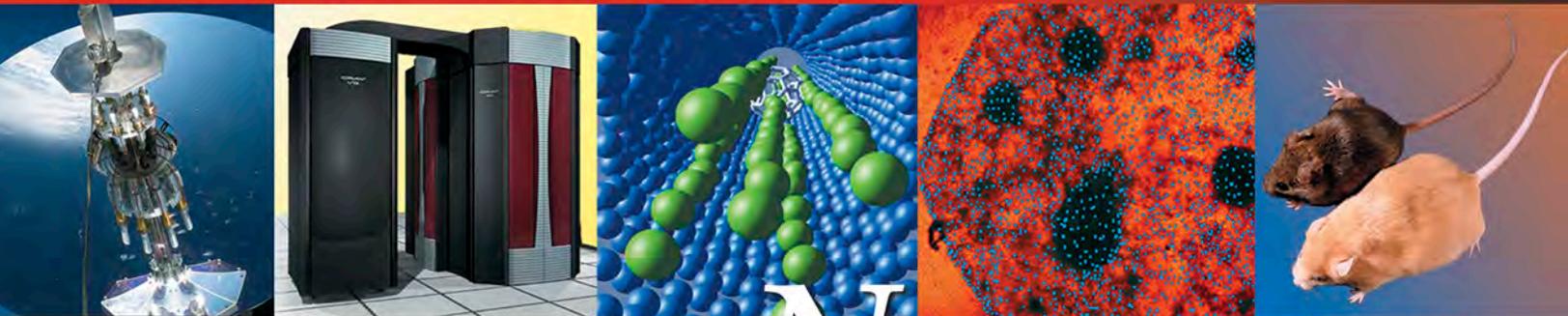


Year-in-Review



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2005

Putting Science to Work

OAK RIDGE NATIONAL LABORATORY



TECHNOLOGY TRANSFER
AND ECONOMIC DEVELOPMENT

MESSAGE FROM THE DIRECTOR

I can't reflect on progress in 2005 and the opportunities ahead of us in 2006 without great optimism and excitement. It was certainly a busy and exciting year in the Office of Technology Transfer and Economic Development. Our staff and partners continue to aggressively pursue new opportunities to use ORNL's technologies for economic opportunity for our community, region, and country.



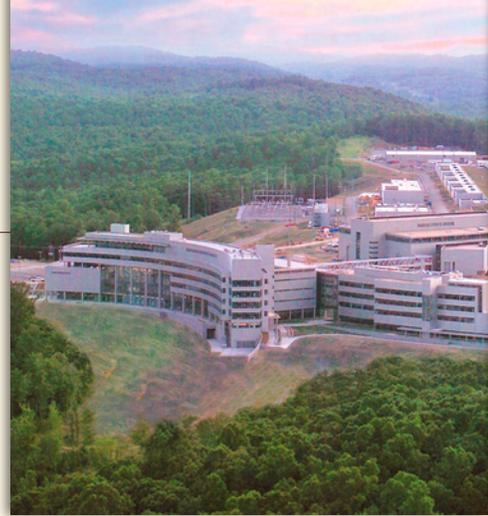
Alex Fischer

Under the leadership of Casey Porto, recruited for the post of director of technology transfer from Case Western University, ORNL logged a record year in a variety of areas, including royalty income, patent reimbursements, and invention disclosures. This report details many of the exciting licensing deals that form the core mission of our office. Our sponsored research office executed more than 90 new work for others agreements valued at \$53 million and 10 new cooperative research and development agreements valued at \$10.5 million. Once again, ORNL swept

the Federal Laboratory Technology Transfer Awards, winning more awards than any other laboratory for the third year in a row – certainly a tribute to ORNL's world-class researchers. While we didn't think a "threepeat" was possible, we have now set our sights on the 2006 awards. ORNL researcher Amit Goyal passed a laboratory milestone of 50 issued patents – not only an ORNL record, but one that leads all of the Battelle-managed laboratories. In fact, ORNL has more Battelle Distinguished Inventors (inventors with more than 14 issued patents) than any other laboratory. And ORNL continues to excel in the R&D 100 awards, now having more than 120 recognized technologies, more than

any other public laboratory in the world and second only to General Electric – certainly not bad company.

Under the leadership of Tom Ballard, ORNL's economic development programs continued to grow throughout the region with significant impacts for the private sector. Our vision of ORNL's position as the "Lab of the South" gained significant momentum with new partnerships with the Southern Growth Policies Board and throughout many southeastern states. Most notably, partnerships are thriving from our home base in Tennessee to North Carolina, South Carolina, and into Mississippi. Locally, ORNL's Center for Entrepreneurial Growth at Technology 2020 continues to provide entrepreneurial support to technology companies throughout the region. Since UT-Battelle assumed the management of ORNL in April 2000, our technologies and other resources have contributed significantly to the creation of 61 companies that had \$36.5 million in revenues during the past year, and created 285 full-time and 33 part-time jobs. Regionally, ORNL's partnership with the Tennessee Valley Authority fostered the creation of a very robust telecommunications capability utilizing existing TVA fiber. Because of this arrangement, both ORNL and the University of Tennessee have more affordable connectivity to the National Lambda Rail, and UT has unparalleled access to ORNL's world leadership computing center. This year, the network will be extended throughout West Tennessee and to institutions in Mississippi in an effort that is greatly enhancing Tennessee's high-speed connectivity.



ORNL Technology Transfer & Economic Development (TTED) seeks to foster economic development and the growth of business and industry by making

BUILDING A TECHNOLOGY-BASED ECONOMY

| Metric | FY05 |
|---|----------|
| New Invention Disclosures | 167 |
| Total New Licenses/Options | 151 |
| Total New Licenses: Fee-bearing | 28 |
| Revenue from Licensing | \$2.56 M |
| New Cooperative Research and Development Agreements | 10 |
| New Work For Others | 92 |

The Metrics of Technology Transfer: Measuring Success

Technology transfer can be measured in many ways, and the definition of "success" varies according to each institution's goals. At the Oak Ridge National Laboratory, technology transfer is the mechanism for moving important innovations from the research laboratory to the marketplace in order to enhance U.S. competitiveness and bolster the regional economy. FY05 was a banner year in terms of technology transfer outcomes,



The Spallation Neutron Source with the Center for Nanophase Materials Sciences.

This past year also saw a milestone in local venture capital with the creation of Innovation Valley Partners, a \$35-million technology-based venture

capital fund, financed by a group of Knoxville-based business leaders. This new fund, managed by the partners of the \$150-million Battelle Ventures, joins the existing Southern Appalachian Fund in providing new opportunities for financing technology-based ventures in our region. ORNL partner Technology 2020 made more than \$15 million in equity investments to new technology-based start-up companies, and 2006 holds even further progress as Technology 2020 finalizes the creation of Meritus Ventures, a \$30-million fund sponsored in part by the U.S. Small Business Administration. All of these initiatives are working collaboratively, creating a new spirit of entrepreneurialism in East Tennessee. I am proud of ORNL's leadership and sponsorship of many of these initiatives that are helping to ensure that our local businesses have the needed capital for success.

