our TTED team and empowering them to grow their jobs beyond the original expectations. This strategy has brought a track record of success, and we plan to unveil other exciting initiatives in subsequent issues of the newsletter. Stay tuned; the best is yet to come!

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TECHNOLOGY PARK (cont.)

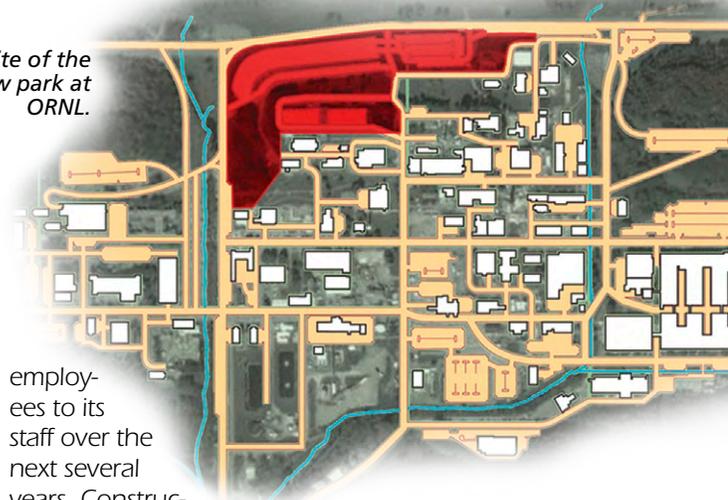
Stanford University, and the largest is the Research Triangle Park in Raleigh, NC. The Oak Ridge technology park will be the first in Tennessee with an AURP designation.

The location offers access to unsurpassed research and development capabilities, a skilled talent pool, a modern telecommunications infrastructure, a central location, and low business costs.

ORNL Director Jeff Wadsworth believes the new park will open up partnership opportunities for a variety of groups that would like to have close and regular access to the laboratory's scientists and facilities. “In the years ahead I expect this park will be home to universities, large established companies, and small start-up companies. Each can benefit from the unique resources we have in Oak Ridge,” Wadsworth said.

Supporting Wadsworth's prediction, the ceremony was marked by an announcement of the technology park's first tenant. Pro2Serve Professional Project Services, an engineering services firm, announced plans to construct a 100,000-ft<sup>2</sup> facility that will serve as the company's National Security Engineering Center and corporate headquarters. Pro2Serve plans to add about 200 new

Site of the new park at ORNL.



employees to its staff over the next several years. Construction on the facility is scheduled to begin this summer.

U.S. Rep. Zach Wamp said he was pleased to see companies able to take advantage of the proximity of researchers while reusing land already cleared for construction. “This is a tangible way to transfer technology. We'll have businesses coming inside the fence in a way that won't threaten the necessary security but will allow older parts of the laboratory to be put into modern use by local companies and still grow the tax base.”

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## Hightower Leads Intellectual Property Legal Section



IP staff L to R, Steve Hamel, Elizabeth Warfield, Joe Marasco, Karen Drew, Kirk Wilson, Karen Bowman, and Jud Hightower.

Technology transfer normally starts with the disclosure of an invention from an ORNL researcher to the laboratory's Intellectual Property (IP) Legal Section. The patent agents and paralegals of the IP Legal Section have always been a part of the technology transfer function at ORNL, and this working relationship was formalized at the outset of FY 2006 when the group was officially incorporated into Technology Transfer and Economic Development.

Jud Hightower, former associate general counsel, was promoted in February to the role of IP managing attorney to lead the patent legal section. Under his leadership and on behalf of the Technology Transfer Division, members of the IP Legal Section help inventors identify new inventions, file invention disclosures, and file (or manage outside counsel who file) patent applications.

Other members of the IP Legal Section are patent agents Joe Marasco and Kirk Wilson, legal assistant Karen Drew, paralegal Elizabeth Warfield, consultant Steve Hamel, and administrative assistant Karen Bowman.

## Palmer, DeTrana Are New Licensing Associates

Jennifer Palmer and Alex DeTrana joined TTED in May as licensing associates. Their primary role is to assist the technology transfer commercialization managers in identifying, evaluating, protecting, marketing, and licensing ORNL technologies in biological and environmental sciences, physical sciences, computing and computational sciences, and energy and engineering sciences.

Palmer began her career at ORNL in 1992 and most recently worked in ESTD where she focused on finding energy-efficient solutions in residential buildings and was responsible for communications, marketing, and outreach projects. She holds a BS in environmental science and an MA in organizational management from Tusculum College. "I've consistently been impressed by the innovative nature of the research at the lab," Palmer said. "Joining TTED affords me the opportunity to be a part of the process in the transition of ORNL technologies from the laboratory to the marketplace to find solutions for some of the world's most difficult problems."



Jennifer Palmer



Alex DeTrana

DeTrana joined TTED from Integrated Manufacturing Technology Initiative, a Knoxville manufacturing strategy and technology road mapping firm, where he spent two years as a program analyst. He received an MBA from the University of Tennessee, an MS in polymer science and engineering from the University of Southern Mississippi, and a dual-major BS in biology and environmental science from Virginia's Ferrum College. While working toward his MBA, he spent nearly a year in TTED as an intern. "It was during that time that I became acquainted with the work and the people in TTED, and it was a fantastic experience," DeTrana said. "I'm very excited to be back as a permanent part of the team."

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## ORNL and the SBIR and STTR Programs

ORNL recognizes the positive impact that small businesses have on the economy, especially those involved in research leading to new product development. Thus ORNL has enhanced its efforts to team with small businesses seeking funding for research through the federal Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. We're doing this in conjunction with UT and several other organizations.

SBIR is a highly competitive program that encourages small businesses to explore their technological potential and provides incentives to profit from commercializing technologies. Including qualified small businesses in the R&D arena stimulates high-tech innovation. SBIR targets the entrepreneurial sector because that is where innovators thrive. However, the risks and expense of conducting serious R&D are often beyond the means of small businesses. By reserving a percentage of federal R&D funds for them, SBIR protects smaller companies and enables them to compete on the same level as larger businesses. SBIR funds the critical startup and development stages.

