Technology Transfer 2005–2006 Progress Report

Innovation

Los Alamos
NATIONAL LABORATORY
EST. 1943

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Credits

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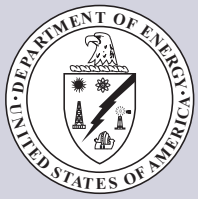

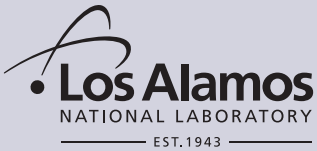

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Los Alamos National Laboratory

Honoring the End of an Era

From its origins in 1943 as the secret Manhattan Project laboratory, Los Alamos National Laboratory has consistently attracted scientists from around the world and applied their energy and creativity to solving some of the most challenging problems facing both the nation and the planet. As one of the U.S. Department of Energy's oldest multi-program, multi-disciplinary research laboratories, Los Alamos has prided itself on a legacy of having the best people doing the best science to solve problems of global importance.

A vital component of the Laboratory's ability to remain at the leading edge of discovery in science and technology is ongoing collaborations with industry. Through multiple partnerships with industry, academia, and other government agencies, the Laboratory maintains an aggressive, ongoing program to transfer the Laboratory's cutting-edge technologies to the private sector. Laboratory industrial partnerships help bolster the economy and enhance America's global competitiveness.

As the largest employer in northern New Mexico, the Laboratory employs over 13,000 people with an annual budget of $2.1 billion. Approximately one-third of the Laboratory's technical staff members are physicists, one-fourth are engineers, one-sixth are chemists and materials scientists, and the remainder work in mathematics and computational science, biological science, geoscience, and other scientific disciplines. Professional scientists and students from all over the world routinely visit the Laboratory to participate in scientific projects.

Throughout 2005, the University of California, the sole manager of the Laboratory since its founding, prepared to transition the Laboratory to a new type of management partnership for the first time in its 63-year history. As one member of the new, four-member management partnership, the UC tradition of world-class science will continue to be key to the Laboratory's creativity and innovation, sustaining a rich variety of research programs that directly and indirectly support the Laboratory's basic mission of maintaining the safety, security, and reliability of the nation's nuclear deterrent without the need to return to testing. As a national research laboratory, success depends on Los Alamos remaining at the forefront of multi-disciplinary and robust science.

New Frontiers

On June 1, 2006, Los Alamos National Laboratory transitioned from being managed solely by the University of California to being managed by a new corporate entity, Los Alamos National Security, LLC, a partnership established for the purpose of managing Los Alamos for the Department of Energy's National Nuclear Security Administration. LANS comprises a team composed of Bechtel National, the University of California, BWX Technologies, and Washington Group International.

Bechtel is the leading project management contractor in the United States, UC is the world's largest academic research institution, BWX Technologies is the top DOE nuclear facilities contractor, and Washington Group International manages and operates three of DOE's safest sites. By integrating top science and scholarship with leadership, innovation, and best business practices, LANS promises to foster the secure, efficient environment necessary for new scientific breakthroughs and delivery of national security milestones.

The LANS management structure for Los Alamos is a fully integrated, efficient, and accountable organization with clear lines of responsibility and authority. All levels of the organization share responsibility for helping the Laboratory accomplish its missions and for maintaining it as a source of pride and confidence for the American people.

As the guardian of America's freedom and security from the birth of the atomic age until the present, Los Alamos will continue to enhance national security by ensuring the safety and reliability of the U.S. nuclear stockpile, developing technologies to reduce threats from weapons of mass destruction, and solving problems related to energy, environment, infrastructure, health and global security concerns. The LANS highly skilled management team of nuclear experts and industry leaders is focused on the mission of making Los Alamos the premier national security laboratory for the 21st century.

Introductory Messages

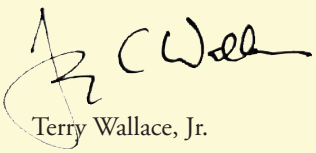
Meeting Our Future Challenges from Science to Commercialization

In June 2006, we gathered our staff into a new organization under Los Alamos National Security, LLC, to better support our missions. As the nation's premier national security science Laboratory, we apply our unique capabilities to solve the toughest challenges facing our nation and our world. Keeping the Laboratory at the leading edge of new science, technology, and engineering requires increasing nimbleness, flexible alliances with other government labs, academia, and industry, and better ways of quickly turning the best ideas into new technologies. Technology transfer is a mission area that combines these challenges, and the Technology Transfer Division is the focal point for the Laboratory in commercializing our ideas together with our partners. Such commercialization efforts reflect significant investment by many government agencies ranging from the National Nuclear Security Administration Defense Programs and various Department of Energy program offices such as Fossil Energy, Nuclear Energy, and Energy Efficiency to the National Science Foundation and the National Institutes of Health.

The Laboratory's greatest strength is its intellectual capital: the staff and their ideas. Intellectual property management is the Laboratory's path to capture these ideas, convert them into issued patents and copyrights, and leverage these assets toward making the Laboratory stronger and more competitive. Effective intellectual property management supports the Laboratory's core capabilities and programmatic funding and enhances the U.S. economy. For example, a portfolio of patents for accurate radiation monitoring has been commercialized in devices manufactured by several U.S. companies and deployed worldwide on behalf of the International Atomic Energy Agency. In addition to creating important new products for national security, this has resulted in $6 million in additional programmatic funding for the Laboratory's Nuclear Nonproliferation Division. This is just one example of how intellectual property management is central to the Laboratory's industry partnerships, from strategic alliances to regional startup companies.

Technology transfer will also be an important component of success in meeting our grand challenges for science. High-performance computing is being applied to model complex phenomena and interactions at scales from atoms to oceans. Our ability to apply computing to the most challenging problems in biotechnology, sensing, and materials properties will continue to lead to important applications. Addressing our future energy security will continue to be one of our most urgent national security needs. Applying our expertise in climate change science to address global warming will require creative new partnerships with global technology leaders in government and industry. These are all areas that will dramatically impact people's lives. Closer to home, LANS, LLC, has made substantial commitments to grow the ecosystem of technology companies in our region, an important part of our future recruitment and retention strategy as well as our corporate citizenship. The creation of new companies from Laboratory technologies is critical to strengthening our regional economy, and TT Division is at the forefront of this effort.

Despite the many challenges facing our nation and our Laboratory in a time of change, I remain deeply optimistic that the staff of the Laboratory will respond with continued vitality and technology leadership. Our solutions of tomorrow will amaze us all.



Terry Wallace, Jr.
Principal Associate Director for Science, Technology, and Engineering

Maintaining Innovation at Los Alamos National Laboratory

Recently the national challenge to maintain leadership in innovation has been highlighted in reports from the National Academy of Sciences, Congress, and many media articles. Managing innovation is a hot topic among research and development leaders everywhere. This challenge is critical for government labs as the competition in emerging technology, scientific talent, and funding continues to increase worldwide, while threats to our national security also multiply.

At Los Alamos National Laboratory, the Technology Transfer Division has the most innovative program for technology transfer among the Department of Energy national laboratories. In its broadest definition, innovation is "the creation of something new." TT Division facilitates new technology creation from Laboratory inventors into products with commercial partners. The statistics for the past two fiscal years, 2005 and 2006, demonstrate that Los Alamos continues to be a leader in partnering with industry to accelerate the commercialization of the most diverse portfolio of science programs in the complex. Over the two-year period from October 2004 through September 2006 the division's total revenues from all sources (licenses, Work for Others, Cooperative Research and Development Agreement income) were up almost eight percent over FY 2004 totals, with the most significant increase coming from the revenue generated through our CRADA activities with our strategic partners. The Laboratory saw a remarkable 212 percent increase in this area of growing importance. Licensing income continued its annual increase reaching an all time high in FY 2005 of over $1.8 million before taking a breather in FY 2006 and settling in at $1.4 million. Equally important as the raw numbers, the Laboratory continued to lead in leveraging strategic partnerships to tackle important national challenges, such as energy security (with the Alliance for Advanced Energy Solutions with Chevron Corporation) and simulation and modeling (with Procter & Gamble). These successes enhance the impact of the Laboratory's work on the regional and global economies.

We continue to lead in exploring new ways to generate entrepreneurial activities from Laboratory programs. Our Technology Maturation Fund has shown an impressive return on investment by attracting new funds into the Laboratory and creating new startup businesses in the region. As highlighted in this report, this fund has served as a model for similar programs at other national laboratories. Our entrepreneurial training and mentoring programs continue to be an important means of professional development for Laboratory staff. Our Visiting Entrepreneur program (launched in 2005) has catalyzed several new internal collaborations and spinoff ventures that will strengthen Laboratory programs. Our future goals in TT Division are to increase the level of engagement with Laboratory staff to strengthen our research and development capabilities and to increase recognition nationally for the impressive technology impact of the Laboratory's inventive staff.

Under new Laboratory management, TT Division is poised to continue our positive momentum by increasing our partnering activities, renewing the Laboratory's commitment to intellectual property as a vital part of science and technology excellence, and continuing to adopt innovative approaches to technology commercialization.

I want to thank the staff of TT Division, our inventive technical staff, and our collaborators and partners who have contributed their passion to making this an exciting and challenging time.

Duncan McBranch
Technology Transfer Division Leader

Technology Transfer Turns 25

25 Years of Technology Transfer

THE United States government spends over $80 billion per year on research and development (R&D) to meet mission requirements of federal departments and agencies. While much of this investment has been in defense, government R&D has led to new products and processes for the commercial marketplace including but not limited to microwaves, computers, new drugs, and alternative energy sources. Despite the potential, the level of commercialization results of federally funded R&D remained low through the 1980s. Early in the decade, two very significant acts were passed in Congress to encourage better transfer of dual-benefit technologies to the commercial sector—the Bayh-Dole Act (Public Law 98-620) and the Stevenson-Wydler Technology Innovation Act (Public Law 96-480).

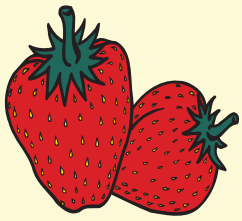
The Bayh-Dole and Stevenson-Wydler Acts were intended to increase the rate at which new technologies are commercialized and to facilitate inventor involvement in technology development—requiring research institutions to take an active approach to the protection and management of their innovations. The Bayh-Dole Act allowed universities, nonprofit institutions, and small businesses to patent research discoveries partially financed with federal funds. The Stevenson-Wydler Act allowed federal laboratories to issue exclusive licenses for patents of their inventions.