ORNL also helped provide the leadership to launch the Innovation Valley Nano Alliance, looking to leverage ORNL's assets. In 2006, ORNL opened the first of DOE's Centers for Nanophase Materials Sciences, adjacent to the world's largest scientific project, the Spallation Neutron Source. SNS will become operational in 2006, on time, scope, and budget, and with a world-leading safety record. A nano-business plan competition is under design and will be launched during 2006.

We were all proud to see Technology 2020 celebrating its 10th year of assisting technology-based companies in the region. Imitation is one of the best forms of

flattery, as organizations continue to model economic development efforts after the programs and partnerships of Technology 2020 and ORNL.

We also are continuing to invest in enhanced market research at ORNL. Led by former Motorola executive Pat Richardson, we are continuing our partnership with the University of Tennessee MBA program. The initiative was established in 2002 to provide graduate assistantships and internships to a select group of MBA students each semester. Students from UT participate in the early discovery process at the laboratory, investigating the license possibilities for new inventions. The students gain valuable experience working on real problems here at ORNL and help start the process of transitioning technology from research in the laboratory to business. This past year our MBA team, working with Pat, completed 52 first-look marketing studies to support our Technology Transfer activities.

I thank all of our staff and partners who are working hard every single day to make all of these good things possible. Together as a team, we will continue to push new ground in 2006.

Ally R. Fischer

Technology Transfer entrance at ORNL.



available innovative equipment, the latest technology, and the expertise of ORNL researchers to technology-based companies throughout the nation.

with record numbers for invention disclosures, licenses and options, and revenue.

Revenue is an important metric because the dollars generated by the technology transfer process are reinvested in the laboratory to enhance the research agenda and future innovation. For example, revenue from technology transfer is used to fund a laboratory-wide annual competition for the maturation of specific technologies that are close to being ready for commercialization but need additional support for the

completion of a final task, such as the development of a prototype to show prospective licensees. Revenue also is reinvested in ORNL's research divisions via specific projects that are deemed by the divisions to be important, and via a "special projects" fund that has been used to purchase expensive instruments or equipment for key initiatives. Some technology transfer revenue is also used to support the Center for Entrepreneurial Growth, ORNL's partner for the incubation of new

(BUILDING A TECHNOLOGY-BASED ECONOMY continued on page 4)

(BUILDING A TECHNOLOGY-BASED ECONOMY continued from page 3)

The Metrics of Technology Transfer (cont.)

ventures. In FY05, the revenue from technology transfer activities was approximately \$2.5M.

Numbers of agreements, such as licenses, options, work for others agreements and cooperative research and development agreements, constitute a key metric because these agreements reflect the numbers and types of ORNL's transactions with industry. There were 248 such agreements executed in FY05. Most represent income for the laboratory – in the form of royalty revenue that can be reinvested as explained above, or as funds that sponsor research. One measure of the laboratory's ability to move innovation out of the research setting and into commercial use is reflected in how often and to what extent commercial companies enter into agreements with ORNL.

The general level of activity and participation by researchers in the technology transfer effort can be gauged by the number of inventions that are disclosed. In FY05, a record number of 167 inventions was disclosed to the Technology Transfer Office. Half of these were selected for commercial pursuit and patenting.

A key metric for ORNL technology transfer is the number of startups that trace their origins to the laboratory – either because the technology on which the company was founded was licensed from ORNL, or because the company founders were laboratory employees. These startups often pioneer new technologies that may represent important breakthroughs but are not suitable for licensing to established companies – perhaps because there is substantial development to be done before commercial products can be realized, or because the new technologies are potential replacements for well-established products. The chart below depicts the ten companies that were ORNL startups in FY05; six of these were established in the region.

| | |
|--|---------------------|
| GeoNuclides, Inc. | Oak Ridge, TN |
| NanoTek, LLC | Knoxville, TN |
| Nanodetection Technologies, LLC | Knoxville, TN |
| Sunlight Direct, LLC | Oak Ridge, TN |
| Oak Ridge Technology Connections | Mtn. City, TN |
| ID Systems, LLC | Knoxville, TN |
| FemtoGen | St. Louis, MO |
| Multispectral Imaging, Inc. | Newark, NJ |
| Isotron, Inc. | Norcross, GA |
| Hercules Development Corp. (successor to Vanguard Technologies) | North Attleboro, MA |

(BUILDING A TECHNOLOGY-BASED ECONOMY continued on page 5)

FOCUS ON SUCCESS

Budhendra Bhaduri



LandScan Provides Versatile Dataset for Global Population Mapping

In recent months ORNL's LandScan 2003™ "High Resolution Global Population Data Set" has seen an unprecedented level of applications in humanitarian, research, and commercial arenas.

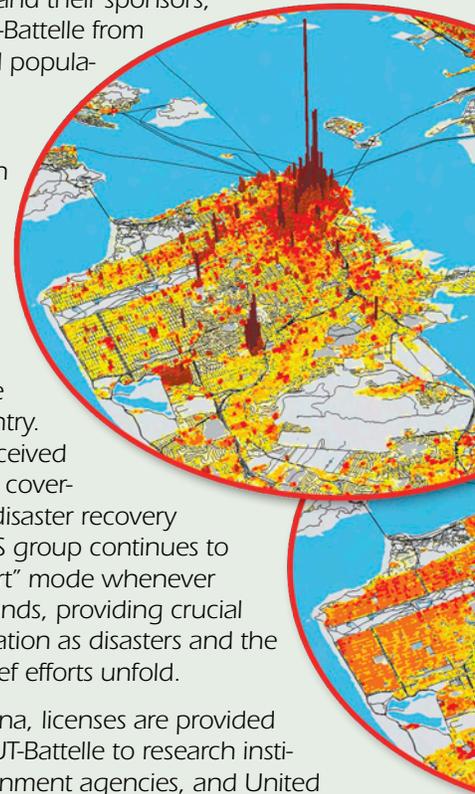
Working closely with ORNL's Geographic

Information Science and Technology (GIS) Group, led by researcher **Budhendra Bhaduri**, the Office of Technology Transfer and Economic Development developed and implemented a strategy to maximize tangible and intangible returns for the benefit of ORNL researchers and their sponsors, the public, and UT-Battelle from this versatile global population dataset.

On the humanitarian front, LandScan 2003™ was a critical component in disaster response planning during the recent tsunami in Southeast Asia and Hurricane Katrina in this country.

The technology received widespread media coverage during these disaster recovery efforts, and the GIS group continues to function in an "alert" mode whenever the situation demands, providing crucial population information as disasters and the accompanying relief efforts unfold.