Small businesses must meet eligibility criteria to participate in the SBIR program. These include

- Being American-owned and independently operated
- Being a for-profit entity
- Having the principal researcher employed by the business
- Having 500 or fewer employees

Following proposal submission, various federal agencies make SBIR awards based on small business qualifications, the degree of innovation, technical merit, and market potential. Businesses that receive awards or grants then begin a three-phase program.

- Phase I (start-up) features awards of up to \$100,000 for approximately 6 months' support to explore the technical merit or feasibility of an idea or technology.
- Phase II awards are up to \$750,000 for up to 2 years to expand Phase I results. During this time, the R&D is conducted and the developer evaluates commercialization potential. Only Phase I award winners are considered for Phase II.

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## TTED | TECHNOLOGY EVENTS

### Southern Leaders Learn about Auto R&D Initiatives

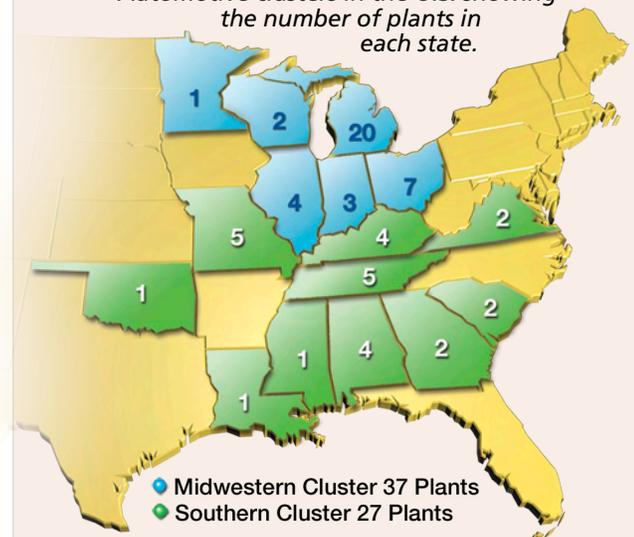
Leaders from throughout the South had two opportunities in June to learn about the possibility of collaborating on automotive R&D activities.

Ben Ritchey, vice president of Battelle's Transportation and Space Division, described the year-long effort to build a southern automotive R&D initiative during presentations at the annual meeting of the Southern Growth Policies Board in New Orleans and the annual Tennessee Valley Corridor Summit in Chattanooga.

Ritchey, under contract to ORNL to develop an overall transportation strategy for the laboratory, has linked his efforts with those of a working group of Southern automotive research centers convened in 2005 by TVA Economic Development and ORNL Technology Transfer and Economic Development. TVA and ORNL launched the group to develop new strategies for linking the region's assets in ways that allow the South to compete for R&D work that previously was done outside the area.

During his presentations, Ritchey described two strong automotive clusters in the nation – the long-standing Midwestern group that includes 37 plants and the newer Southeastern group of 20 plants. He noted that the Southeastern cluster has witnessed the emergence of a number of university-based R&D and outreach centers. These are found in Alabama (Auburn University and the Birmingham and Tuscaloosa campuses of the University of Alabama), Kentucky (Center for Manufacturing at the University of Kentucky), Mississippi (Center

Automotive clusters in the U.S. showing the number of plants in each state.



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for Advanced Vehicular Systems at Mississippi State University), South Carolina (International Center for Automotive Research at Clemson), and Tennessee (University of Tennessee). ORNL and UT also manage a collaborative program at the National Transportation Research Center in Knoxville.

ORNL and TVA will be working with the universities over the next few months to fine-tune a strategy that allows collaboration where it makes sense.

### Commercialization at Battelle-Managed Labs Is LES/AUTM Topic

Technology transfer professionals in the United States and around the world participate in meetings of the Association of University Technology Managers and the Licensing Executives Society.



Photo courtesy of Carla J. Blackman

**“Ben Franklin” speaks to the first joint meeting of LES/AUTM in Philadelphia.**

In May, the first joint meeting of the organizations was held in Philadelphia, with the theme “Connect: Breaking Down Organizational and Cultural Barriers.” As part of this international event, the directors of technology transfer from ORNL, Pacific Northwest National Laboratory (PNNL), and National Renewable Energy Laboratory (NREL) conducted a workshop focusing on some of the unique commercialization approaches being implemented at DOE national laboratories under management or co-management by Battelle Memorial Institute.

Tom Williams of NREL presented an overview of the national laboratories, explaining the Federal Funded Research and Development Center model. Cheryl Cejka of PNNL, ORNL’s Casey Porto, and Williams gave overviews of their respective laboratories’ commercialization programs and research strengths. As a wrap-up, Cejka presented an overview of mechanisms brought to the labs by the Battelle commercialization influence, including maturation funding programs and access to venture capital.

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### SBIR and STTR (cont.)

- In Phase III, Phase II innovation moves from the laboratory into the marketplace. No SBIR funds support this phase. The business must find funding from the private sector or non-SBIR agencies.

Competition for this potentially significant funding can be fierce. Businesses willing to partner with a university or federally funded R&D center (FFRDC) may gain an advantage from access to research facilities and expertise not typically available in small businesses.

ORNL has actively sought SBIR partnerships with small businesses for more than 10 years. An ORNL researcher may obtain up to \$33,333 of support over 12 months for a Phase 1 award and more than \$500,000 of support over 2 years for a Phase 2 award.

STTR expands funding opportunities in the federal innovation R&D arena to include joint venture opportunities for small businesses and premier U.S. nonprofit research institutions. The program’s most important role is fostering innovation to meet U.S. scientific and technological challenges.

STTR also is highly competitive and reserves federal R&D funding for small business and nonprofit research institution partners. Small businesses encourage innovation but may lack the resources to conduct serious R&D. Nonprofit laboratories, on the other hand, are instrumental in developing high-tech innovations, but their efforts frequently are tied to the theoretical rather than the practical. STTR combines the strengths of both entities by introducing entrepreneurial skills to high-tech research efforts to stimulate the transfer of technologies and products to the marketplace. Small businesses profit from commercialization, which in turn stimulates the U.S. economy.