The Effect of Bayh-Dole for Academia

The Bayh-Dole and the Stevenson-Wydler Acts and subsequent amendments helped turn a generation of research into useful products and services for the public. According to the latest data available from the Association of University Technology Managers, statistics reveal that technology transfer has had many positive impacts on academic research, economic development, and the public. Key statistics from the 2005 AUTM Licensing Survey include the following:

- The U.S. Patent and Trademark Office issued more than 3,200 U.S. patents in fiscal year 2005 to universities responding to the survey; less than 250 were issued to universities in 1980.
- Since 1998, 3,641 new products based on university or nonprofit research results were introduced.

UC Tops the List for University Patents*



Until June 2006, the University of California as operator of Los Alamos National Laboratory retained rights to the intellectual property (patents and copyrights) produced by Los Alamos inventors. The University of California has a long history of creating commercial value from its innovations.

Crunching into the juicy sweetness of a strawberry is a natural treat, but if you are eating a Camarosa strawberry, it is also a treat of science. Patented by the University of California, Davis in 1992, the Camarosa strawberry is one of many products licensed by UC for commercial cultivation.

In 2005, the UC system received 390 patents—nearly three times the number received by the second-ranked Massachusetts Institute of Technology. According to the U.S. Patent and Trademark Office, the UC system led the nation's universities in number of patents for the 12th consecutive year in 2005. The UC system's invention portfolio comprises more than 6,600 active inventions. Licensing revenues, which is the income from UC agreements with corporations, totaled $92.9 million in 2005. A portion of the licensing revenues are reinvested into research and education on the UC campuses.

Under LANS, the Laboratory will continue its tradition of commercially relevant innovation. The University of California remains an important component of the Laboratory's intellectual property management strategy as one of four partners (Bechtel, UC, BWX Technologies, and Washington Group International) who came together as Los Alamos National Security, LLC, to manage Los Alamos National Laboratory.

*Update of story from *The California Aggie*, by Melissa Taddei, April 4, 2005.

- Since 1980, U.S. universities, hospitals and research institutes have spun out over 5,000 companies based on licenses from those institutions. The majority of these companies are still operating.
- In 2005, 4,932 new licenses were signed.

The Effects of Bayh-Dole and Stevenson-Wydler on Los Alamos

At Los Alamos our efforts to promote technology transfer have enabled the development of new industries such as fuel cells and superconductivity; new capabilities such as flow cytometry and supercomputing; and new products such as electrochromic mirrors and more efficient catalytic converters. In addition, the Laboratory's technology transfer activities have attracted funds to support further R&D and generated revenues that are distributed, in accordance with the Laboratory's license distribution policy, as personal income to inventors. Specifically, Laboratory technology transfer efforts since 1982 have created

- 1,151 Los Alamos patents;
- 265 copyrights asserted;
- $13 million in license income;
- $282 million in funds-in from industrial companies for collaborative research projects;
- $19.7 million in funds into the Laboratory for the use of our unique User Facilities; and
- Over 100 new companies based on Laboratory technology or expertise.

In addition, Los Alamos National Security, LLC (and previously UC), currently holds equity in four companies that have licensed technology from the Laboratory and is in the process of taking equity in nine other startups.

Since 1980, 5,171 new spinoffs . . . is more than one company every two days during 9,133 days of innovation.

AUTM, 2006

Protecting Our Intellectual Property

Thomas Edison, Enrico Fermi, Henry Ford, and Ernest O. Lawrence have one important thing in common—patented intellectual property.

Protecting intellectual property is vital to any research institution—especially if it wants the results of its R&D to have an impact on society and the world. Patents and copyrights used by others are a direct measure of the value of an institution's science and technology. Without patent- or copyright-protected technologies, Los Alamos could not transfer its technologies to companies for commercial applications or form partnerships with private industry to bring private funding into the Laboratory for additional R&D.

In its bid to DOE to operate Los Alamos, LANS, LLC, included a plan to increase the visibility and importance of intellectual property management at the Laboratory. In response, TT Division established an Intellectual Property Management program. The IPM team has launched several projects to meet its overall goals of increasing Laboratory staff awareness about the importance of intellectual property including streamlining invention disclosure intake and review processes. During FY 2006, the team also began development of a policy and education program to improve the quality of patents and copyrights generated by Laboratory R&D.

Collaborating with the Laboratory Counsel's Intellectual Property Practice Group, the IPM team is working to integrate and unify intellectual property processes and policies under LANS. Development of a common electronic enterprise system for tracking all intellectual property actions including invention and software disclosures, patents and patent applications, licenses and royalties, Cooperative Research and Development Agreements, and Work for Others Agreements is supporting this integration effort. By improving processes and policies for handling intellectual property, TT Division serves the Laboratory in two ways: We help grow Laboratory programs by leveraging our intellectual property; and we enhance technology commercialization opportunities through business intelligence and competitive landscape analysis.

One of the Laboratory's greatest assets is its intellectual capital. Protected intellectual capital helps Los Alamos be a desirable partner for collaborations with private industry.

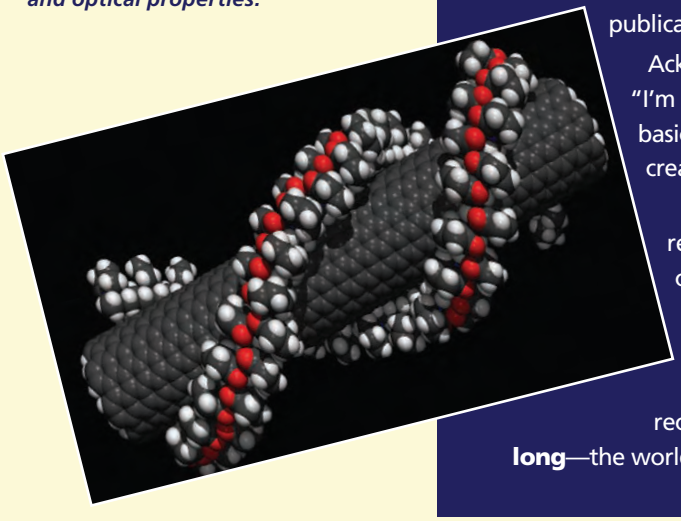
Introduction

Enhancing the Laboratory Mission

The Los Alamos National Laboratory Technology Transfer Division enhances the Laboratory's missions by partnering with industry, by accelerating the creation of products from Los Alamos discoveries, and by fostering a regional entrepreneurial economy. As the primary bridge between the nation's leading science laboratory and the commercial world, our responsibilities are more varied than any other comparable technology commercialization organization among our sister labs within the Department of Energy complex. At Los Alamos, TT Division's responsibilities include the following:

- Implementing and managing a broad variety of partnership, commercialization, and licensing mechanisms and programs;
- Managing the Laboratory's intellectual property (invention disclosures, patents, and copyrights);
- Developing productive strategic partnerships with industry and academia;
- Promoting and nurturing a sustainable, technology-focused, regional economy;
- Marketing Laboratory technologies and industrial partnership programs; and
- Educating Laboratory staff about technology transfer processes through commercialization and entrepreneurial training programs.

In order to meet the needs of our diverse customer base and manage our many responsibilities effectively, TT Division strives to foster a culture that rewards innovation. Innovations such as our Technology Maturation investments, the Industrial Fellows program, Visiting Entrepreneurs, and our MBA Summer Internships have been emulated throughout the DOE complex. Our efforts to stimulate both regional economic development and national competitiveness have resulted in numerous awards recognizing our innovative technical staff and the technologies they have helped us transfer to industry. Our ongoing goal as an organization is to continue to forge successful partnerships with the private sector to bring advanced technical solutions to global challenges.



This image depicts polymer wrapping of a carbon nanotube as a solubilization method. Polymer wrapping is a way to functionalize nanotubes while retaining electronic and optical properties.

Los Alamos Technologies Win Nano 50 Awards

Two technologies developed by Los Alamos National Laboratory scientists have been named winners in the 2005 Nano 50™ Award competition by *Nanotech Briefs,* a digital publication from the publishers of *NASA Tech Briefs*.

Acknowledging the awards, former Laboratory Director Bob Kukuck said, "I'm proud of the fact that Los Alamos scientists are a driving force behind the basic research required to produce nanotechnologies. Their collective work and creative genius are helping to ensure America's future."

Among the winners of the 2005 Nano 50 awards, which are designed to recognize "the 50 best of the best" in nanotechnology, are the development of four-centimeter-long carbon nanotubes and the graphite lattice production technology.

Laboratory scientist Lianxi Zheng, a member of Yuntian Zhu's carbon nanotube team in the Materials Science and Technology Division, recently synthesized **single-walled carbon nanotubes four centimeters long**—the world's longest—using catalytic chemical vapor deposition from ethanol.

CleanAIR Systems Inc.

Steel fabrication of a filter/silencer unit at the CleanAIR facility. SCR ceramic substrates used in the manufacturing of the ENDURE™ SCR Catalyst.

Regional economic growth and development are key TT Division goals. Forging partnerships with local companies not only enables the development of Laboratory technologies for commercial use but also creates jobs and grows revenue in the region. Santa Fe-based CleanAIR Systems Inc. has been making big impressions on domestic and foreign customers as well as growing the northern New Mexico economy.

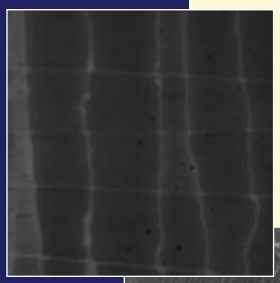
CleanAIR has been delivering exactly what its name says since its establishment in 1993—offering complete emission control technologies to companies worldwide. CleanAIR designs and produces emissions control systems for on- and off-road vehicles, machinery, and stationary generators. The company expected to make $5 million in revenues in 2006, 30 percent more than 2005 and more than double its reported revenue for 2000.

In 2006, CleanAIR signed an Exclusive License Option Agreement with Los Alamos National Laboratory to commercialize a technology that eliminates nitrogen oxides from car exhaust. This technology, called ENDURE™ SCR Catalyst by CleanAIR, operates over a full range of temperatures (from 150° Celsius to more than 500° Celsius) and converts between 90 and 98 percent of nitrogen oxides. While Los Alamos scientists invented the technology for vehicles, CleanAIR is developing it for use in a variety of applications, including large diesel vehicles, power plants, and lean burn engines.

"This is one of the few companies that does manufacturing here [Santa Fe] with high-paying jobs and good benefits," said Craig Fiels, the city's special projects administrator, in an article about CleanAIR in *New Mexico Business Weekly.* "It's also a clean industry, not a smoke-stack company. We want them to stay."