In the research arena, licenses are provided free of charge by UT-Battelle to research institutions, U.S. government agencies, and United Nations organizations for research, humanitarian, and U.S. government uses. In FY 2005, UT-Battelle granted 142 such licenses, resulting in an equally impressive number of research publications. The



(BUILDING A TECHNOLOGY-BASED ECONOMY continued from page 4)

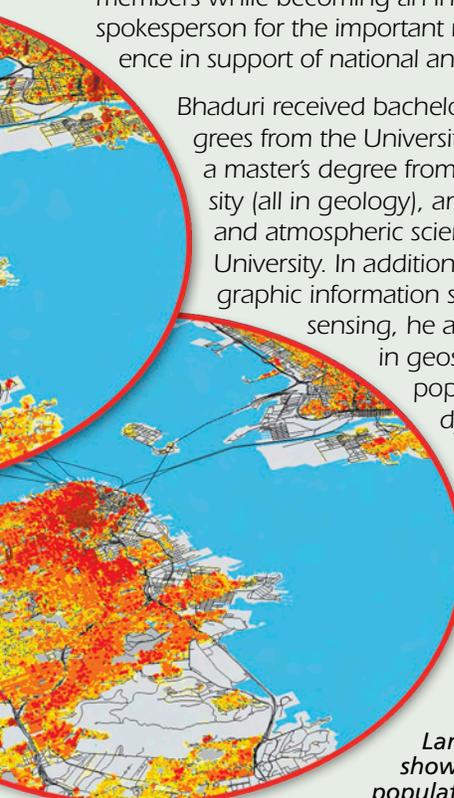
dataset has been used in studies ranging from climate change effects to pollution monitoring, and by a constituency ranging from high schools to Germany's Max Planck Institute.

On the commercial front, 11 revenue-generating licenses were executed in FY 2005. High-profile users have included *National Geographic* and *TIME* magazines and *The New York Times*. These publications routinely have LandScan-generated images in their periodicals. The dataset has also been featured in books published by Architecture for Humanity and Oregon's Wild Salmon Center.

GIS group leader Bhaduri also received corporate recognition for his work with LandScan. At UT-Battelle's 2005 Awards Night, he received the Director's Award for Outstanding Individual Accomplishment in Community Service. Bhaduri was honored for "his efforts toward enhancement and enrichment of the lives of the laboratory's international staff members while becoming an internationally known spokesperson for the important role of geospatial science in support of national and global missions."

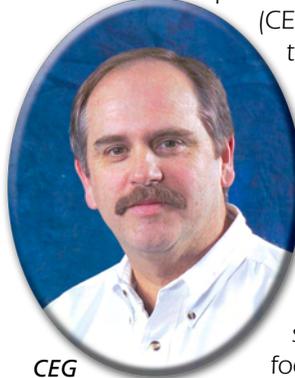
Bhaduri received bachelor's and master's degrees from the University of Calcutta, India, a master's degree from Kent State University (all in geology), and a Ph.D. in earth and atmospheric sciences from Purdue University. In addition to the areas of geographic information science and remote sensing, he also has expertise in geospatial modeling in population and social dynamics, earth system sciences, and emergency preparedness and response management.

Landscan images showing San Francisco population during the day (top) and night (bottom).



CEG Helping Scores of New Companies Grow

The Oak Ridge Center for Entrepreneurial Growth (CEG) is located in the Technology 2020 complex in Oak Ridge's Commerce Park. Its mission is to create an entrepreneurial climate in the state of Tennessee and to improve the dissemination of technology through the creation and support of early-stage companies focused on growth and long-term sustainability. This is accomplished through a developmental program focused on the seven stages of growth and movement through the transitions that all start-up companies must make to reach maturity and success.



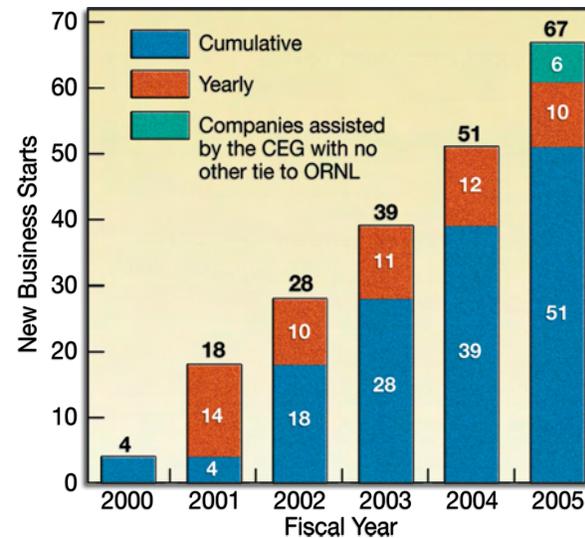
CEG Director Bob Wilson



For the past 10 years, Technology 2020 has worked to establish an unparalleled entrepreneurial support system that will help the Tennessee Valley Corridor become one of America's new technology hot spots. The CEG is working with more than 50 technology-based companies, providing a program of assistance in business development as they progress through the stages of growth.

A significant portion of the CEG support comes from a contract with UT-Battelle, which can require its technology licensees to participate in the CEG Program. Through its program-based business incubator support, the CEG has established a remarkable record of success, evidenced by a number of attempts to reproduce the model in areas around the region.

At year's end, the Oak Ridge CEG had 67 member companies, including 61 that have direct links to the Oak Ridge National Laboratory. More information on the Center for Entrepreneurial growth can be obtained at http://www.tech2020.org/ceg/ceg_battelle/mission.php.



PEOPLE IN TTED NEWS

TTED Adds New Faces, Shows Significant Growth

ORNL's Technology Transfer and Economic Development Directorate experienced significant staff growth and change during the past year. Several new staff members were added, and a group of existing ORNL employees formally transferred to the TTED team.

Two senior managers joined the team in early 2005 – **Casey Porto** as director of technology transfer in January and **Pat Richardson** as director of strategy and business development in March. Porto came to ORNL from Case Western Reserve University, where she spent three years as the associate vice president for technology transfer and executive director of Case Technology Ventures. Prior to her time at Case Western, she served as director of technology transfer at Carnegie Mellon University. Richardson retired in 2002 as vice president of Motorola's Advanced Design and Technology Center and later served as an associate in Emerging Leadership Partners, a Chicago-based consulting group.

Casey Porto



Porto leads TTED's commercialization, sponsored research, and patent agents teams, while Richardson is coordinating market and business intelligence that supports commercialization efforts, building strategic alliances with key private-sector organizations, and integrating TTED's commercialization efforts with the laboratory's research agenda. Their hiring rounded out the comple-

Pat Richardson



tion of a leadership recruitment effort launched in 2004 by TTED Director **Alex Fischer** with the employment of **Tom Ballard**, a retired vice president at the University of Tennessee, as director of economic development and partnerships.