The key difference between SBIR and STTR is that small businesses seeking SBIR funding *may choose* to partner with universities or FFRDCs, while STTR proposals *must* involve such partnerships. Thus the restriction on the amount to be subcontracted to a university or FFRDC changes from not more than 33% for an SBIR partnership to 30–60% for an STTR project. Realizing the importance of having partner agencies for these vital programs, TTED and other ORNL staff are involved in many events and activities to help increase ORNL’s involvement with small businesses in these projects. (See sidebar on SBIR activities on next page.)

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#### SBIR/STTR: Three-Phase Program

##### PHASE 1

- Feasibility study
- \$100K and 6 months (SBIR) or 12 months (STTR)

##### PHASE 2

- Full R/R&D work
- 2-year award and \$750K (SBIR) or \$500K (STTR)

##### PHASE 3

- Commercialization stage
- Use of non-SBIR funds

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## The ABCs of SBIR Proposals

Federal Small Business Innovation Research programs provide funding for small businesses and entrepreneurs seeking to develop new products. Each SBIR proposal must be submitted by a small business, and the business must win a Phase 1 award (~\$150 K over 12 months beginning in FY 2007) before it can submit a Phase 2 proposal (~\$1000 K over 24 months beginning in FY 2007). Agencies' SBIR programs may differ slightly, but general rules apply to all.

SBIR programs fund small businesses to perform R&D or innovation intended to lead to new products in specified areas called technical topics. Each agency's solicitation will identify several technical topics; a proposal submitted to an agency must be directly linked to a stated technical topic to qualify for review.



Agency solicitations are found on several websites. You can check each agency's SBIR program site or an SBIR site with search capability (e.g., [www.sbirworld.com/](http://www.sbirworld.com/) or [www.zyn.com/sbir/](http://www.zyn.com/sbir/)). Both sites can search all open SBIR solicitations for your keyword. Thus, if you are interested in nanotechnology research, look for agencies with technical topics containing the word "nanotechnology."

Note that if a solicitation is not yet open, no match will be possible. (Some agencies state the dates when they will announce their solicitations.)

A small business must assess whether it has or can obtain a qualified principal investigator (PI) for a project. In an SBIR project, the PI must be employed primarily by the business during the project period. Nearly every

## Larry Dickens, Longtime Tech Transfer Leader, Passes Away



Larry Dickens, a well-known leader nationally in the field of technology transfer, died suddenly May 8

at his home in Oak Ridge. A former commercialization manager at ORNL, he was serving as licensing executive at Oak Ridge's Y-12 National Security Complex.

During his 15-year tenure at ORNL in the technology transfer organization, Dickens was instrumental in negotiat-

## Focus on SBIR Activities

ORNL plays a role in many local, regional, and national activities focused on increasing its involvement with small businesses on SBIR projects.

Tennessee SBIR Proposal Assistance Center

**Tennessee SBIR Proposal Assistance Center.** This center was established by the University of Tennessee Center for Industrial Services along with ORNL, BWXT Y-12, East Tennessee Economic Council, IMTI, and Technology 2020. Its goal is to increase the volume and quality of SBIR proposals submitted by Tennessee's small businesses; the result should be an increase in federal research dollars granted to the state.

Leaders of the Proposal Assistance Center plan to

- Provide proposal writing training workshops
- Provide assistance/coaching with proposal writing
- Provide proposal review services
- Provide suggestions for partnerships when it would strengthen the proposal

For more information, see [www.cis.utk.edu/SBIR/](http://www.cis.utk.edu/SBIR/).

**USDA/SBIR Program Energy Summit.** The U.S. Department of Agriculture and SBIR programs hosted an Energy Summit at ORNL July 6 and 7. The event provided a forum to engage the small business community in developing renewable energy technologies.

Goals of the meeting were to

- Highlight USDA and SBIR alternative/renewable energy-related research and energy efficiency-related funding opportunities
- Enhance the ability of public/private researchers to conduct research on cost-efficient alternative/renewable energy
- Showcase research and collaboration opportunities available at ORNL and at regional partner universities
- Engage small businesses to facilitate the transfer of publicly supported research results to real-world applications.

**National SBIR Conference.** Tennessee was well represented at the National SBIR Conference in May in Louisville, Ky. Terry Payne of TTED served on the conference planning commit-

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ing some of the largest cooperative research and development agreements in laboratory history. He also was a leader in negotiating numerous licenses that had a significant impact to ORNL's technology transfer program.

Dickens received several national and regional awards in technology transfer and had served in a variety of leadership positions with the Federal Laboratory Consortium (FLC), including vice chairman. He had just returned from the FLC annual meeting when he died.

He was also a dedicated local public servant. Dickens was serving on the Anderson County Commission at the time of his death and previously was a member of the Oak Ridge City Council. He will be remembered as a man of strong convictions who possessed a deep love for his wife and two sons and a passion for military aviation.

agency weighs PI qualifications heavily in evaluating a proposal. Although most agencies do not require that the PI have a PhD, they generally require a successful record of research in its stead.

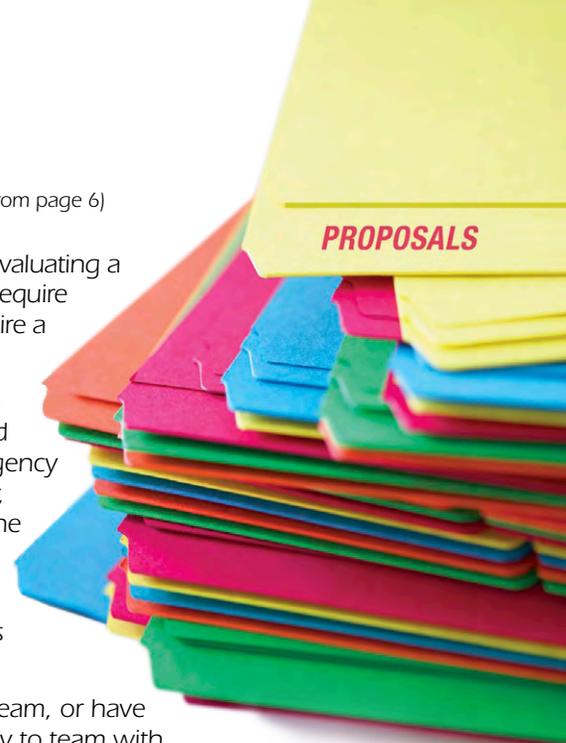
Finding out when to submit proposals can be frustrating for businesses unaccustomed to dealing with government rules. Each agency has one or more solicitations during a year, and proposals are accepted only during one of those solicitation periods.