With growing concern about global warming, the company's largest number of established accounts are in California and Sweden due to strict emission standards. With a new building and additional technologies to market, CleanAIR intends to double its 25-employee workforce by mid to late 2008.

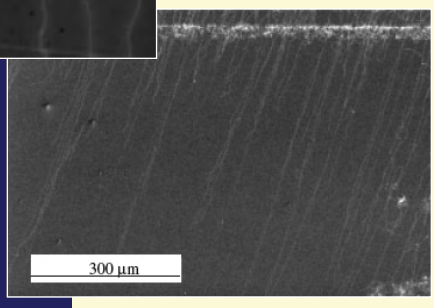
Carbon nanotubes have a number of potential uses. Spun into fibers or yarns, they would be more than 10 times stronger than any currently known structural material. Used in lightweight, high-strength applications, metallic nanotubes could be used in electro-mechanical systems such as microelectric motors, diodes, and as wires in microelectronic devices.



Nanotube grids made from ultra-long nanotubes are good for sensors and electronics applications.

The **graphite lattice production technology** allows complex graphitic structures of virtually any design to be grown chemically, inexpensively with simple equipment, and at relatively low temperatures using a process developed by Jonathan Phillips of the Laboratory's Engineering Sciences and Applications Division. These graphite structures could be used for heat spreaders and integrated circuit packages, as well as for elements in fuel cells, or as key parts of nanoscale circuits. The graphite structures also could be used to create strong and light composites with the potential to replace carbon fibers in structural materials already employed in applications ranging from golf clubs to airplanes.

A complete list of the Nano 50 winners is available at www.nanotechbriefs.com.



Los Alamos can make single-walled carbon nanotubes up to 4 centimeters in length.

Fiscal Year 2005–2006 Performance

Over the past several years, TT Division has served thousands of customers, both internal and external. Our internal customers include individual researchers, technical divisions, and program offices. Our external customers include universities and companies, large and small.

Supplying power to the world's strongest long-pulse magnet at Los Alamos' National High Magnetic Field Laboratory is a 1.4-billion-watt generator, itself the largest among magnetic power sources. It can produce enough energy to power the entire state of New Mexico.

Partnerships with Universities

During 2005 and 2006, TT Division worked with nearly 100 universities on a variety of important collaborations ranging from the design of proteins that can rapidly eliminate bacteria from infected sites in plants and humans (chimeric antimicrobial proteins) to probing the heliosphere. Universities are a key conduit through which the Laboratory gains access to the new science and technology that enhance its programmatic capabilities. In turn, by working with Los Alamos, universities gain access to unique facilities that enable them to carry out vital research and provide training grounds for new generations of scientists. For example, the National High Magnetic Field Laboratory partnership with Florida State University has resulted in $34.8 million in Laboratory funding since the beginning of FY 2001. The Los Alamos campus is one of three that make up the NHMFL; the other two are located in Florida. The NHMFL supports a user facility open to all qualified users, develops magnet technology in association with the private sector, and advances science and technology opportunities using high magnetic fields. The NHMFL-Los Alamos hosts hundreds of scientists a year who visit the magnet lab to conduct measurements in the pulsed magnetic fields. As one of the most scientifically productive high-magnetic field labs in the world, an impressive and ever growing list of papers published in the most respected journals can be attributed to work accomplished in this facility.

LANSCE-Isotope Production Facility hot cell used for production of radioisotopes.

New Mexico Center for Isotopes in Medicine

The National Academy of Sciences estimates that more than 36,000 imaging procedures are performed daily in U.S. departments of nuclear medicine. Radiopharmacists prepare (formulate) and deliver radioactive pharmaceuticals with incorporated isotopes that spontaneously emit radiation for use in these nuclear medicine scans for the diagnosis, investigation, and treatment of diseases such as cancer and heart disease.

While Los Alamos National Laboratory has been an unofficial isotopes research partner with universities all over New Mexico for decades, in March 2005, the Laboratory and the University of New Mexico joined with other universities and private partners to develop the New Mexico Center for Isotopes in Medicine. According to Los Alamos Chemistry Division Leader Gene Peterson, the NMCIM is "a formal collaboration to develop new end uses for isotopes and radiopharmaceuticals to improve healthcare in the state and the nation." As a critical member of the partnership, the Chemistry Division's Isotope Production Facility uses a 100-megavolt proton beam extracted from the Los Alamos Neutron Science Center (LANSCE) accelerator to produce radioactive materials for medicine and scientific research.

NMCIM is a result of a more than 25-year research and education collaboration between the UNM College of Pharmacy and Los Alamos. Other partners include the UNM Cancer Research and Treatment Center, the UNM School of Medicine, and the Lovelace Respiratory Research Institute. Funding provided by the New Mexico Technology Research Collaborative is enabling NMCIM

to develop commercial partnerships with companies such as GE Healthcare, which is collaborating with UNM and Los Alamos to develop new imaging agents. The state-funded program was established to aid the creation and expansion of a technology-based economy by encouraging collaboration between the state's research universities and its national laboratories. State support of TRC is leveraged with outside investments, including private company, foreign, and other government sources to support projects with strong commercial potential.

Partnerships with Industry

TT Division executed over 60 sponsored research agreements with large companies on behalf of the Laboratory in 2006. While they have different missions, large companies and the Laboratory often face similar problems. TT Division works to foster strategic partnerships that lead to new science and technology solutions for both parties. The Laboratory's partnerships with industry, built on common goals and shared risk, are collaborations that help us achieve our Laboratory mission and enhance our critical capabilities while simultaneously addressing significant U.S. and global technical challenges. For example, in 2005, Los Alamos and Chevron Corporation established the Alliance for Advanced Energy Solutions with Chevron's Energy Technology Company. This rapidly growing, multi-division, multi-program-office collaboration uses an innovative approach to enhance the Laboratory's mission to develop and apply science and technology to solve national problems in energy security. The Alliance also provides an efficient means to develop, demonstrate, and deploy new technologies that can dramatically enhance industry operations in the near term. Chevron's business model will lead to further deployment to the entire energy industry. Currently, Los Alamos and Chevron are jointly researching three projects. Two have advanced sufficiently to be in scaled-up testing in Chevron well fields. These are INFICOMM, a Los Alamos wireless technology for downhole communications, and TAP (trapped annular pressure), a new material that can eliminate catastrophic failure in deep-sea wells. TT Division, together with the Office of Energy and Environment Initiatives, initiated a new program under the Alliance Cooperative Research and Development Agreement for research on oil shale recovery.

Newest Radiation Detectors in Development

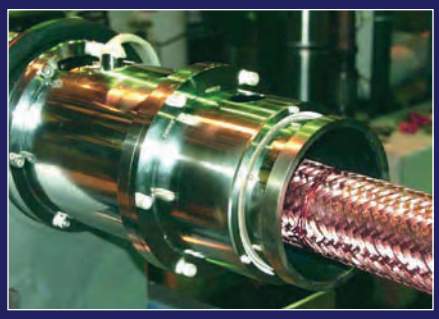
Development and commercialization of a new generation of multiplicity shift registers—devices used to detect plutonium and other radioactive materials—will soon be underway. Under a CRADA negotiated during 2006, Los Alamos National Laboratory and Canberra Albuquerque Inc. will develop the new handheld devices, which have the potential for use in homeland security applications domestically and abroad.

These instruments count and analyze pulse streams generated by neutron detectors to quantify radioactive materials. They are currently used by the International Atomic Energy Agency to ensure that radioactive materials are not lost, stolen, or used for military purposes. According to Los Alamos researcher and principal investigator Matt Newell, the new multiplicity shift registers are needed because existing devices are nearly 10 years old and becoming incompatible with other detection technology used by the IAEA.

Under the CRADA agreement, Canberra will fund development of a new multiplicity shift register that can continuously store neutron measurements automatically for use in remote or unattended operations. In addition, the company will validate the use of a handheld, battery-operated, multiplicity shift register already developed by Newell and his team. Both devices will be faster, easier to use, compatible with new measurement instrumentation, and designed in accordance with IAEA guidelines. Following testing, Canberra Albuquerque will manufacture the instruments at its Albuquerque facilities.

"Our collaboration with Los Alamos National Laboratory is vital to Canberra's work extending the boundaries of neutron-counting technology," said Dr. Markku Koskelo, Vice President of Special Projects. "Together we have built a roadmap for the next generation of shift registers."

Los Alamos and SuperPower Inc. Collaborate on More Reliable Electric Power Transmission



SuperPower Inc., a wholly owned subsidiary of Intermagnetics General Corporation, and Los Alamos National Laboratory have been working together on high-temperature superconducting (HTS) wire for more than six years. In 2006 the partners reached a significant milestone.

SuperPower, which develops state-of-the-art, second-generation HTS wire and electric power components, began collaborating with Los Alamos when the first CRADA, originally with Intermagnetics, was executed for development of a coated conductor fabrication process. This work resulted in the production of first-generation HTS wire.

In 2006, using the first-generation HTS wire, SuperPower implemented its first commercial in-grid demonstration of the technology in Albany County, N.Y., connecting two power substations by running a 350-meter superconducting wire. SuperPower also manufactured enough second-generation HTS wire to replace a 30-meter section of the 350 meters in Albany County to be energized in fall 2007.

With the formation of SuperPower, Intermagnetics made a significant investment in the scale up of second-generation conductors. The DOE Office of Electricity Delivery and Energy Reliability has invested significantly in developing new processes for manufacturing HTS wire and new products using the wire in areas in which performance is high enough and cost low enough to enable near-term military and other future commercial applications. Coated conductors may eventually be used in electric power applications such as magnets, motors, transformers and power transmission lines.

Under a new CRADA and pending license agreements for a portfolio of patents related to the second-generation wire, Los Alamos continues to work with SuperPower on improvements to transfer the latest research to enable broader commercial viability of the material.

"This technology has enabled SuperPower to gain a significant edge in developing our second-generation HTS wire and to attain commercial-scale manufacturing far ahead of our competitors in this field," said Philip J. Pellegrino, president of SuperPower.

Plasma Assisted Engines Fuel Efficient, Cleaner

Gasoline, diesel, and turbine engines could soon burn cleaner or be more fuel efficient through the application of plasma assisted combustion, a technology developed at Los Alamos National Laboratory, now poised to enter the marketplace.