"We have in place a well-experienced leadership team with skills in every area that we cover, whether it is negotiating the best license or building new strategic partnerships," Fischer said. "We were also successful in recruiting several additional key players who strengthen

(PEOPLE IN TTED NEWS continued on page 7)

(FOCUS ON SUCCESS continued from page 5)

SeizAlert Can Help Detect Epileptic Seizures

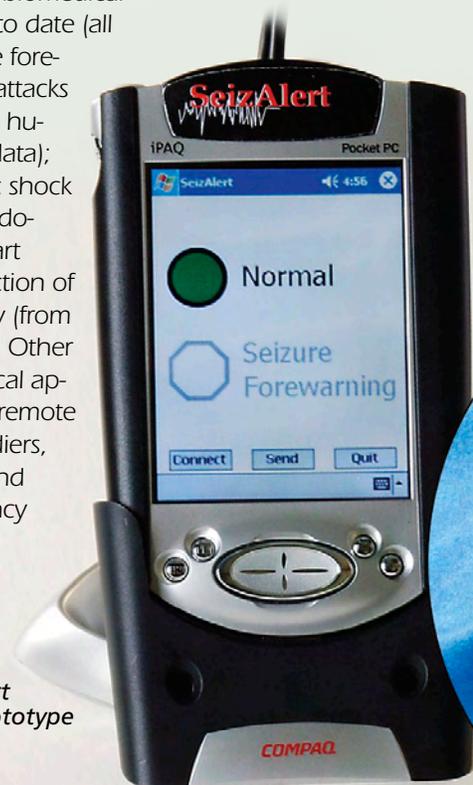


Lee Hively

What if seizures could be reliably predicted 30 minutes in advance? The answer is that safety and quality of life could soar for the nation's nearly one million epilepsy patients who cannot be successfully treated with drugs. The "SeizAlert" technology developed at ORNL promises to do just that.

The patented technology cuts through the chaotic complexity of brain activity to detect oncoming seizures with enough warning time to allow the patient to prepare. Because the algorithm runs on a handheld PDA and uses easily available scalp EEG data, ORNL scientists see a day in the near future when wearable, unobtrusive devices are widely available.

The SeizAlert technology can also forewarn of other biomedical events. Examples to date (all successful) include forewarning of heart attacks and fainting (from human heart-wave data); detection of septic shock due to inhaled endotoxin (from rat heart waves); and detection of breathing difficulty (from pig chest sounds). Other potential biomedical applications include remote monitoring of soldiers, first responders, and others in emergency situations.



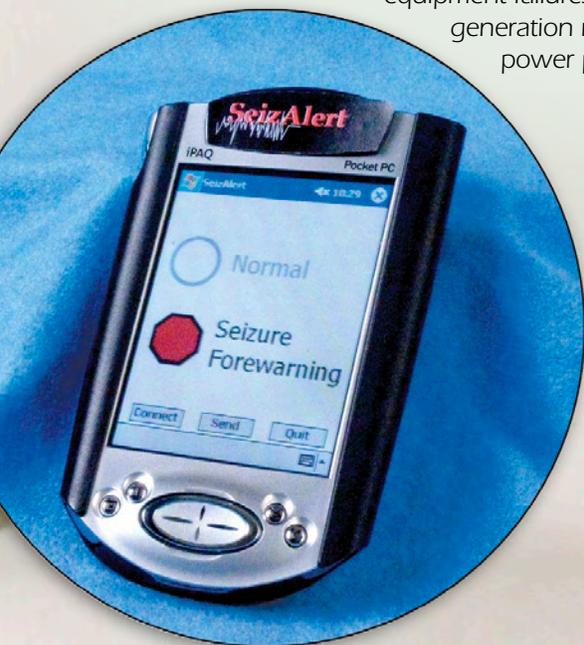
The SeizAlert compact prototype device.

(PEOPLE IN TTED NEWS continued from page 6)

Hercules Development Corporation (HDC) of North Attleboro, Mass., has licensed the SeizAlert technology from ORNL for forewarning of epileptic seizures and cardiac events. HDC has also arranged a clinical validation at the world-famous Cleveland Clinic Foundation via prospective analysis of EEG data. Led by an energetic entrepreneur, HDC previously launched a similar technology for the diagnosis of sleep apnea and looks forward to bringing that experience to the commercialization of SeizAlert.

Lee Hively leads the ORNL team that developed SeizAlert, which received *R&D Magazine's* prestigious R&D 100 Award in recognition of significant technological innovation in 2005. Hively is a senior research staff member in the ORNL Computational Sciences and Engineering Division. He holds undergraduate degrees from Penn State and a master's in physics and a Ph.D. in nuclear engineering from the University of Illinois (Urbana). He joined the ORNL staff in 1984 after stints at General Electric Company and the Western Electric Company's Engineering Research Center. His work has included health and safety research, fusion research program management as a detailee at DOE Headquarters, fusion product physics, and criticality safety and nuclear shielding for nuclear transportation packages.

Hively's present research focuses on nonlinear analysis of time serial data to forewarn of – in addition to epileptic seizures – machine failure, tool wear, and machine tool chatter. He also was principal investigator on a project that is sponsored by DOE's Nuclear Energy Research Initiative to forewarn of equipment failures in next-generation nuclear power plants.



New Faces (cont.)

our commercialization, economic development, and sponsored research activities.”

Brett Bosley, former vice president for marketing and commercial development for Fluorous Technologies in Pittsburgh, filled a commercialization manager vacancy in ORNL's Computing and Computational Services directorate. Prior to joining Fluorous Technologies, Bosley spent eight years at Mine Safety Appliances, where he served as finance manager and later as general manager of MSAs Callery Chemical division.



Brett Bosley

Bill Painter, formerly a senior contracts administrator with ORNL, is now a sponsored programs manager. He worked for the past 12 years at ORNL in procurement, technology transfer, and contracts. Before joining ORNL, he was a supervisor of major subcontracts at Martin Marietta Aerospace in Denver and a subcontract administrator for both the National Renewable Energy Laboratory in Denver and Los Alamos National Laboratory in New Mexico.

Bill Painter



Leigha Stewart, a former branch manager for ORNL Federal Credit Union, joined the Economic Development team as an economic development associate. A graduate of the University of Tennessee with a B.A. in English, Stewart worked for ORNL FCU in a variety of roles for almost 10 years.

As part of a strategic realignment, the patent agents and paralegals who were formerly part of the Legal Directorate also joined TTED. Patent agents **Joe Marasco**, **Jack Spicer**, and **Kirk Wilson** work with laboratory



Leigha Stewart

researchers on invention disclosures and patent filings. Legal assistant **Karen Drew** and paralegal **Elizabeth Warfield** coordinate all of TTED's patent filings and correspond with the U.S. Patent and Trademark Office and outside patent counsel.

(BUILDING A TECHNOLOGY-BASED ECONOMY continued from page 5)

The Technology Transfer Process: From Disclosure to Commercialization

How do inventions – like the hybrid solar lighting system described below – make it from the lab to the marketplace?

When an ORNL employee believes that he or she has produced an invention, the first step is to disclose it. The disclosure can be made on paper using an invention disclosure form, or even verbally to a Technology Transfer and Economic Development patent agent who will record the necessary information, but most inventors use the web-based system IDEAS (<http://ideas.ornl.gov>) to log their inventions.

Once a new invention disclosure has been reviewed and approved by a patent agent for comprehensiveness, it is sent to the appropriate TTED commercialization manager and scheduled for review at an upcoming Invention Disclosure Review Committee (IDRC) meeting. The committee, which meets monthly, consists of representatives

from each ORNL research directorate, as well as the TTED commercialization managers and patent agents.

The IDRC convenes to determine if UT-Battelle will “elect title” to new inventions. TTED elects title to inventions that have commercial potential. The commercialization manager researches the invention prior to the IDRC meeting so that he or she can make a recommendation as to its commercial potential. Only those inventions elected by the IDRC are patented.