To maximize the chances of having a proposal funded, consider these questions in preparing a submission.

- Have you assembled the best possible team, or have you left another business an opportunity to team with better institutional partners?
- Have you complied with all of the rules of the specific agency?
- Have you been responsive to a technical topic in the solicitation?
- Is your work plan clear and concise (i.e., logically organized so that one activity leads to the next), and can you perform the work for the budgeted amount?

The most efficient way to learn to prepare an SBIR proposal is to attend a proposal writing workshop or receive counseling from someone knowledgeable about the SBIR process. If you have SBIR-related questions and/or interest in exploring SBIR collaboration with ORNL, e-mail TTED's Terry Payne at [paynetl@ornl.gov](mailto:paynetl@ornl.gov).

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tee and coordinated the state's involvement, which included several presentations and special events.

- East Tennessee Economic Council sponsored a dinner for the Tennessee SBIR proposal assistance team and federal SBIR program managers.
- Tennesseans attended a meeting of state SBIR representatives

*Terry Payne was a presenter at the National SBIR Conference.*



and encouraged the group to ask permission to market a regional SBIR event planned for 2007 in Charlotte, N.C., as the Spring National SBIR Conference.

- Shawn Carson, Center for Entrepreneurial Growth, presented "Commercialization Plan: The Whole Concept."

- Craig Grossman, University of Memphis FedEx Institute of Technology, presented information on faculty entrepreneurship.
- Joe Matteo of Nanotek presented at a session called "Success Stories: It Really Can Work!"
- A session was held to educate state companies about the Tennessee SBIR Proposal Assistance Center.
- Payne made three presentations: "Tech Transfer: Easy or Difficult?"; "Credible Team Building—It Really Does Take a Team"; and "Partnering Is a Key to Success."

Eric Cromwell, Tennessee Department of Economic and Community Development, also participated in the conference. Tennessee businesses were one of the largest contingents with more than 50 registered participants of a total of about 850.

**Florida State SBIR Conferences.** Payne represented ORNL and SBIR at Florida SBIR Conferences in Orlando and Jupiter. After providing overviews of SBIR solicitation practices and topics, he met one-on-one with businesses interested in collaborating with ORNL on SBIR proposals.



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INNOVATION VALLEY<sup>SM</sup>  
**NANO**  
 ALLIANCE



## Nano Alliance Receives Funding, Continues To Grow

ORNL has joined Technology 2020, Knoxville-Oak Ridge Innovation Valley, the University of Tennessee, and the Y-12 National Security Complex to found the Innovation Valley Nano Alliance. The alliance seeks to capitalize on the region's nanoscience research facilities, talent, and intellectual property to create new nanotechnology-related businesses, jobs, and wealth in East Tennessee. Technology 2020 leads the alliance.

The Center for Nanophase Materials Sciences and Spallation Neutron Source at ORNL will attract researchers from around the world to drive the advancement of nanoscience and nanotechnology-based economic development. The alliance will act on opportunities to recruit and establish nanotechnology companies. A group of "nano rainmakers" are identifying companies with whom to link research interests. Researchers from ORNL, UT, and Y-12 are being recruited as "nano ambassadors" to represent regional economic development interests at conferences and meetings. The confluence of research and business interests in nanotechnology also is being encouraged through monthly meetings featuring topical speakers and roundtable discussion.

The U.S. Commerce Department's Economic Development Administration recently announced a \$100,000 grant to Technology 2020 to support further development of the alliance. (EDA promotes innovation and competitiveness, preparing American regions for growth and success in the worldwide economy.) Another \$50,000 in matching funds is coming through the Jobs-Now! regional economic development initiative. Tech 2020 pitched in \$50,000 in matching funds and has received a \$50,000 contract with ORNL for nanotechnol-

ogy-related work. "Our partners are beginning to step up and help us provide the operating funding it's going to take to enable us to fulfill this vision," said Tom Rogers, president and CEO of Technology 2020.

Part of the funding will be used to target Fortune 100 companies interested in working with local researchers and match them with technologies developed here, Rogers said. "We're diving a little deeper than normal," he added. "We're discovering who the lead nanoscience research people are in these facilities and really trying to determine their agendas, then taking the time to do some matching so that when we invite them to come to the region we have a focused presentation about how we might help them."

The alliance is working to define the scope of a nanotechnology commercialization facility to help transition research to products. A nanotechnology business plan competition and venture conference are planned for 2007.

ORNL's role as the pivotal research institution in linking nanotechnology research relationships among Southern universities was identified in the recent study "Connecting the Dots: Creating a Southern Nanotechnology Network." (See page 10.) It recommends forming a Southern Nanotechnology Institute based on ORNL's research assets with a mission in the Southern states mirroring that of the Innovation Valley Nano Alliance. ORNL and Technology 2020 are working with the Southern Technology Council to explore forming a Southern Nanotechnology Institute based on the Innovation Valley model.

For more information, see [www.nanovalley.us](http://www.nanovalley.us).

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OUR | **TECHNOLOGIES**

### NavSci To Develop RFI Technologies



NavSci, of Charleston, S.C., has entered into an agreement with ORNL

to commercialize radio frequency identification (RFID) technologies that may be employed in oceangoing container tracking for logistical and security uses.

NavSci has extensive experience in tracking and monitoring mobile assets ranging from vehicles to shipping containers. The company was granted a license to next-generation wireless intellectual property developed at ORNL, including hybridized spread spectrum RFID and software-defined radio technologies. NavSci has demonstrated successful efforts for the Department of Homeland Security (DHS) and industry in the Port of Charleston.