In 2006, the Laboratory was negotiating a CRADA with PerriQuest Defense Research Enterprises LLC to advance the technology for commercial refinement and implementation. PerriQuest, based in Meriden, Conn., and Idaho National Laboratory are collaborating on the R&D of plasma assisted combustion, under a licensing agreement with Los Alamos, for turbine and internal combustion engine applications.

Los Alamos scientist Louis Rosocha and his team have been working on the technology for four years. It consists of an electronic device that can be attached to an existing fuel injector that applies electrical voltage to the atomized fuel stream prior to combustion—generating a plasma in the fuel. This effect essentially breaks down the long chains of hydrocarbons in the fuel into smaller parts, allowing the fuel to be burned more completely, resulting in more miles per gallon, or reducing harmful emissions.

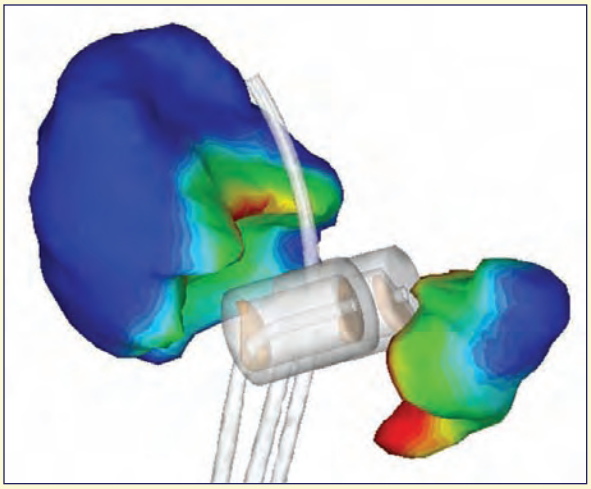
PerriQuest founder and CEO, Nicholas V. Perricone said that his company, which routinely works with the U.S. Government on defense technologies, is dedicated to turning the plasma combustion technology into a commercial product that will improve turbine and internal combustion engines.

"We knew we wanted to work with Los Alamos because, not only are their scientists world-renowned, but they also have some of the best plasma technologies in the world. We hope to commercialize the plasma combustion technology for fuel efficiency and reduced pollutants for the American public," Perricone said.

Enabling New Venture Creation

In addition to our corporate partnerships, TT Division has built relationships with entrepreneurs and investors that have resulted in a growing number of startup companies based on Laboratory technologies. This growing entrepreneurial community serves the Laboratory in multiple ways by providing a path for moving Laboratory-developed technologies to the marketplace; creating a pool of trained individuals for recruitment by both the Laboratory and the regional business community; and by improving the overall economic health of the region. In FY 2005 through FY 2006, TT Division facilitated nearly 50 sponsored research agreements with small companies to transfer technologies to products; five of these companies were new startups or spinoffs from the Laboratory.

Transpire Inc.



Transpire's expertise in the development of and application for solving the radiative transport equation will be leveraged for use within a commercially viable, small animal, optical imaging system.

Greg Failla, Chief Executive Officer of Transpire, Inc., has plenty of reasons to be proud of what the company has accomplished in the past few years. In 2002, Radion Technologies (later reincorporated as Transpire, Inc.) was founded by Failla and two former Los Alamos scientists, John McGhee and Todd Wareing. McGhee and Wareing launched the startup company while on Entrepreneurial Leave of Absence from the Laboratory where they worked as scientists in the Computer, Computational, and Statistical Sciences Division. They were soon joined by Douglas Barnett, another scientist who previously worked with DOE. Through a licensing agreement with the Laboratory, the company built on core technology originated at the Laboratory to develop a complete radiation transport software product, Attila. Attila can predict how radiation behaves in a broad range of applications faster and more accurately than just about anything else available on the market.

Since the first official release of Attila in January 2004, interest has grown rapidly. Attila is now being used in over seven countries for applications as diverse as radiation shielding, radiotherapy, medical imaging, fusion research, homeland security, spacecraft design, and reactor analysis. In addition, the company has received numerous small business innovation research grants, including two from the National Cancer Institute for medical imaging and radiotherapy.

"Los Alamos National Laboratory was a great asset to us getting started," Failla said. "The Technology Transfer Division helped with the development of our business plan and provided logistical support and valuable guidance. In addition, being associated with Los Alamos substantially adds to the credibility of our products and solutions."

"The rapidly growing commercial interest for our solutions in radiotherapy and pre-clinical and clinical medical imaging is a great example of 'turning swords into plowshares,' where technology originally developed as part of the U.S. national defense programs may ultimately save lives and improve the quality of life of many others. I think that's what Los Alamos would like to be known for."

Paving the road to a hydrogen economy

Nearly 30 years ago, Los Alamos scientists created their first fuel cell vehicle. Since then, they have remained at the forefront of hydrogen and fuel cell development and have improved fuel cell efficiency, reduced fuel cell cost, and improved fuel cell power density. General Motors publicly credits its nearly four-year collaboration with Los Alamos as the basis for its $1-billion fuel cell research activity. DOE and the US FreedomCAR partnership have repeatedly honored Los Alamos researchers with individual and team awards. In 2004, Los Alamos established the Institute for Hydrogen and Fuel Cell Research to strengthen research efforts and bring together the Laboratory's long-standing fuel cell research and the newly established DOE Center of Excellence for Chemical Hydrogen Storage. Los Alamos receives about $12 million annually from DOE for these efforts and hopes to strengthen the program through international and domestic industrial partnerships. To nurture partnership building, TT Division supports a portion of the costs of a dedicated business development executive who works directly with the IHFCR. Through this collaborative effort, the Institute has recently concluded a partnership with two of Japan's key research institutes in hydrogen storage and fuel cells. The Institute is also actively discussing new ideas in hydrogen storage and distribution with several potential industrial partners.

The Hydrogen Technology Partnership, a statewide, private-public partnership jointly led by the Laboratory and the New Mexico Economic Development Department, received a Federal Laboratory Consortium Partnership Award in 2005 for its efforts to create the economic and public-policy environments necessary to grow a hydrogen and fuel cell business cluster in New Mexico.

David Garman, right, DOE Assistant Secretary for Energy Efficiency and Renewable Energy, listens as Mahlon Wilson of Electronic and Electrochemical Materials and Devices describes how a hydrogen-powered fuel cell works to power a personal mobility vehicle.

Internal Customers: Laboratory Inventors

The Laboratory's technical divisions that produce new discoveries comprise TT Division's internal customers. TT Division markets both the intellectual property and the underlying capabilities/expertise that spring from these divisions. Our efforts spawn new relationships that yield both license revenues and new funds for expanded programmatic work. These relationships are often managed jointly with Laboratory program offices such as the Science Program Office and the Defense and Homeland Security Program Office to coordinate both programmatic funding and complementary industrial collaborations. The Institute for Hydrogen and Fuel Cell Research (IHFCR) is one of these programs (see sidebar). The IHFCR has expanded its efforts to bring new industry partners to the Laboratory in collaboration with New Mexico Governor Bill Richardson's Asia Initiative. Further commercial relationships are expected as IHFCR leads the DOE Center of Excellence for Chemical Hydrogen Storage, a project that includes 12 industry and academic partners.

The inventors and software authors who produce the intellectual assets and property that attract external partners to the Laboratory benefit both from the increased research dollars generated by industry partnerships and by personally sharing in revenues generated when their innovations are licensed. The licensing revenues and other recognition that innovators receive provide compensation and professional growth—an incentive for Laboratory staff to actively participate in technology transfer. During 2005 and 2006, Laboratory innovators received nearly $1.3 million as personal income under the Laboratory's royalty distribution policy.

Software Success: Los Alamos National Laboratory and AES Corporation Form Strategic Partnership

During FY 2006, Los Alamos National Laboratory and AES Corporation worked together to formalize a strategic partnership that will enable the two entities to identify, evaluate, and develop a range of mutually beneficial technologies with broad energy applications. Headquartered in Arlington, Va., AES Corporation is one of the world's leading power companies, generating and distributing electric power in 26 countries through an array of world-class power businesses.

Potential areas of collaboration include: greenhouse gas offset technologies; smart networks; technology grids; power generation technologies (e.g., zero emission fossil fuel, nuclear); water technologies; energy storage; biofuels; operational reliability and efficiency; separation technologies; power-aware computing; and fuel cell technologies.

Los Alamos and AES have also executed an Exclusive License Option Agreement for a unique technology called EnergyFit™—a transparent software layer that reduces the power consumption of high-performance computing systems. Because the algorithm minimizes the energy consumed by individual CPUs in a cluster, EnergyFit can dramatically reduce overall power consumption in a data center. EnergyFit delivers typical system energy savings of 10–25 percent while maintaining performance—typically lowering it by only a few percent. Energy consumption is the largest component of a typical data center's budget. EnergyFit's novel, patent-pending algorithm has been proven to yield the maximum energy savings while delivering computational results within a deadline.

Los Alamos and AES envision a long-term cooperative effort that will involve a variety of important and mutually beneficial energy-related projects.

Disclosures: Seeds of Commercialization

During FY 2005 through FY 2006, the Laboratory generated 253 invention disclosures, 196 patent applications, and was issued 82 patents by the U.S. Patent and Trademark Office. In addition to working with the innovators who submit these disclosures, TT Division also tracks software disclosures and, when appropriate, initiates the process to assert copyright, allowing the Laboratory to license the copyright. Prior to 2000, the Laboratory's licensing portfolio was dominated by software copyrights. However, in FY 2005 and FY 2006, because of the rapid growth in open source software licensing, copyright licensing revenues comprised only 18 percent and 20 percent respectively of Los Alamos' total license income. (Hybrid, patent/copyright, licenses are included in patent income.) While software revenues have declined, the number of copyright licenses still exceeds the number of patent licenses executed by the Laboratory. To better reap the benefits of this traditionally significant revenue source, TT Division established a Software Technology Management Team in June 2006. A key objective of this team is to educate Los Alamos software authors regarding the opportunities for licensing software innovations.