Once an invention has been elected by the committee, and the patent filing is under way, the commercialization manager pursues potential licensees. An ideal licensee is an established company that is already selling a product that could benefit from licensing the invention as a product improvement or perhaps as the basis of a new product.

Frequently, the researcher who made the invention is already working with a company via a cooperative research and development agreement or work for others program, and the company is familiar with the invention and interested in licensing it. In this case, the commercialization manager will explore the possibility of licensing the invention to the company. If there is not an existing relationship with a company that is interested in the invention, the commercialization manager will research the best commercial companies in the technology area of the invention and contact their representatives to see if they have an interest in licensing it.

Sometimes the company that expresses interest in the invention is a start-up company – typically one that has been formed recently for the purpose of licensing the new invention as the basis for its



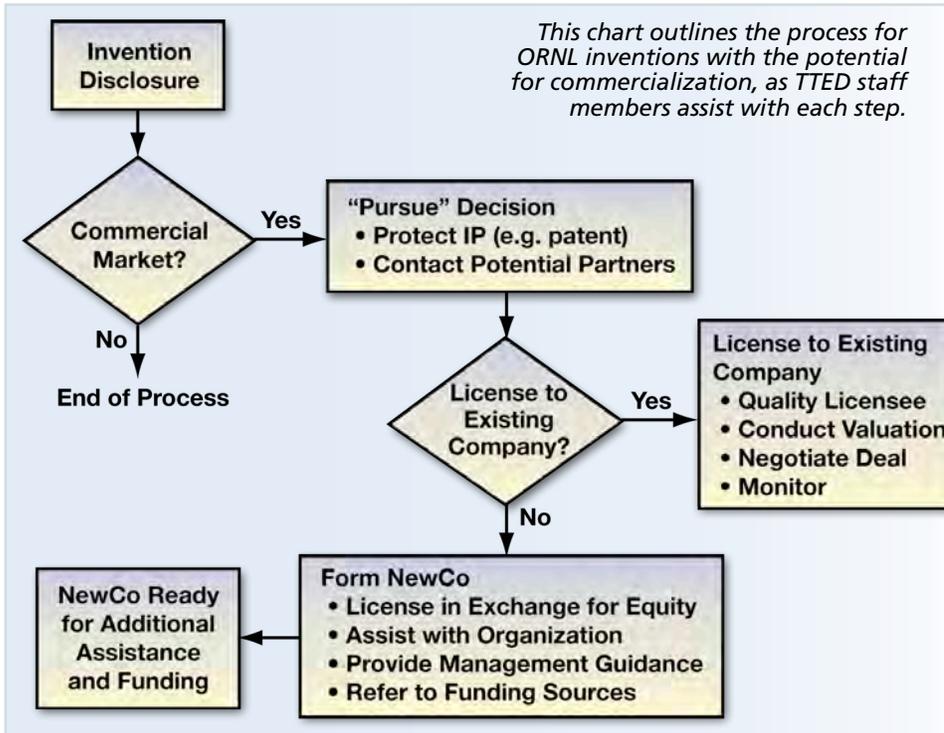
ORNL START-UP COMPANY COMMERCIALIZES HYBRID SOLAR LIGHTING

The innovative hybrid solar lighting technology developed at ORNL literally pipes sunlight into a room, creating the potential for significant energy savings and a better quality of light for commercial buildings.

The Tennessee Valley Authority has sponsored a hybrid lighting system at the American Museum of Science and Energy in Oak Ridge, and ORNL is co-sponsoring systems at the Sacramento Municipal Utility District headquarters and at a recently opened Super Wal-Mart in McKinney, Texas.

Sunlight Direct, an ORNL startup formed to commercialize hybrid solar lighting, has sold another six beta systems to be installed at commercial buildings in Minneapolis, New York, San Diego, and other sites around the country. The company's HSL 3000 product uses a roof-mounted 48-in.-diameter collector and small fiber optics to transfer sunlight to top-floor hybrid fixtures with electric lights that dim in bright sun and intensify as clouds or darkness approach. The result is a dramatic improvement over conventional solar lighting systems. Sunlight Direct, which is located in Oak Ridge, plans a full product launch in 2007.

The patented technology was funded by DOE and TVA in partnership with utility companies, state energy agencies, industry, and universities. DOE's Solar Energy Technologies



the circumstances – to make it a viable entity that would be able to license the ORNL technology as the basis for its business.

Such start-ups often will need help in identifying and hiring experienced business management staff, drafting realistic business plans, and pursuing pathways for financing. TTED refers start-ups’ representatives to the Tech2020 Center for Entrepreneurial Growth, where they can obtain this kind of help. Once a start-up has obtained viable management and put together a plausible business plan, the commercialization manager will be able to discuss a license for the ORNL invention with the company’s representatives.

business. A start-up company can take many forms, but such a venture often is made up of one or two individuals who would like to build a business

around the invention; sometimes those individuals are the inventors themselves. TTED endeavors to work with each start-up – no matter what

Program leads the effort to research, develop, and deploy hybrid lighting and other cost-effective technologies to encourage the use of solar energy. Increased energy costs and provisions in the Energy Policy Act of 2005 that provide tax incentives make the timing ideal for hybrid solar lighting.

The technology reduces energy usage not only for lighting but also for cooling because of the system’s ability to block ultraviolet and infrared heat. Developers note that the savings can be dramatic, especially in areas of the nation blessed with abundant sunshine.

“With 24 percent of the energy use of commercial buildings attributed to artificial lighting, we believe the time is right for this energy-efficient technology to help commercial building owners save energy while also creating jobs and helping the environment,” said Duncan Earl, a co-developer of hybrid solar lighting and chief executive officer for Sunlight Direct.

A study by the Antares Group for the Solar Energy Technologies Program concluded that up to 1 million hybrid solar lighting systems could be in use by 2020, saving ratepayers billions of dollars annually. In addition to the environment benefits and financial incentives – which include a 30 percent

tax credit – proponents of hybrid solar lighting also note that the higher quality of natural light leads to increased productivity and improved sales in retail outlets.

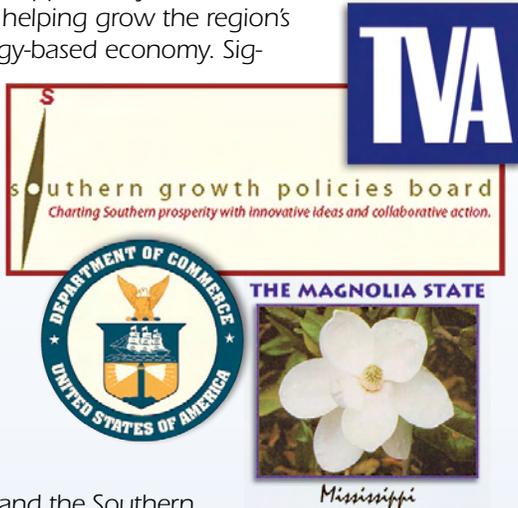
HSL3000 Optical Fibers



IMPACTS IN ECONOMIC DEVELOPMENT

ORNL Advances “Lab of the South” Initiative

ORNL is the only true federal laboratory in the south. As such, it has a unique responsibility, as well as a significant opportunity, to be a true leader in helping grow the region’s technology-based economy. Significant strides were made over the past year in positioning ORNL as the “Lab of the South.”