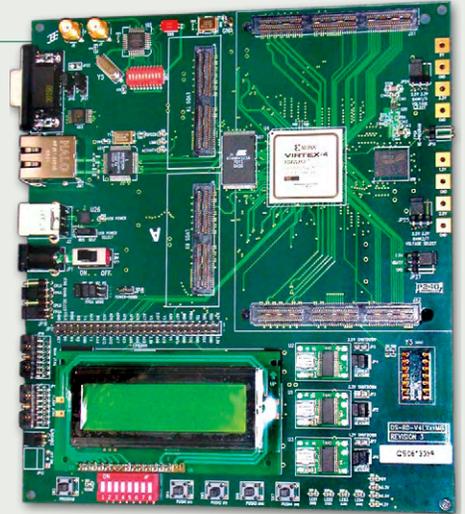
The DHS Advanced Research Projects Agency awarded NavSci about \$1.1 million in Phase I and Phase II Small Business Innovative Research (SBIR) grants to develop a marine asset tag tracking system. SBIR's objective is to develop a prototype tag system (using RF technology) for shipping containers that operates in a marine environment while loaded and stacked aboard a ship, unloaded, and moved and stacked in shipping terminals. NavSci chose HSS RFID technology to provide proof-of-concept and economic viability. The Phase I effort was completed in 2004; Phase II will be completed in 2006.

NavSci has constructed a central command and control (known as NOC) infrastructure that integrates RFID

products with advanced asset tracking based on a geographic information system (GIS). The functionality of the NOC will be expanded over the next year to include advanced data mapping, visualization, and reporting to enhance operational efficiency. The information derived is expected to fuel intelligence systems that warn of impending danger and provide tools to deliver the right information at the right time to the right place to the right people while providing total asset visibility. Currently, NavSci's GIS-based asset tracking system accepts data from multiple sources (satellite networks, cellular networks, the telephone system, and the Internet) and filters it, creates information from it, and provides the information to clients via secure Internet. NavSci's system, including the NOC, is completing the process of certification by the Defense Information Technology Security Certification and Accreditation Program for further work with federal agencies.

As part of the license agreement, NavSci and ORNL have established a cooperative research and development agreement (CRADA) for further development of the technology. NavSci expects the products being developed through the CRADA to be used primarily to enhance supply chain efficiencies but also in homeland security.

Multi-protocol, 4 channel, HSS (hybridized spread spectrum) reader prototype. Image courtesy of NavSci.



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*TTED Staff gather for a group photo in the Technology Transfer lobby of ORNL.*



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## Report Creates Foundation for Southern Nano Network

ORNL Technology Transfer and Economic Development helped fund research for “Connecting the Dots: Creating a Southern Nanotechnology Network,” a regional report mapping the South’s assets in nanotechnology. The report,



which provides recommendations for establishing the South as a leader in the emerging industry, was released by the Southern Growth Policies Board.

“Connecting the Dots” outlines the South’s strengths and weaknesses in nanotechnology in five key areas – human capital, knowledge generation, patents, funding, and commercialization. The report includes data for all of the Southern Growth member states, including Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, West Virginia, and the Commonwealth of Puerto Rico.

Southern Growth’s research revealed that the South performs about 20 percent of all nanotechnology research activity in the United States. Although Tennessee, Georgia, North Carolina, and Virginia have the most highly concentrated activity, every Southern state is participating in the nanotechnology industry, from publishing nanotechnology articles to producing dissertations and winning nanotechnology grants. The Southern region is also home to four of the top 25 nanotechnology research institutions – Georgia Institute of Technology, the University of North Carolina, ORNL, and North Carolina State University – and to some 20 percent of this country’s highly cited nanotechnology researchers.

The Southern region’s weaknesses in nanotechnology assets lie in patents and funding. The South lags behind the nation in nanotechnology patents, with only 14.8 patents per million in population, compared with 40.9 per million for the United States. Although the Southern region represents 20 percent of the nation’s economic activity, it attracts only nine percent of the total U.S. venture capital in all sectors. Lack of venture funding affects the technology commercialization process and the region’s ability to attract and grow new nanotechnology companies.

While Southern research institutions boast strong linkages to international researchers, they lack connections to critical U.S. nanotechnology centers like those in California and the Northeast. Southern universities and research centers also lack strong connections among institutions in the region.

As Scott Doron, director of the Southern Technology Council explained, “Our research suggests that the South can signifi-

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## ORNL ‘Building Bridge’ with French Officials

Representatives of the French Parliament and French Consulate were among a 26-member delegation that made a special visit to ORNL and other Tennessee locations in April.

The Blount Chamber Partnership hosted the group, led by Philippe Ardanaz of the French Consulate in Atlanta and Jean-Francois Le Grand, member of the French Parliament and governor of Manche in Normandy, for a ten-day visit to the state. During their tour, the delegation honored numerous World War II veterans with certificates of thanks and glass-encased medals containing sand from Utah Beach, one of the famed landing beachheads at Normandy on D-Day, June 6, 1944.

The tour of ORNL was one of the last major events in the visit, which also took the delegation to Nashville, Murfreesboro, Lynchburg, Memphis, Pigeon Forge, and Maryville. ORNL Director Jeff Wadsworth and TTED Director Alex Fischer both spoke at the ORNL opening session.



Members of the French Delegation toured the Center for Nanophase Materials Sciences on a recent visit to ORNL.

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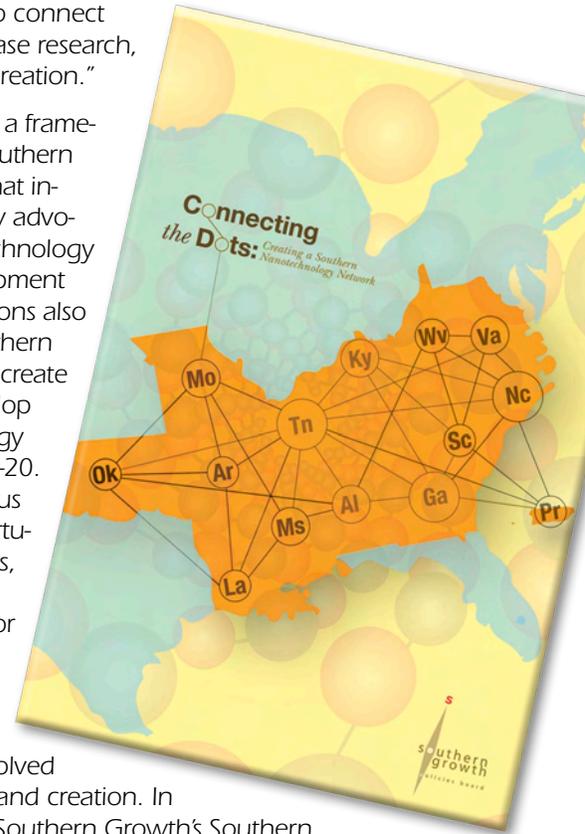
During a luncheon with the delegates, officials continued to build a “bridge” between the La Manche area and ORNL, with presentations from Suzanne Herron and Norbert Holtkamp on the ITER project that will be constructed in France. Associate Laboratory Director Lee Riedinger provided an overview of ORNL university partnerships with an increasingly international flavor. On a more personal note, the event also featured the unveiling of a number of picture postcards recently found by the mother of SNS employee Max Cronan. They were of special interest because Cronan’s grandfather brought them back from Normandy in 1918.