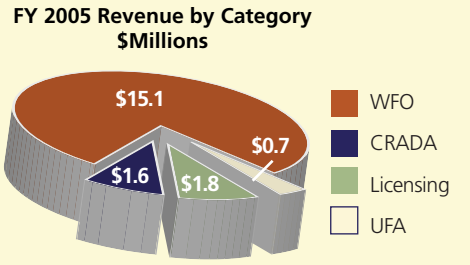


Figure 1

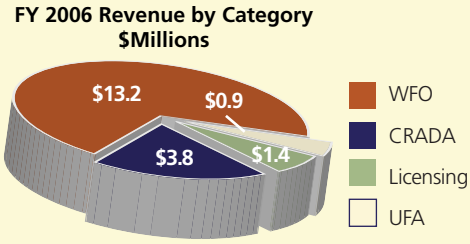


Figure 2

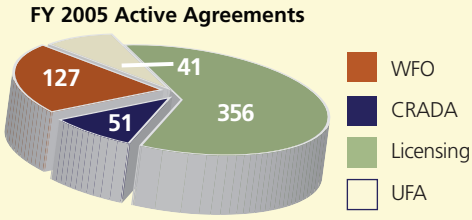


Figure 3

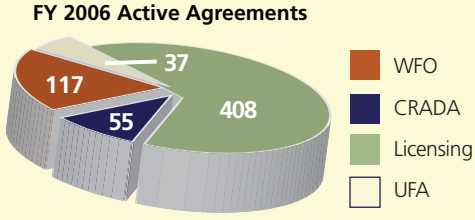


Figure 4

FY 2005–FY 2006 Financial Summary

TT Division's FY 2005 performance on financial metrics and agreements is summarized in Figures 1 and 3. Our total revenue received in FY 2005 was $19.2 million, an increase of approximately 8 percent over FY 2004. Overall, we actively managed nearly 600 revenue agreements in FY 2005.

TT Division's FY 2006 performance is summarized in Figures 2 and 4. Our total revenue received in FY 2006 was $19.3 million, an increase of approximately ½ percent over FY 2005. Overall, we actively managed over 600 revenue agreements in FY 2006. In FY 2006, 52 percent of our Cooperative Research and Development Agreement (CRADA) revenue came from our strategic partners Chevron and Procter & Gamble.

Fiscal years 2005 and 2006 showed excellent performance overall on all revenue metrics with our totals up significantly over previous years, and at or above five-year averages in most categories. We have a healthy portfolio of agreements with leading companies, including one third of the Fortune 50 companies and one quarter of the Fortune 100 companies. Additionally, about 40 percent of our agreements are with small companies.

Although the Laboratory's research budget has increased since 2002, the number of disclosures decreased in 2005. Disclosure of an invention is the first step toward obtaining a patent or copyright. Once protected, Los Alamos innovations can lead to beneficial collaborations with industry and provide additional funding sources through licensing activity. In part to address the decline in invention disclosures by Laboratory staff, TT Division launched its new Invention Disclosure Electronic Applications System (IDEAS) in 2006, a Web-based application that enables inventors to submit invention disclosures electronically. The new tool produced a 124 percent increase in disclosure submissions compared with the same period in 2005. The increase was due in part to a contest sponsored by TT Division and Laboratory Counsel's Intellectual Property Office. A team of Laboratory employees, Oingwen Li, Yuntian Zhu, Paul Arendt, Raymond DePaula, and James Groves from the Superconductivity Technology Center (MPA-STC) received a check for $25,000 for further development of "Long Carbon Nanotube Arrays for Fiber Spinning." The invention was selected by TT Division and LC-IP as the disclosure "most likely to succeed commercially" from among the 103 disclosures submitted during the IDEAS contest conducted from January 1 through March 31, 2006. Twenty-five thousand dollars were also given to Dynamic and Energetic Materials (DE-2), the technical group that won the lottery draw with "Mechano-Electrical Initiation of Energetic Material," submitted by Blaine Asay and Lloyd Davis. Each inventor who submitted a complete disclosure—one with sufficient information to permit a thorough evaluation by TT Division and LC-IP reviewers—was eligible for the drawing. Funding for the awards was contributed from TT Division's share of the Laboratory's licensing and royalty income.

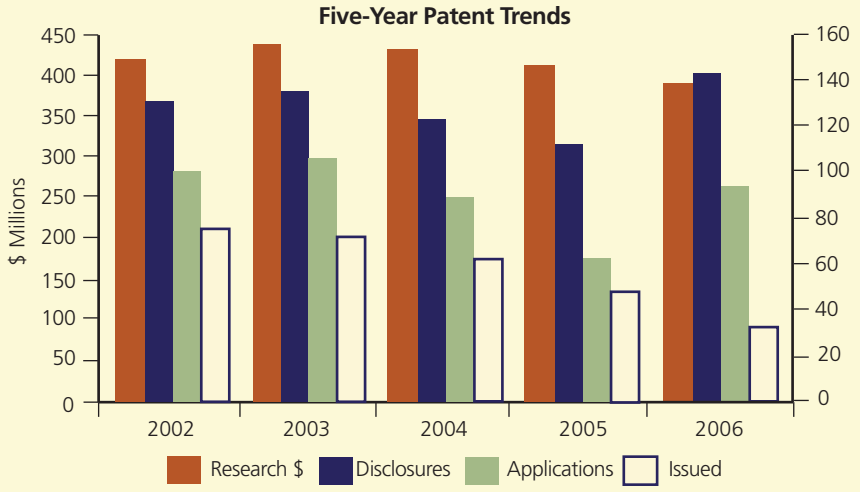


Figure 5

Institutional Impact: How does technology transfer impact the institution?

Over the life of the Technology Transfer Program, the Laboratory has realized over $160 million in income from industry collaborations. Currently, we are generating approximately $20 million a year in revenue from industry. A significant portion of this funding comes in through the Work for Others (non-federal agency) program as well as through CRADAs. These funds are used as labor and material costs, allowing our scientists to actively engage in research that enables applications outside but supportive of the Laboratory's primary mission. In many cases the diversity of skills used and best practices learned from industry during these collaborations have served to enhance the Laboratory's core scientific capabilities.

The Los Alamos User Facility Program, managed by TT Division, allows industry users access to our unique scientific equipment and facilities to fabricate, calibrate, test and evaluate products. The funds provided under this program help support the maintenance and usage of these facilities by Laboratory staff for key mission-related programs.

Because of the Laboratory's generous royalty policy, the income generated by licensing our intellectual property (patents and copyrights) to industry is shared with the Laboratory innovators who created it. At the annual Patent and Licensing Awards Reception, held on February 23, 2006 to honor Laboratory staff whose work was patented or licensed in 2005, approximately $700,000 was distributed to innovators as personal income. The additional $1.1 million in income generated by the Laboratory's licensing program was used within the institution for R&D, technology transfer, and educational programs. Divisions use royalty money generated by their employees in a variety of ways. For instance, the Nuclear Nonproliferation Division has a very active scholarship program. The Materials Science and Technology Division has used funds to attract more fuel cell partners, and TT Division uses a portion of these funds for its Technology Maturation Program—a grant program that enables inventors to take the next step toward commercial applications or to reduce an idea to practice.

The technical divisions that produce the most intellectual property are also those that attract the most revenue from industrial agreements. Five Laboratory divisions—Materials Science and Technology, Chemistry, Bioscience, Physics, and Theoretical—are in the top ten by intellectual property metrics as well as for revenue generation.

TT Division works with a diverse set of customers (41 division and program offices and hundreds of companies and universities during the last five years). The results of this work since 2002 have contributed to strengthening Laboratory programs and the U.S. economy, bringing in over $93 million in Laboratory funds, and helping 82 new companies create a variety of new jobs. These companies have attracted over $79 million in external capital to the region.

Technology Transfer Innovation

In an effort to consistently drive performance increases, TT Division strives to stay on the leading edge of technology transfer practices by innovating and piloting new programs and processes. A number of these programs designed to help the Laboratory meet its technology transfer goals have been recognized by the Department of Commerce and the Federal Laboratory Consortium, among others, as best-in-class.

Los Alamos Tech Transfer staff Erica Sullivan and Shandra Clow (left), join SDSU professor Alex DeNoble (left) and several of his MBA graduate students (right) to review student projects.

Unique Educational Programs

For the past decade, TT Division has fostered innovative student programs together with a suite of educational programs designed to encourage technology transfer by Laboratory staff and within the regional business community. Our summer MBA Internship Program, which gives traditional MBA students the opportunity to help the Laboratory evaluate and market its intellectual property assets, has set a standard that other national laboratories are now emulating.

Partnering with Business Schools to Turn Theory into Practice

Building on the success of the MBA Internship Program, in 2005, TT Division expanded this rich opportunity for future business leaders to learn about technology commercialization to the university classroom. TT established partnerships with San Diego State University, the University of New Mexico and New Mexico State University, giving students at these campuses a chance to use Laboratory innovations as the basis for applying commercialization and entrepreneurial theory to real projects—projects that may help bring cutting-edge technologies to the marketplace.

Left to right, Sara Pirayesh, Dawn Hommer, and Kevin Boberg, NMSU professor and Arrowhead Center director, promote the NMSU College of Business and the Arrowhead Center to potential candidates.

In response to TT Division's request for graduate students to evaluate the commercialization potential of technologies in the early development stage, SDSU created a course titled "Seminar in Entrepreneurship and Technology-Based Ventures." "This is a unique and innovative experience in which students learn about the commercialization of new technologies in a very hands-on way," said SDSU management professor Alex DeNoble. "The alliance between SDSU and Los Alamos gives students the opportunity to learn about the technology commercialization process through direct interactions with leading-edge scientists and technologists."

Working closely with the Los Alamos team, SDSU students have evaluated market potential for cutting-edge, early stage nanotechnology, solar cell technology, optical lasers, cooling technologies for integrated circuits, and software for protecting sensitive data. At the end of the course, they delivered a comprehensive presentation of their findings to Laboratory staff, assessing the market potential, risks, barriers, and trends for each technology and the intended application within those segments.

NMSU's Arrowhead Center Inc. has completed over two dozen commercialization projects for Los Alamos. One of these projects required students to evaluate a Los Alamos Structural Health Monitoring software application for marketability and to recommend commercialization strategies. Another project had students explore the market environment and commercialization strategies for electronic applications of single-walled carbon nanotubes.

According to center director Kevin Boberg, "The learning experiences the Laboratory has given the Arrowhead Center are inimitable to any other we have had. The students have not only learned what steps are needed to commercialize a technology, but also how to understand a technology that was foreign to them when the project started and still relate business strategies to that technology. Students had to think out of the box throughout the whole process, helping them to become skilled at expanding their research when an unforeseen business opportunity presents itself."

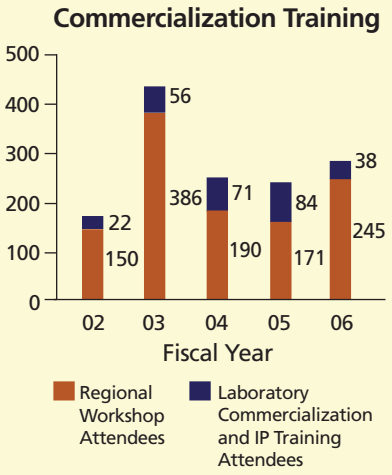
It's a tremendous bridge to the real world from school and helps forge both effective skills and attitudes through directed experience.