- ORNL and the Southern Growth Policies Board launched a “Southern Nanotechnology Initiative” (SNI), one of six key components of an all-encompassing “Southern Innovation Initiative” focused on technology-based economic development. During FY05, gubernatorial advisors and leaders of public-private research enterprises in Arkansas, Delaware, Georgia, Louisiana, North Carolina, and Virginia increasingly referred to ORNL as the “hub” of a “hub and spoke” nano initiative and talked about ways their states or organizations could become “spokes” on the network. The SNI will continue to evolve during FY06.
- ORNL and the Tennessee Valley Authority gained traction on a concept that links the south’s disparate automotive research centers into a virtual alliance to leapfrog Michigan’s stranglehold on automotive R&D. As Korean, German, and Japanese automotive manufacturers have built plants in the south, state universities have created automotive research centers (e.g., the Center for Advanced Vehicular Systems at Mississippi State, tied partly to Nissan’s plant in Canton, and the International Center for Automotive Research at Clemson, tied to the BMW facility in Spartanburg). These centers, coupled with the increasing responsibilities placed by original equipment manufacturers on their suppliers, present unique opportunities for ORNL to play a leadership role in

linking automotive-focused researchers in the south in a virtual R&D operation. The fledgling effort will be accelerated during FY06.

- ORNL pulled together representatives of six state industrial extension programs and designed a pilot program to help the U. S. Department of Commerce respond to criticisms about the focus of its Manufacturing Extension Program. The report by the National Academy of Public Administration faulted the MEP Centers for failing to “infuse and diffuse” technologies to existing companies. The “21st Century Manufacturing Technology Initiative” aligned six states – Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Tennessee – in an effort to help existing manufacturers take advantage of the technological expertise of research enterprises like ORNL.
- ORNL and a variety of organizations in Mississippi worked throughout the year to identify opportunities for collaboration. Projects in energy efficiency, high-performance computing and networking, and homeland security were being developed with five Mississippi universities as the fiscal year ended. At least two Mississippi-based companies, one a start-up and the other a \$1.3 billion enterprise, had visited ORNL and identified opportunities for future collaboration.

Major initiatives are located in a 10-state area in the southern United States.



(IMFACTS continued from page 10)

ORNL Markets “Soon-To-Open” User Facilities

One of ORNL’s greatest resources for the nation is the mix of user facilities that range from the High Temperature Materials Laboratory to the High Flux Isotope Reactor. Each user facility provides the business and research communities

the opportunity to access unique facilities and instruments to advance their research. During FY06, two new world-leadership-class user facilities will open – the \$1.4 billion Spallation Neutron Source (SNS) and the \$65 million first DOE nano center. The co-located SNS and Center for Nanophase Materials Sciences (CNMS) represent truly unparalleled capabilities for researchers and companies requiring “best-of-class” expertise in neutron scattering and nanotechnology. The SNS will be the most advanced and powerful pulsed neutron source in the world and will provide research opportunities unavailable elsewhere. Studies conducted at the



The “clean room” nanofabrication research laboratory at the CNMS.

SNS are expected to go beyond basic research and will lead to technological breakthroughs that will benefit not only the scientific community but also industry.

In order to leverage these unique facilities and ORNL’s unparalleled capabilities in nanotechnology research, the laboratory has been marketing the facilities through a

variety of established and newly created initiatives. The Innovation Valley Nano Alliance focused on making those in the Knoxville-Oak Ridge area familiar with and excited about the SNS and CNMS. The broader “Southern Nanotechnology Initiative” expanded the marketing effort to the 13 states that comprise the Southern Growth Policies Board. The latter effort gained momentum with individuals like Mike Cassidy, president of the Georgia Research Alliance, and Bob McMahan, senior advisor for science and technology to the Governor of North Carolina, talking about the critical importance of these facilities to the ability of southern states to build nano enterprises.



ORNL Leads in Creation of Innovation Valley Partners

Access to capital in early stages of development is one of the biggest challenges facing entrepreneurs trying to start new companies in the Knoxville-Oak Ridge Innovation Valley. Addressing this reality became a top priority for ORNL as it sought to bring “stickiness” to its efforts to grow companies locally based on ORNL technologies.

ORNL Director Jeff Wadsworth and Alex Fischer, the laboratory’s director of Technology Transfer and Economic Development, convinced a group of Knoxvilleans to invest more than \$35 million in a local venture capital company that would operate as an affiliate of the \$150 million Battelle Ventures (BV) fund created a year earlier.

As a BV affiliate, Innovation Valley Partners (IVP), as the new fund is called, will invest alongside Battelle Ventures, which provides capital to technology companies at many stages of development, from firms looking for seed or start-up capital through pre-revenue companies raising later rounds of financing. BV focuses particularly on early stage companies in the areas of life sciences, information technology, homeland security, energy, and advanced materials/nanotechnology.

BV’s general partners will manage the IVP fund, with the addition of a partner to be located in the Knoxville-Oak Ridge region.



(IMFACTS continued on page 16)

AWARDS AND REWARDS



UT-BATTELLE AWARDS NIGHT 2005 INVENTOR OF THE YEAR

Amit Goyal, Metals & Ceramics, "For Establishing an Intellectual Property Portfolio That Has Resulted in ORNL's Worldwide Dominance in High-Temperature Superconducting Wire Fabrication."

Finalists: Jack L. Collins, Nuclear Science and Technology, and Peter T. A. Reilly, Chemical Sciences

Amit Goyal (left) with ORNL Deputy Director Jim Roberto.



OTHER HONORS

Mark Reeves, Technology Transfer and Economic Development, elected to two-year term as regional coordinator of the Federal Laboratory Consortium for Technology Transfer Southeast Region

FLC 2005

FEDERAL LABORATORY CONSORTIUM 2005 AWARDS FOR

SOUTHEAST REGION

"Polyelectrolyte Thin-Film Array Slide"

ORNL Environmental Sciences and Technology Transfer and Economic Development; Diversified Biotech
Jizhong Zhou, Xichun Zhou, Russ Miller, and Mark Fins (Diversified Biotech)

"Laser-Based Item Monitoring System"

ORNL Engineering Science and Technology and Technology Transfer and Economic Development
Peter Chiaro, Curt Maxey, Timothy McIntyre, Fred Gibson, Larry Dickens, and John Murphy (DOE)

"SensArray® Integrated Wafer Wireless Microchip Fabrication Monitor" (Honorable Mention)

ORNL Engineering Science and Technology and Technology Transfer and Economic Development
Carl Sohns, Ashok Choudhury, Robert Lauf (consultant), and Don Bible (retired)

"Flame Doctor® Burner-Monitor System"

ORNL Engineering Science and Technology and Technology Transfer and Economic Development; Babcock & Wilcox Company
Charles Finney, Stuart Daw, and Larry Dickens; Timothy Fuller, Thomas Flynn, and Ralph Bailey (Babcock & Wilcox); Jeff Stallings (Electric Power Research Institute)



ORNL R&D 100 WINNERS – 2005

SeizAlert - A Seizure Alerting Device

Computational Sciences and Engineering;
Computer Science and Mathematics;
Life Sciences

Lee M. Hively, Vladimir A. Protopopescu,
Kara L. Kruse, and Nancy B. Munro

SEMCO Revolution™: Integrated, Active-Desiccant Rooftop Air Conditioner

ORNL Engineering Science and
Technology and SEMCO, Inc.
(Columbia, Mo.)