The delegation also toured the Spallation Neutron Source, Center for Nanophase Materials Science, National Leadership Computing Facility, and Everest Visualization Center. The Blount Chamber Partnership is planning a reciprocal visit to France and England in October.



cantly increase its competitive advantage in nanotechnology through regional collaboration among research institutions and with the private sector. No Southern institution or locale has the critical mass of nanotechnology assets to go it alone and achieve global leadership. We need a Southern Nanotechnology Network to connect the region’s assets and increase research, funding and new business creation.”

“Connecting the Dots” offers a framework for the creation of a Southern Nanotechnology Network that includes identifying state policy advocates to incorporate nanotechnology in primary economic development plans. Report recommendations also call for the creation of a Southern Nanotechnology Institute to create research coalitions and develop guidelines for nanotechnology education in the years pre-K–20. Other recommendations focus on increasing funding opportunities for Southern institutions, the need for affordable research tools, and the need for further research to identify the South’s market niches.



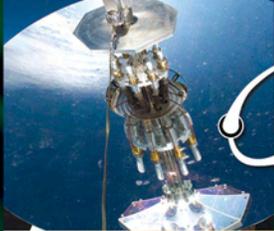
A consortium of Southern research institutions was involved in the report’s development and creation. In addition to ORNL’s support, Southern Growth’s Southern Technology Council and the Georgia Institute of Technology Program in Science, Technology and Innovation Policy prepared the data and manuscript.

Southern Growth Policies Board is a public policy think tank based in Research Triangle Park, North Carolina. Formed by the region’s governors in 1971, the board develops and advances visionary economic development policies by providing a forum for collaboration among a diverse cross-section of the region’s governors, legislators, business and academic leaders, and the economic and community development sectors.



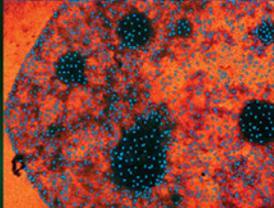
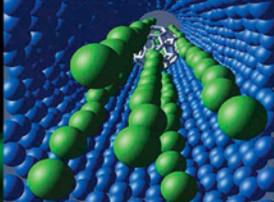
### SAFETY REMINDER

As you vacation with family and friends this summer, please keep safety foremost in your plans and actions. For auto trips, always buckle up, obey posted speed limits, build in time for breaks to avoid drowsiness, and be sure your vehicle is in good shape for hot-weather driving conditions. Best wishes for a safe and pleasant summer from the ORNL Technology Transfer and Economic Development staff.



# TECHNOLOGY TRANSFER

AND ECONOMIC DEVELOPMENT



## UPCOMING EVENTS

- August 23–24 Emerging Technology Forum, “The Next Industrial Revolution: Nanotechnology and Manufacturing,” Oak Ridge. For more information: [www.sme.org](http://www.sme.org)
- September 12–13 Tennessee Governor’s Conference on Economic and Community Development, Nashville Convention Center. For more information: [www.state.tn.us/e cd/govconf06/eblast1.html](http://www.state.tn.us/e cd/govconf06/eblast1.html)
- September 17–19 BioFusion 2006, Washington Duke Inn & Golf Club, Research Triangle Park, N.C. For more information: [www.biosouth.org](http://www.biosouth.org)
- September 27-28 Tennessee Valley Venture Forum, Knoxville Convention Center. For more information: [www.tvf.biz](http://www.tvf.biz)

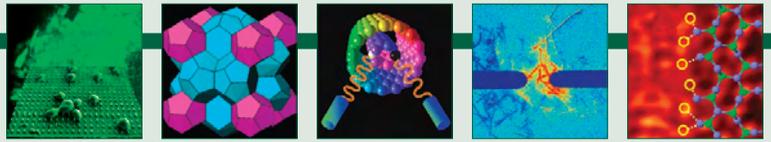


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Toll-free number: 866-221-2527



# User Facilities at ORNL

PROVIDING

## UNIQUE OPPORTUNITIES

Department of Energy user facilities give industry and universities access to expensive, unique research facilities and equipment at the national laboratories. Oak Ridge National Laboratory is home to 18 user facilities that advance national research and development missions while minimizing duplication of effort, promoting beneficial scientific interaction, and making the most effective use of these resources. The facilities are used by scientists from ORNL, industry, academia, foreign institutions, and other government laboratories. During 2005, some 1300 experimenters from more than 400 organizations worked at ORNL's user facilities.

### How To Gain Access

Access to Oak Ridge user facilities involves the review and approval of the user's proposal and an executed agreement between the user institution and UT-Battelle. Prospective users can submit proposals directly to the facility of interest. Acceptance depends on scientific merit, suitability of facility for the project, selection of an Oak Ridge collaborator, and appropriateness of the work to DOE objectives.

Once a proposal is approved, specific operating procedures, time allotted, user fees (if any), and collaborative arrangements will be determined. Concurrently, TTED begins the process to execute a user agreement with the user institution. This agreement, which can be proprietary or nonproprietary, stipulates terms and conditions, including disposition of intellectual property.