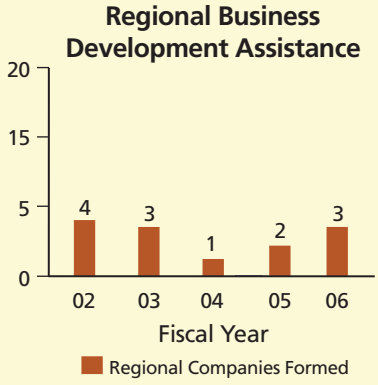
—William Paulin, Paulin Neal Associates

Training Events for Laboratory Staff and Community

TT Division also supports commercialization training for Laboratory inventors and managers and for the regional entrepreneurial community. During 2005 and 2006, TT Division offered the following programs:

- **Commercialization Training for Laboratory Staff:** Inventors learn how to evaluate the commercial potential of their ideas as well as the process for getting their innovations to market. Since 2003, over 200 technical staff evaluated over 150 technologies; 40 percent of participants continue to work with TT Division to commercialize a technology. Six commercialization sessions were held during 2005 and 2006.
- **Managing Intellectual Property—A Guide for Laboratory Managers:** Managers and innovators learn the importance of strategic intellectual property management practices and the Laboratory's processes for protecting its intellectual assets. During 2005 and 2006, 88 Laboratory staff attended five sessions of this event.
- **Innovation Challenge and Student Breakfasts:** More than 40 percent of the student population returns to become full-time Laboratory employees. These TT Division networking events introduce Laboratory summer students to the world of patents, copyrights, technology business planning and the commercialization process.
- **Small Business Innovation Research and Small Business Technology Transfer Research Training:** Regional businesses and Laboratory entrepreneurs learn how to access funds available through these federally sponsored programs. During 2005 and 2006, 92 participants attended six events. In conjunction with Sandia National Laboratories and Technology Ventures Corporation, Los Alamos co-sponsored annual New Mexico SBIR/STTR conferences. Federal agency representatives from the Departments of Energy, Defense, Agriculture and others gave presentations about their specific programs and provided one-on-one consulting opportunities to over 70 New Mexico small business owners and entrepreneurs.
- **Center for Commercialization and Entrepreneurial Training:** The education/training arm of TVC offers a broad array of training topics, which TT Division helps promote, including Marketing Research, Financial Management, Preparing and Presenting the Business Plan, and The Term Sheet and Lessons Learned. The monthly series attracted over 250 participants during 2005 and 2006.





Technology Maturation and Strategic Investments

TT Division initiated the Technology Maturation Fund in 2002 to meet a significant, unmet need for bridge funding to help the Laboratory's early stage technologies reach commercial viability. In FY 2005, building on the tremendous success of this fund, TT Division implemented a Strategic Investment Portfolio approach to identify, screen, and invest in technologies or programs with the potential for strong programmatic or commercial impact.

These TT employees received a Laboratory Distinguished Performance Award for piloting the development and implementation of TT Division's successful and innovative Technology Maturation Fund to support early stage Laboratory technologies with high potential.

Technology Maturation Fund: With a four-year track record of picking winners, this fund provides up to $50,000 per project to Laboratory inventors to refine and mature commercially viable innovations. The fund typically supports prototype/proof-of-concept projects. TT Division measures success by the number of funded projects that ultimately result in a technology transfer agreement. For example, a $40,000 investment enabled a prototype fuel cell to be developed, leading to a new license with Mesoscopic Devices Inc. for delivery of a new high-power fuel cell to the U.S. Army. The TMF is funded on an ongoing basis at a level of up to $450,000 per year from monies dedicated to Appendix M (now Appendix N) of the Laboratory's prime contract and new royalties.

Strategic Investment Fund: Established in FY 2005, this fund supports emerging technologies that have significant benefit to the Laboratory and U.S. industry but do not meet the short-term ROI criteria of TT Division's Technology Maturation Fund. For example, in FY 2005, TT Division made a $100,000 investment from retained royalties in new technologies to harness radioisotopes for medical applications. This investment provided momentum to the newly created New Mexico Center for Isotopes in Medicine, a joint effort between Los Alamos and the University of New Mexico expected to lead to significant advances in the diagnosis and treatment of cancer. Initial funding for Strategic Investments comes from accumulated royalties of approximately $1 million.

LANS Venture Acceleration Fund: Conceived in FY 2005, the LANS Venture Acceleration Fund will invest up to $100,000 in projects that facilitate the creation and growth of regional ventures based on Los Alamos technology or expertise. The fund will build on the success of the Laboratory's internally focused Technology Maturation Fund by serving as an externally focused fund that supports businesses with a Los Alamos affiliation such as a licensee of Laboratory intellectual property. Funding for the VAF is provided by LANS, LLC, at a minimum commitment of $350,000 per year out of its management fee as part of its Community Commitment Plan. Activities will commence in FY 2007.

Through each of these funds, TT Division is strategically investing in well-defined projects that accelerate the commercialization of products from cutting-edge research efforts. TT Division's Technology Maturation Fund has been widely recognized as an innovative approach to technology transfer. It has been featured in *R&D Magazine* and by the Federal Laboratory Consortium. Sandia National Laboratories and UNM each piloted a new program in FY 2006 modeled on this funding concept.

Technology Maturation Fund: Proven Results

The following statistics through FY 2006 indicate early success for this innovation:

- $1.4 million invested in 34 projects from 19 technical divisions
- 7 new inventions
- 7 new CRADA/Work for Others agreements with $5.5 million total lifetime value
- 15 new licenses with $2.4 million total lifetime value
- 5 startup companies with $7.2 million in funds raised

Technology Maturation Fund Success: Underground Radio Will Save Lives

In FY 2005, the Underground Radio project stood out as a TMF success. Los Alamos researcher David Reagor developed this novel device, which enables two-way communication through hundreds of feet of rock, earth, or concrete. Underground Radio uses very low frequency, electromagnetic radiation and advanced digital signal processing to carry voice and text data through otherwise impenetrable structures.

Two TMF-funded projects totaling $49,000 enabled Reagor to improve his system and demonstrate it in a mine to interested licensees. Two licenses to commercial companies resulted: one for use of the Underground Radio in mines, and the other for use in urban environments (e.g., subways and skyscrapers). Recent mining tragedies in the U.S. and the London subway bombings have demonstrated why clear and effective communication and the ability to locate people underground are critical in emergency situations. Los Alamos expects that a commercial device based on the Underground Radio will soon be a life-saving tool for first responders.

Industrial Fellows: Laboratory Advocates Embedded with Strategic Partners

The most successful technology transfer occurs when the Laboratory collaborates with an industrial partner to apply Los Alamos technology to a customer problem while concurrently enhancing the Laboratory's national security mission. Achieving this mutual leverage requires the partners to develop a deep understanding of one another's needs, capabilities, and culture. To accomplish this, in 1995 TT Division developed a unique initiative called the Industrial Fellows Program. Industrial Fellows are Los Alamos staff, cost-shared with a partner, who coordinate and facilitate interactions by spending at least half their time located at the partner company. The Fellow becomes an on-site Laboratory ambassador capable of crafting and managing an effective strategic alliance with the industrial partner.

In the last six years, Industrial Fellows have helped initiate over $5 million in CRADA/WFO work, delivered value to the partner companies in the tens of millions of dollars, and accelerated the resolution of major challenges in programmatic work by bringing the Laboratory and partner company resources together. These joint projects have involved almost every Los Alamos technical division in areas as diverse as bioinformatics, decision analysis, colloid chemistry, molecular modeling, hydrodynamics, biosensors, and reliability engineering. Procter & Gamble and Chevron both currently support an Industrial Fellow.

In addition to P&G and Chevron, Los Alamos previously placed Industrial Fellows at General Motors/Delphi, Eaton Corporation, AMTEX (American Textile Partnership), Dow Chemical, the Association of American Railroads, Lockheed Martin, Allied Signal, Caterpillar, PPG Industries, Eastman Chemical, Rockwell International, IBM, Parke-Davis (now part of Pfizer), Phillips Petroleum, and Motorola.

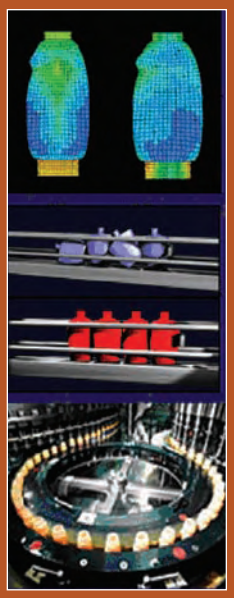
Procter & Gamble Builds on Success

P&G and Los Alamos National Laboratory have enjoyed a productive research collaboration for more than a decade. The partnership, which began with a single reliability engineering project, has led to 15 projects covering multiple technical areas distributed among seven Los Alamos technical divisions with joint research valued at over $30 million today. The initial project has produced an impact of over $1 billion for P&G while providing the Laboratory with a real-world test bed for its simulation and modeling programs.

For the last five years, P&G has sponsored a Los Alamos Industrial Fellow at its research facilities to aid in collaboration building.

"The Industrial Fellow program has been critical in P&G's ability to rapidly, efficiently, and effectively identify and screen high value collaboration opportunities with Los Alamos," says Keith Grime, Vice President of Corporate R&D at P&G. He continues, "The program fits in extremely well with our corporate strategy of Connect & Develop to bring the best ideas in the world to P&G's products."

The program with P&G continued with a new (and record third) Industrial Fellow in FY 2006.

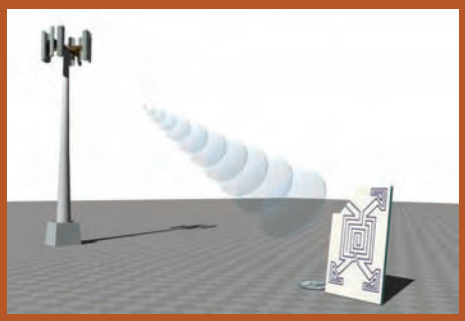


PowerFactoRE, a product of the first collaboration, is based on intellectual property P&G licenses from the Laboratory.