(joint award with SEMCO)

James R. Sand (ORNL) and John C.
Fischer (SEMCO)

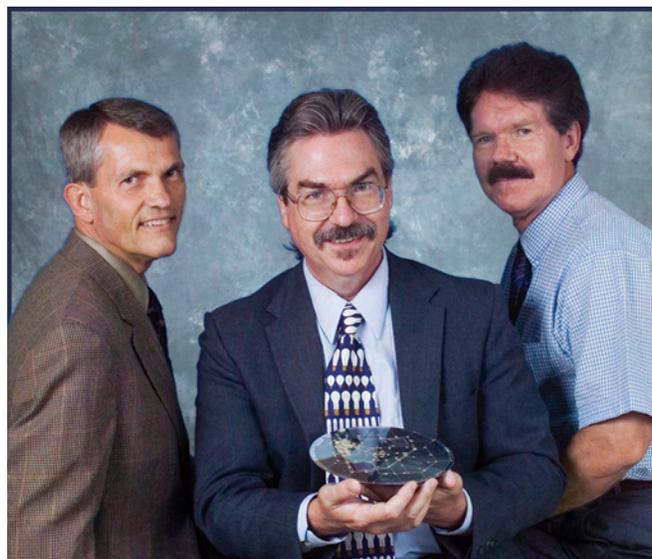
SensArray® INtegrated Wafer

ORNL Engineering Science and
Technology and SensArray
Corporation (Freemont, Calif.)
(joint award with SensArray)
Carl W. Sohns (ORNL),

Robert J. Lauf (consultant),
Don W. Bible (retired), and
Wayne Renken, Earl Jensen,
Brian Paquette, Jeff Parker,
and Jim Barnett (all of
SensArray)

*Left to right, Carl Sohns,
Robert Lauf, and Don Bible*

R&D AWARDS



EXCELLENCE IN TECHNOLOGY TRANSFER

“Cooperative Research and Development Agreement for Development of a New Genera- tion of Gas Centrifuge Plants To Produce Nuclear Fuel for Com- mercial Power Reactors”

(Partnership Award)

ORNL and United States Enrich-
ment Corporation (USEC)

Doug Craig, Ted Fox, John
Shaffer, Steve Hamel, and Larry
Dickens; Dave Mason, Dennis
Scott, Dan Stout, and Dean
Waters (USEC); Jim Reafsnyder
and Emily Schneider (DOE)

*Shown with one of the FLC awards are,
from left to right, Jim Reafsnyder of the
Department of Energy, Mark Reeves,
Ashok Choudhury, Alex Fischer, and
ORNL Associate Director Lee Riedinger.*

NATIONAL

“MicroCAT™: X-ray Micro- Computed Tomography for Biological Research”

ORNL Engineering Science and
Technology and Technology
Commercialization; Phillips
Medical Systems

Shaun Gleason, Michael Paulus,
Derek Austin, Miljko Bobrek, Gary
Alley, Chris McKinney, Kenneth
Tobin, and Michael Licata (Phillips)

“AquaSentinel Real-Time Water Supply Protection Monitor”

ORNL Chemical Sciences, Life
Sciences, Metals and Ceramics,
Craft Resources, and Technology
Commercialization; Department
of Defense Programs; United
Defense, LP

Elias Greenbaum, Miguel Rodriguez,
Charlene Sanders, David Hill,
John Harrell, Richard Stouder,
Mark Reeves, and Steven McCarter

“Miniature Californium-252 Neu- tron Source for Cancer Therapies”

ORNL Metals and Ceramics, Nuclear
Science and Technology, Craft
Resources, and Technology
Commercialization; Isotron
Rodger Martin, Ian Gross, Larry
Pierce, Russ Miller, Mark Reeves,
and Manfred Sandler

“Photo-Molecular Comb Biomo- lecular Separator”

ORNL Life Sciences, Chemical
Sciences, Engineering Science
and Technology, and Technol-
ogy Commercialization; Protein
Discovery, Inc.

Thomas Thundat, Gilbert Brown,
Thomas Ferrell, Robert Warmack,
Russ Miller, Charles Witkowski,
Jay Harkins, Dean Hafeman,
and Kilin Dill

OUR TECHNOLOGIES

Oil Shale Project Looks for Ways To Extract New Energy

With gasoline prices averaging more than two dollars per gallon, the United States is more oil-conscious than ever. DOE manages a wide range of research aimed at assuring a reliable and affordable energy supply for the nation. The resulting world-class expertise and resources have attracted substantial collaborative activity, including the Oil Shale Project at ORNL sponsored by Shell Oil Company.

Requiring the kind of multi-disciplinary approach at which the national laboratories excel, the Oil Shale Project is intended to develop the highly specialized materials needed for the machines that will find and extract deep oil shale. Alloy design, fabrication, compatibility analysis, and mechanical and physical characterization were all under way in 2005. This groundbreaking work spans multiple areas within ORNL, including the High Temperature Materials Laboratory and the Chemical Sciences Division. DOE's Albany Research Center is also part of the team that will help find ways to unlock an estimated two trillion barrels of oil in U.S. shale deposits.

Providing Advanced Communications Capabilities for Law Enforcement

Under a cooperative research and development agreement with Louisiana State University, ORNL will provide technical leadership and services to

upgrade the Law Enforcement Online (LEO) system at the National Center for Security Research and Training.

LEO is a clearinghouse for secure communications and information sharing for law enforcement at all levels of government as they manage public safety and combat terrorism. Oak Ridge scientists will tap into their expertise in specialized cyber security fields like encryption, intrusion detection, communications, and complex systems engineering to get the job done.

Researchers Apply MEMs Technology to IR Imaging

ORNL researchers have applied micro-electro-mechanical (MEMs) technology to uncooled infrared (IR) imaging. Microcantilever IR sensors have specific advantages over solid state detectors and other competing sensor technologies, and they have application in infrared imaging, infrared spectroscopy, and remote temperature detection. The ORNL MEMs technology has been licensed to Multi-Spectral Imaging, Inc. (MSI) of Newark, N.J., which was founded in 2003 to commercialize night vision, infrared, and multispectral (comprising both visible and infrared) imaging systems. A cooperative research and development agreement will facilitate the further development of the licensed technology.