*The expanded east campus is part of the new facility improvements available at ORNL.*



### Facilities and Their Missions

The **Bioprocessing Research Facility** combines laboratories for investigating advanced bioprocessing concepts using stirred-tank and columnar bioreactors with a fermentation pilot plant for large-scale batch and columnar experiments.

The **Buildings Technology Center** is used to identify, develop, and deploy sustainable, energy-efficient building technologies and systems. It offers tools and expertise on building envelopes, heating and cooling, equipment, and monitoring and systems analysis.

The **Californium User Facility for Neutron Science** is a neutron irradiation facility that uses compact  $^{252}\text{Cf}$  neutron source capsules, which are stored at the facility for DOE's  $^{252}\text{Cf}$  distribution program. Two uncontaminated hot cells are available for entry and experimental setup by researchers, after which  $^{252}\text{Cf}$  sources capable of emitting  $>10^{11}$  neutrons/s can be used for irradiations.

(continued on next page)

The **Center for Nanophase Materials Sciences** is a research facility for the synthesis, characterization, theory/modeling/simulation, and design of nanoscale materials and structures and the understanding of nanoscale phenomena. Its scientific program focuses on fundamental nanoscale science and nanotechnology opportunities and needs.

The **Cooling, Heating, and Power Integration Laboratory** enables researchers to conduct performance and reliability tests on distributed energy products and systems for building applications.

The **Fuels, Engines, and Emissions Research Center** specializes in detailed characterization of internal combustion engine emissions and efficiency. It boasts specialized diagnostic and measurement tools for developing and evaluating engine and emission control technologies.

The **High Flux Isotope Reactor (HFIR)** is an 85-MW isotope production and test reactor capable of a wide variety of irradiation experiments. It has a peak thermal neutron flux of  $2.6 \times 10^{15}$  neutrons per square centimeter per second – highest in the western world.

The **HFIR Center for Neutron Scattering** provides the highest-flux reactor-based source of neutrons for condensed matter research in the United States. Thermal and cold neutrons are used to study physics, chemistry, materials science, engineering, and biology.

The **High Temperature Materials Laboratory** addresses materials problems that limit the efficiency and reliability of automotive systems. It includes six user centers that provide electron microscopy, measurement equipment, X-ray and neutron diffraction, and high-speed grinding machines.

The **Holifield Radioactive Ion Beam Facility** provides high-quality beams of short-lived radioactive isotopes produced when intense beams of light ions from the Oak Ridge Isochronous Cyclotron strike highly refractory targets. The ion beam is injected in the 25-MV tandem and provided for nuclear reaction, structure, and astrophysics research.

The **Metals Processing Laboratory Users Facility** provides specialized equipment for studies of materials synthesis, deformation processing, materials characterization, joining, and math-

Scanning Auger analysis of a single-crystal detector material.



FACILITY **SUCCESS STORIES**

**High Temperature Materials Laboratory**

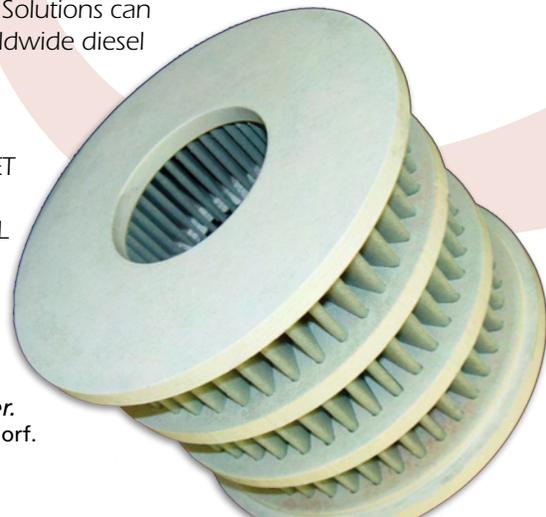
The High Temperature Materials Laboratory (HTML) at ORNL has supported the development of advanced materials since the mid-1980s. By providing visiting researchers with access to a skilled staff and sophisticated devices for materials characterization, HTML has supported many successful enterprises.

**Ceramic Solutions**

Richard Nixdorf worked with HTML staff to develop ceramic materials, primarily whisker- or fiber-based materials. He formed ReMaxco Industrial Ceramic Solutions, an Oak Ridge-based business that created several hundred jobs in East Tennessee from 1987 to 2005. Commercialization of the company's diesel engine particulate is now in progress as a result of improvements. Following the successful work with HTML, Industrial Ceramic Solutions can now begin supplying prototypes to worldwide diesel industry users.

**Medical Imaging**

CTI, a Knoxville-based manufacturer of CAT and PET scanners, utilized HTML to improve the quality and performance of detectors used in its scanners. HTML has provided the unique expertise and state-of-the-art instrumentation needed to implement high-tech materials in medical imaging. CTI's improved crystal material contributes to earlier disease detection.



*ICS Diesel Exhaust Filter.*  
Image courtesy of R. Nixdorf.

emational modeling using leadership-class supercomputers and specialized computing codes developed by ORNL staff .

Mouse geneticists and molecular biologists at the **Mouse Genetics Research Facility** use its standard and mutant strains of lab mice for basic research in analyzing gene function and identifying mouse models of human genetic disease. The facility occupies a new 36,000-ft<sup>2</sup> vivarium operated as a specific-pathogen-free barrier facility with a capacity for 70,000 mice.

The **National Center for Computational Sciences** has been designated as the Leadership Computing Facility for the nation. Its resources include a 25-teraflop Cray XT3 supercomputer and an 18.5-teraflop Cray X1E vector supercomputer.

The **National Transportation Research Center** develops and evaluates advanced transportation technologies and systems. It provides state-of-the-art hardware and computational resources to address issues such as fuel economy, emissions, traffic congestion, evacuation planning, and highway safety.

The **Oak Ridge Electron Linear Accelerator** produces intense, nanosecond pulses of neutrons with an energy spectrum of 10<sup>-3</sup> to 10<sup>-8</sup> eV. Using time-of-flight techniques, researchers can study different types of neutron reactions with high resolution and precision.

The **Power Electronics and Electric Machinery Research Center** provides expertise in developing and prototyping advanced power converters and adjustable speed drives; electric machines; power transmission and distribution R&D; and power quality, efficiency, and measurement.