Alliance with Chevron Takes Off Running

The Laboratory's Alliance for Advanced Energy Solutions with Chevron Corporation, established in early 2005, has taken technologies in acoustics, materials chemistry, wireless communications, and modeling rapidly into the field to speed recovery of oil and gas reserves to help meet national energy security needs. As part of this relationship, Chevron chose to host a Los Alamos Industrial Fellow to nurture the partnership.

Los Alamos scientist Otis Peterson, with many years of experience developing and managing innovation in chemistry and physics, has been based in Houston since spring 2005. Peterson spends his days connecting with new potential customers. "Since the drilling engineers started telling their friends about the range of things we've accomplished and the kind of ideas we've generated, I have been running full speed to meet all the people who have challenges we can help address."



Los Alamos' INFICOMM wireless receiver-reflector device modulates and reflects the transmitter-receiver base unit's radio frequency carrier wave to complete half the "conversation." The other half is transmitted from the base unit using conventional techniques.

Two of the first three projects set forth in the Alliance agreement have already been fielded, including trials with a new polymeric liquid that shrinks when heated, eliminating the rupture of deep sea oil wells in the Gulf of Mexico (saving $100 million per well), and a wireless communication technique that enables real-time measurements of pressure and temperature in wells several thousand feet below ground without the need for power electronics. The Alliance is expanding to address more than a dozen important technical challenges that impact U.S. energy independence.

Visiting Entrepreneurs

In 2005, TT Division launched the Visiting Entrepreneurs program to leverage the expertise, insight, and networks of successful entrepreneurs. The first "class" of Visiting Entrepreneurs, John Elling and John "Grizz" Deal, helped tailor new approaches to entrepreneurship within the Laboratory and pioneered a streamlined process for spinning out strategic technologies ready for commercialization.

The Visiting Entrepreneurs program assists TT Division with achieving both regional economic development and other technology transfer goals including

- the creation of new companies based on Laboratory technology or expertise;
- increased licensing royalty and other income;
- increased participation by Laboratory technical staff in entrepreneurial, licensing and cooperative research and development activities; and
- identification and acquisition of programmatic funds in areas that enhance technology commercialization efforts.

Elling and Deal worked closely with technical staff to help them quantify the value of their ideas, identify product development roadblocks, develop technical development milestones and funding requirements, construct viable commercialization paths and, as appropriate, target key staff needed for a new spinoff opportunity.

Expected outcomes for this program included identification of at least four opportunities for New Mexico-based companies within the first year and at least four opportunities for licensing, CRADAs, or other technology transfer mechanisms. By the end of FY 2006, two new startups were underway with several others under evaluation. Both Elling and Deal used their contacts within industry to establish new leads for licensing and cooperative research projects.

John Elling, Ph.D.

Los Alamos research scientist John Elling took Entrepreneurial Leave from the Laboratory in 1997 to start Bioreason, a Santa Fe startup established to develop advanced statistical molecular analysis software for drug discovery research. Subsequently, Elling founded and successfully exited two other biotech companies: Cytoprint and Datect. In addition to returning to the Laboratory as a Visiting Entrepreneur, Elling is president of Integrated Genomics, a microbial metabolic engineering company in Chicago.

"The drug discovery industry invests far more money in research and development than any other industry in the world," said Elling. "The huge market for new drug discovery technology has created a large flux of biotechnology startups seeking to deliver it."

Los Alamos has unique, world-class biotechnology that could be extremely valuable to drug discovery if it can be demonstrated and commercialized appropriately. "My experience starting three biotechs since taking Entrepreneurial Leave from Los Alamos has given me a first hand look at the value propositions and buying behavior in this industry," said Elling. "My opportunity as a Visiting Entrepreneur—to identify technologies that could warrant a biotech startup and to try to facilitate both sides of the process—is kind of like being paid to be a kid in a candy store."

John R. "Grizz" Deal

Former Laboratory computer research and applications consultant John R. "Grizz" Deal left the Lab in 1996 to become a founder and CEO of LizardTech, one of the Lab's most successful spinoffs. Deal led LizardTech through seven years of explosive growth. His role as a Visiting Entrepreneur was to ferret out Laboratory technologies with a reasonably large commercial potential, then to implement his Whole Product Marketing method to ensure the technologies' success in commercial markets. Deal focused most of his efforts on the Laboratory's portfolio of software innovations.

"Software now permeates just about everyone's life in America, from cable box to voice mail to how we get our news. Food production, manufacturing, toys, games, work—software runs the machines that allow us to live in this modern world," said Deal. "While the U.S. software industry has gone through radical changes over the last 20 years, Los Alamos continues to develop the most innovative software available anywhere. The responsibility of helping U.S. industry remain competitive in software and the information economy in general is one we take very seriously."

Deal has over 20 years' experience with startups, fast growing ventures, and acquisitions. Former chief marketing officer for Space Imaging, he is an internationally recognized expert in technology commercialization, consulting with industry, government, and the science community.

Technology Innovation Awards

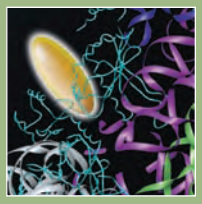
The Laboratory's innovators and their technologies are recognized in multiple ways throughout the year, including through the internationally recognized R&D 100 Awards, Federal Laboratory Consortium awards, and our institutional recognition for patents received and licenses awarded.

Los Alamos Captures Four 2005 R&D 100 Awards

CartaBlanca

CartaBlanca is a state-of-the-art, high-efficiency, object-oriented, general-purpose computer simulation software package poised to offer next-generation modeling and simulation capabilities to scientists in a number of disciplines. CartaBlanca brings the tremendous efficiency of the Java programming language to the world of scientific computing.

MESA



MESA (for Measuring Enzyme-Substrate Affinities) is a low-cost assay for detecting the binding of drugs to proteins without the biasing influence of added fluorescent molecular labels. By capturing and quantitating all drug-protein binding, including potentially therapeutic and potentially toxic bindings, MESA enables measurements to generate a complete therapeutic index early in the drug-development process. Its ability to measure a very large number of interactions and its resulting early detection of toxicity could save the industry hundreds of millions of dollars in drug-development costs.

nanoFOAM

nanoFOAM, a metal-nanofoam fabrication technique, was developed to produce self-supporting, nanoporous metal foams by igniting a pressed pellet of a special compound in an inert atmosphere. The compounds are high-nitrogen transition-metal complexes synthesized with a low-cost, high-volume method developed at Los Alamos. Nanofoams produced to date include iron, cobalt, copper, and silver. The nanofoams have pore diameters of 20 nanometers to 1 micrometer, surface areas as high as 258 meters-squared per gram, and densities as low as 0.01 gram per cubic centimeter. These values compare favorably with those of silica aerogels, the lightest known solids.

NESSUS

NESSUS is a general-purpose tool for computing the reliability of engineered systems. It was originally developed by a team led by Southwest Research Institute as part of a 10-year NASA project to develop a probabilistic design tool for the space shuttle's main engine. Recently, a team consisting of members from Los Alamos National Laboratory and SwRI enhanced and applied NESSUS to the Laboratory's weapon reliability assessments for the Stockpile Stewardship Program.

R&D 100 Awards

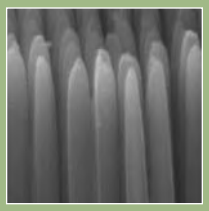
TT Division coordinates Laboratory participation in *R&D Magazine's* annual R&D 100 Awards competition by submitting the Laboratory's most innovative technologies available for commercialization each year. The international competition, which celebrated its 44th year in 2006, seeks technologically significant new products or processes developed by the international R&D community from across multiple industries, government agencies, and universities. Entries must represent technologies available for purchase or license in the year preceding submission. Entries are strengthened when private sector interests such as CRADA collaborations, joint ventures, licenses, or other contractual industrial arrangements exist. This competition is the only industry-wide competition that recognizes the practical applications of science.

The projects recognized during 2005 and 2006 have implications in a wide range of industries from aerospace engineering and drug development to advanced simulation software tools and environmentally friendly energetic materials. Acknowledging Los Alamos' 2005 achievements, former Laboratory Director Robert Kuckuck said, "The teams that received 2005 R&D 100 awards once again showed that, when put to the test, the scientific talent and the research and development excellence at this Laboratory really shine through. I am extremely proud of the award recipients and all the Los Alamos teams that submitted entries to this year's competition."

In 2005 and 2006, Los Alamos won nine awards bringing the total number of awards won by Los Alamos to 103 since it began participating in this competition in 1978.

Los Alamos Captures Five 2006 R&D 100 Awards

ENABLE

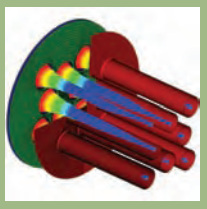


ENABLE (Energetic Neutral Atom Beam Lithography/Epitaxy) comprises a dual-function nanofabrication technology capable of growing thin films and etching high-aspect-ratio nanostructures. Its low-temperature operation, which spares the activation of diffusive and other unwanted surface chemical changes—drawbacks for existing nanofabrication processes—make it unique. Because its precise high-aspect-ratio nanoscale etching and rapid high-quality thin film growth capabilities can be readily combined, ENABLE technology is theoretically capable of fabricating details down to 1 nanometer or less, giving it greater versatility than current nanofabrication processes.

Green Primaries

Green Primaries are designed to replace the lead-based primary explosives currently polluting human tissues and the environment with neurotoxic lead residues. Green Primaries are also superior to lead-based primaries and other experimental substitutes because they are insensitive to spark and can be manufactured in several variants that exhibit differences in explosive energy and impact and friction sensitivity. In addition to being more environmentally friendly, Green Primaries are safer to manufacture and transport because they pose no danger for explosion during the manufacturing and transporting processes.

MICHELLE

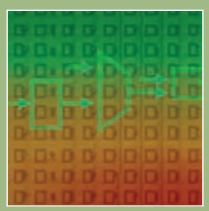


MICHELLE simulates the operation of a wide variety of charged-particle-beam devices by calculating electrostatic fields, magnetostatic fields, and particle trajectories under steady-state or slowly varying field conditions. It can model intense or relativistic particle beams, particle injection into the device volume, and secondary-electron emission produced by particle collisions with device walls. It is the only code that provides accurate simulations of several advanced guns and collectors used in high-power microwave tubes. The use of MICHELLE has led to longer-lasting microwave tubes for defense-radar systems, more cost-effective tubes for satellite-communication systems, and higher-power tubes for particle-accelerator and deep-space communication systems.