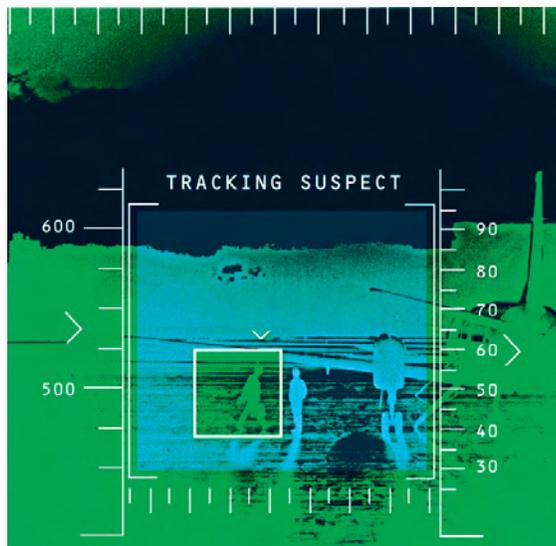
MSI is developing products that have the potential for radical improvements in both price and performance of uncooled infrared focal plane arrays. Such devices are at the heart of key systems used in firefighting, preventive maintenance, homeland security, and military applications, with vast potential in consumer markets,

such as driver vision enhancement as a safety feature in automobiles. The thermo-mechanical technology invented at ORNL can be combined with industry-standard integrated circuit materials and manufacturing to "crack the code" for cost and performance.

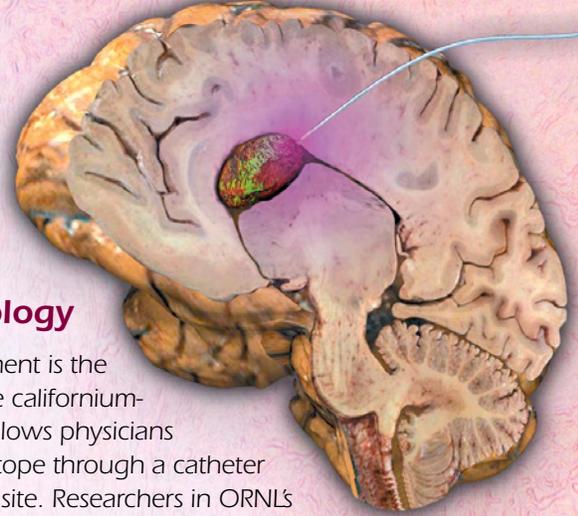
ORNL's research in this area was supported by DOE's Environmental and Biological Sensor Development Program and by the National Science Foundation.



Image courtesy of Multi-Spectral Imaging, Inc.



If inserted in a brain tumor, ORNL's miniature californium-252 neutron source should shrink the cancer and spare healthy cells.



ORNL Licenses Californium-252 Brachytherapy Technology

Patients with cancer may have new hope because of neutron brachytherapy, a treatment enabling physicians to deliver highly concentrated doses of californium-252 neutrons to tumor sites instead of using conventional gamma rays, which often are not as effective at killing cancer cells. The technology has been licensed from ORNL to Isotron of Norcross, Ga.

"This new procedure could be used to more effectively treat thousands of cancer patients, some of whom today have five-year survival rates of less than 1 percent," said Manfred Sandler, a cardiologist and chief executive officer of Isotron. Sandler hopes the treatment is available by early 2007. Cancers most resistant to conventional treatments include brain tumors, melanoma, sarcoma, some types of prostate cancer, locally advanced breast cancer, cervical cancer, and cancer of the head, neck, and mouth.

The key to the treatment is the miniaturization of the californium-252 source, which allows physicians to insert the radioisotope through a catheter directly to the tumor site. Researchers in ORNL's Nuclear Science & Technology Division and at Isotron reduced the diameter of the source by more than half from the previous standard; the length has also been reduced. Although the dimensions are much smaller, the strength of the source is significantly higher, reducing treatment time.

Isotron's method for making the source capsules that are attached to the wire that allows for radioisotope insertion combines the source with a remote automated storage and delivery system using the latest imaging, surgical, and patient-treatment-planning techniques.

Nickel Aluminide Alloys Improve Efficiency in Steel Mills

Furnace rolls in steel heat treating facilities are worn or damaged at the surface due to repeated exposure to high temperatures and stresses. Roll maintenance and replacement are expensive because of down time and the effects on products' surface quality. Nickel aluminide (Ni3Al), a heat-resistant alloy developed at ORNL, has been shown to dramatically improve efficiency and operation of heat treating facilities in steel mills.

A license agreement between ORNL and Duraloy, an industrial casting firm in Scottdale, Pa., enables Duraloy to manufacture and sell centrifugally cast nickel aluminide rolls. The company plans to market the rolls to steel mills and heat treating facilities.

"The enhanced properties of nickel aluminide for steel reheat furnace rolls are leading to greatly improved furnace systems," said Roman Pankiw, Duraloy vice president of Engineering and Sales. "Higher yields, reduced energy consumption, and increased product quality are among the benefits mills can expect from this technology."

Duraloy already has built, installed, and tested 115 nickel aluminide rolls at the ISG steel plant in Burns Harbor, Ind.

Using the rolls to process more than 300,000 tons of steel, the plant eliminated 85 furnace shutdowns, increased uptime 25 percent, and cut natural gas consumption 35 percent. Duraloy is producing more than 100 rolls for a heat treating furnace under construction for IPSCO Steel in Alabama.

Development of the alloy at ORNL was a coordinated effort by DOE's offices of Science, Fossil Energy, and Energy Efficiency and Renewable Energy. "Our

research team looked at atomistic modeling and characterization, microstructure, and composition to improve the alloy," said Peter Angelini, a program manager at ORNL. "Industrial collaborators tested and evaluated nickel aluminide components and helped develop new melting, casting, and welding processes. This was a true joint effort that will help save energy and improve production in the steel industry."



Centrifugally cast nickel aluminide furnace rolls. Image courtesy of Industrial Heating

(IMPACTS IN TECHNOLOGY TRANSFER continued from page 10)

ORNL Partner Technology 2020 Program Receives International Honor

ORNL's key external partner in the area of new business start-ups is Technology 2020, a not-for-profit organization created to champion and support technology-focused entrepreneurial activities in the area.

During the five years that UT-Battelle has managed ORNL, the partnership has grown significantly as Technology 2020 established a Center for Entrepreneurial Growth to advise ORNL licensees and developed a robust mix of investment programs under the "Access to Capital Initiatives" banner.

The three-part funding initiative received the 2005 Incubator Innovation Award at the National Business Incubation Association's 19th International Conference on Business Incubation in Baltimore. The award recognizes an innovation that benefits incubator client companies by either going beyond normal incubation services or introducing a creative way to implement an old idea.

Technology 2020's "Access to Capital Initiatives" program helps Technology 2020 clients, including ORNL

licensees, access the funding they need to grow more quickly. The program has three major components: the Tennessee Valley Venture



Forum, an annual event where up to 20 companies annually present their business plans to potential

investors; Southeast Community Capital, a Technology 2020 subsidiary that has provided loans to nearly 200 Tennessee small businesses as a Community Development Financial Institution; and Southern Appalachian Fund, a \$12.5 million New Markets Venture Capital Company serving Tennessee, Kentucky, and the Appalachian counties of Mississippi, Alabama, and Georgia.



• MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY •

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