The **Shared Research Equipment Collaborative User Facility** offers advanced capabilities in transmission electron microscopy, scanning electron microscopy, atom probe field ion microscopy, and mechanical properties microanalysis.

The **Spallation Neutron Source** is an accelerator-based neutron source that will provide the most intense pulsed neutron beams in the world for scientific research and industrial development. Officials expect the facility to begin hosting users in late 2006.

## ORNL's User Facilities

- Bioprocessing Research Facility
- Buildings Technology Center
- Californium User Facility for Neutron Science
- Center for Nanophase Materials Sciences
- Cooling, Heating, and Power Integration Laboratory
- Fuels, Engines, and Emissions Research Center
- High Flux Isotope Reactor
- HFIR Center for Neutron Scattering
- High Temperature Materials Laboratory
- Holifield Radioactive Ion Beam Facility
- Metals Processing Laboratory Users Facility
- Mouse Genetics Research Facility
- National Center for Computational Sciences
- National Transportation Research Center
- Oak Ridge Electron Linear Accelerator
- Power Electronics and Electric Machinery Research Center
- Shared Research Equipment Collaborative User Facility
- Spallation Neutron Source

### Ultra-Thin Coatings

C3 is a small Georgia company with potential growth of tens of millions of dollars expected in the next few years. Company leaders also expect the number of employees to increase from 12 to 50 (plus 25 part-timers) by 2010. Working with HTML has helped them better understand ultra-thin coatings and how to improve their performance. HTML also has provided new ideas for metal casting technology, fuel cells, catalysts, and cutting tools. C3's projected revenue from aluminum die casting alone is estimated to be nearly \$20M over the next five years.

## National Transportation Research Center

### Heavy-Duty Cycle Project

ORNL and Dana are working together in a DOE-funded heavy-vehicle duty cycle project that involves instrumenting a fleet of tractor-trailer rigs to collect data on fuel usage, engine operating parameters, emissions stability, and other details (e.g., weather conditions) related to long-haul driving environments. The data will be used in computer models that can be used by engineers to develop lighter, safer, cleaner, and more fuel-efficient heavy-duty vehicles.

### More Efficient Electronics for Hybrids

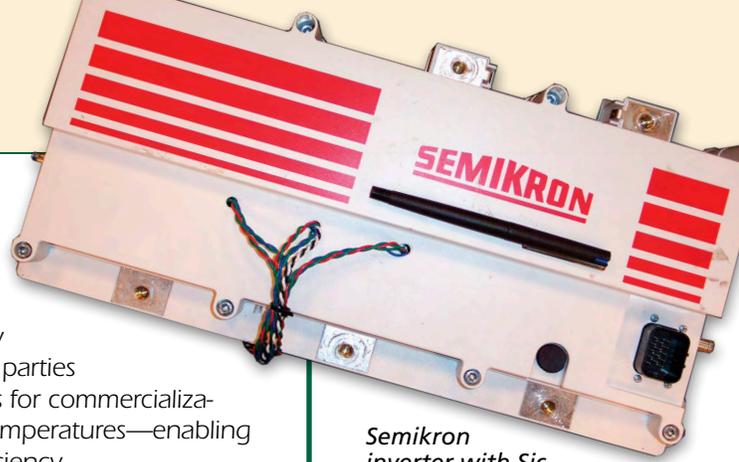
ORNL has collaborated with Cree and Semikron to build a hybrid 55-kW silicon insulated gate bipolar transistor and silicon carbide



*This data acquisition instrument is used to collect on-the-road data from big rigs.*



(continued on next page)



*Semikron inverter with Sic Shottky diodes.*

(SiC) Schottky diode inverter for hybrid electric vehicles. Silicon p-n diodes in Semikron's hybrid automotive inverter were replaced with Cree's SiC Schottky diodes. Schottky diodes, the only commercially available SiC devices, are provided by very few manufacturers. Several parties are developing other SiC and gallium nitride power electronics devices for commercialization. SiC-based devices operate at higher voltages, frequencies, and temperatures—enabling weight and size reductions coupled with increased efficiency.



**On-Board Emission Control**

ORNL staff are working with Ford to develop a nitrogen (NOx) gas sensor for use in onboard engine emission control systems. The sensors permit dynamic monitoring of NOx levels for optimized emission control. Using robust ceramics developed at ORNL (yttria-stabilized zirconia) and modern screen printing and thermal treatments, electrodes for the sensor can be precision-manufactured. Ford officials have shown exclusive interest in ORNL's sensor technology.

*NOx sensor for use in onboard emission control systems.*

**National Center for Computational Sciences**

As a user facility, the National Center for Computational Sciences (NCCS) at ORNL will deliver leadership-class computing for science and engineering; focus on "grand challenge" applications; procure largest-scale computer systems and develop high-end operational and application software; and train next-generation computational scientists. NCCS computing resources are among the fastest in the world, able to perform more than 40 trillion calculations per second. Research areas supported by the center include astrophysics, climate and carbon research, computational biology, fusion simulation, industrial innovation, materials research, and nanomaterials theory.

**Semiconductor Analysis**

A team from Daresbury Laboratory, the University of Alabama, and ORNL analyzed the nature of electronic structure and magnetic exchange in doped semiconductors. The results help resolve discrepancies between phenomenological models and first-principles electronic structure descriptions of magnetic semiconductors. NCCS computational resources enabled the calculations needed to replicate interactions between electronic and magnetic forces as well as other properties in doped magnetic semiconductors. Predicting doped semiconductor materials that retain magnetic order at room temperature should assist in the development of novel devices.

**Climate Modeling**

A Climate Modeling End Station – an important part of the U.S. effort to simulate and study global climate – is being established at the NCCS, allowing the climate modeling effort to complete cutting-edge simulations. Other Department of Energy, NASA, National Science Foundation, Duke, and Georgia Tech researchers are serving as co-principal investigators with ORNL scientists. Use of NCCS resources will enable greater fidelity and complexity in climate simulations, providing more accurate predictions to inform policy decisions.

*The "EVEREST" powerwall in ORNL's Visualization Center can be used to display complex and extensive climate modeling data in a high-resolution format.*