PixelVizion

PixelVizion is the first Network Processor Unit-based computer visualization tool to bring a hardware-assisted, lossless, highly scalable, high-frame-rate solution to the visualization bottleneck of image compositing. Its ability to analyze, sort, and manipulate large data sets enables single-pass network data transmission and on-the-fly image compositing that yields an order-of-magnitude increase in interactive response times, rates 10 to 20 times faster than other current compositing technologies. As a cost-effective, commercial, off-the-shelf solution, PixelVizion removes the need for an expensive network interconnect and accommodates a variety of software rendering packages.

Trident



Trident is a high-level-language compiler that supports floating-point data types and operations. It translates scientific algorithms that use floating-point mathematics into hardware circuits mapped onto reconfigurable-logic arrays. Putting it another way, Trident accepts C language input containing floating-point calculations and translates this language into field-programmable, gate-array hardware. It allows computational scientists to explore partitioning their code between software and hardware.

Hands-Off Sampler Gun

The Hands-Off Sampler Gun, patented in 2005, was developed by Los Alamos scientists with homeland security in mind. It enables first responders to rapidly collect cross-contamination-free solid, gas, and/or liquid samples after a terrorist attack. The gun will also be useful for crime scene investigators who often carry large kits containing sampling and recording tools. It may even be used, in the future, for testing athletes for performance-enhancing drugs.

The gun integrates a number of technologies to make one portable, rugged and inexpensive device for evidence and sample collection and electronic data recording. It is equipped with an onboard, 3-D accelerometer, internal GPS, Pocket PC, digital camera, LED flashlight, replaceable air sampling cartridge, memory card reader, speaker-independent voice recognition board, barcode reader, audio recorder, user authentication, digital signatures, data encryption, and temperature sensor.

The device uses a universal, sample-media adaptor, which clicks into place and is released with a trigger, to collect samples of almost any kind without possible contamination by a human hand. The gun operates using an integrated microcontroller that controls each of the sensors and works as the communicator between the different parts of the device and the Pocket PC.

Federal Laboratory Consortium Awards

The Federal Laboratory Consortium is a nationwide network of federal laboratories that strives to link laboratory-developed technologies and expertise with the private sector. More than 700 federal laboratories and centers are FLC members. The FLC encourages participation in the technology transfer process through its awards program, annually honoring groups and individuals for advancing technology transfer. In 2005 and 2006, Los Alamos scientists received four National Awards for Excellence in Technology Transfer and four Mid-Continent Region (which includes 14 states and more than 100 laboratories) Technology Transfer Awards for Outstanding Technology Development.

2005–2006 National Awards for Excellence in Technology Transfer

PowerFactoRE: Harry Martz and Michael Hamada of Statistical Sciences (CCS-6) received this award for PowerFactoRE created in conjunction with Procter & Gamble (see page 22).

Green Destiny and mpiBLAST: Developed by Wu-chun Feng of Computing and Computational Sciences (CCS-1), Green Destiny provides up to 10 times higher performance/power ratio than other supercomputing platforms. mpiBLAST, an open-source parallelization of BLAST, an open-source software package, running on Green Destiny, can reduce search query times from more than 22 hours to several minutes.

10 Gigabit Ethernet Adapter: Also developed by Wu-chun Feng, this is a "super-adapter" whose plug-and-play installation, reliability, and unprecedented speed are expected to revolutionize how computers and the Internet positively impact our lives.

SOLVE/RESOLVE: These complementary software packages developed by Tom Terwilliger of Cell Biology, Structural Biology, and Flow Cytometry (B-2) help researchers get clear, 3-D images of protein structures, aiding development of new pharmaceuticals and enhancing understanding of how proteins work.

2005–2006 Mid-Continent Region Technology Transfer Awards for Outstanding Technology Development

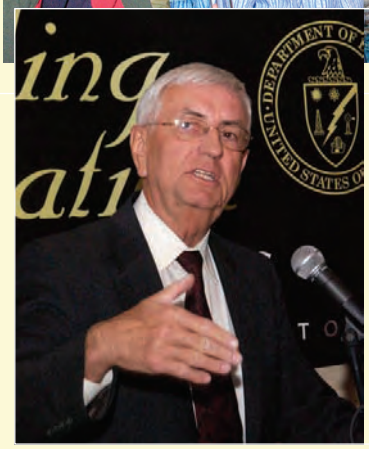
Hands Off Sampler Gun: Torsten Staab of Applied Engineering and Technology (AET-5) developed this device in response to growing terrorist threats (see sidebar).

Underground Radio: Invented by David Reagor of the Superconductivity Technology Center (MPA-STC) to provide through-the-earth communication for first responders, rescue and security teams, underground miners, and the public in critical emergency situations (see page 21).

High Temperature Superconducting Tape: Dean Peterson, Center Leader of the Superconductivity Technology Center (MPA-STC), and Randy Tremper of TT Division received this award for their efforts to commercialize HTS tape, which carries high currents in high magnetic fields at liquid-nitrogen temperatures with no resistance (see SuperPower, page 12).

NOx HyCat: Kevin Ott of Materials Chemistry (MPA-MC) received this award for his efforts to commercialize his technology, a new catalytic system for diesel engines (see CleanAIR Systems, page 9).

Patent and Licensing Awards



In February 2006, TT Division and the Laboratory Counsel co-hosted the Laboratory's eighth annual Patent and Licensing Awards Ceremony to honor innovators whose work was issued patents or copyrights and whose inventions generated license or royalty income during 2005. More than 240 current and former Laboratory staff members were recognized for their direct contribution to the Laboratory's technology transfer mission during 2005, and checks totalwere distributed to individuals as patent, royalty, and license Laboratory retained $1.1 million in license and royalty education, and technology transfer activities.

Former New Mexico Governor and current dean of the New Mexico State University College of Business, Garrey Carruthers, was the evening's keynote speaker. Carruthers, who is also the current governor-appointed Chairman of the Board of the New Mexico Technology Research Collaborative, reminded honorees and their guests about the impact of their efforts to ensure the transfer of cutting-edge technology from the Laboratory to the private sector on the state and regional economies. He also praised the recently formed collaboration between NMSU and the Laboratory's TT Division to help graduate students in the College of Business learn how to assess Laboratory technologies for commercialization opportunities. He outlined a promising future for technology collaborations between the Laboratory, the New Mexico business community, and the state's universities.

Former Laboratory Director Kuckuck congratulated innovators for their achievements and praised them for their efforts to protect the Laboratory's intellectual assets and to actively contribute to the technology transfer process. He then presented trophies to the winners of the 2005 Distinguished Patent, Distinguished Copyright, and Distinguished Licensing awards and shook hands with each patent awardee present. The Laboratory will recognize 2006 patent and technology transfer award recipients in early 2007.

> ***This is a big part of the success of the Laboratory and an important part of the national economy.***
>
> ***—Robert Kuckuck, former Director, Los Alamos National Laboratory***

Regional Innovation

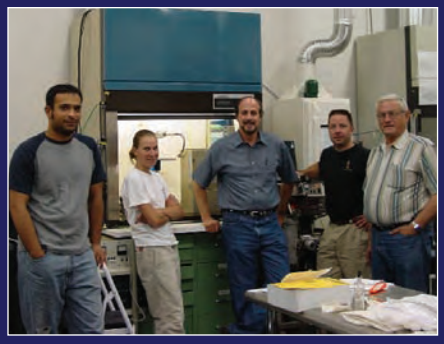
Creating Regional Jobs

Common questions posed to Laboratory officials by our congressional delegation are: How have you leveraged your vast technology base to benefit the regional economy? How many businesses have you spun out from the Laboratory? What have you done for my constituents?

Since the passage of the Bayh-Dole Act in 1980, universities have been an increasing resource for technology-based economic development through the transfer and commercialization of their inventions. Regions such as Silicon Valley, Route 128 (Boston) and Research Triangle Park (North Carolina) have managed to consistently capture the value of university research locally with vast positive economic impact. Similar to a university, the Laboratory represents a treasure chest of science and technology innovation that can be leveraged to advance the economic diversity and health of the northern New Mexico region. Our ability to cite examples of effective regional transfer to our congressional delegation demonstrates our ability to leverage public investment dollars for regional economic benefit—measured by the creation of new jobs and wealth in our local communities.

Los Alamos technologies that have been transferred to regional companies have been used to create new product lines, enhance processes, and create business efficiencies—and in some cases to create new companies from the ground up. In this way, the Laboratory uses its vast reservoir of technology and talent to benefit the regional economy by helping to build a local supplier base, creating alternative job opportunities and attracting new business and capital to the region.

MBA Interns Help APJeT Evaluate a New Market



A new company can always use a little help, especially when help comes from the bright young minds of Los Alamos National Laboratory's Technology Transfer Division MBA interns.

APJeT, a spinoff company based in Santa Fe, N.M., was launched in 2000 by former Los Alamos scientist Dr. Gary S. Selwyn to commercialize his Atmospheric-Pressure Plasma Jet technology. The technology produces a high-flux gas stream of reactive chemical species that can clean, decontaminate, etch, or coat surfaces—at atmospheric pressure and low temperatures. The technology has multiple applications including graffiti removal, decontamination of surfaces exposed to chemical or biological warfare agents, and fabric treatments.

APJeT has worked with interns since 1999 on projects ranging from business plans to market analysis and predictions of long-term financial success.

"The program can be very beneficial because it provides small companies with the added benefit of supplementing their staff with key capabilities," said Alex Padilla, APJeT's director of business development. "In our case it was in marketing and sales."

APJeT's strongest market is with textile manufacturers—the TextJet system can treat large bolts of fabric very quickly. However, in 2005, APJeT asked the interns to research the polyethylene terephthalate (PET) film market to help APJeT evaluate venturing into a new market. The Los Alamos team, led by Vishal Pahwa from the University of Texas, investigated the PET film market, determined major applications, researched growth trends and competition, and analyzed advantages and disadvantages of PET films to determine a proper market for APJeT to invest in.

"My internship at Los Alamos was a chance to get exposure to technologies I would never get to see or work with anywhere else," said Pahwa. "We chose to work with APJeT because their technology was so interesting and it has a real chance to revolutionize that space. I learned to quickly analyze markets for new technologies."

Since 1997, TT Division has worked with over 47 regional startup companies in the region that have an affiliation with the Laboratory through a formal technology transfer agreement or through the employment of former Laboratory staff. Thirty Laboratory employees have taken Entrepreneurial Leave of Absence to engage in the creation and growth of these new entities.

The Laboratory has executed over 100 agreements with New Mexico companies enabling hundreds of new products and services along with a dramatic positive impact on regional employment resulting from these products.

To meet a variety of challenges to regional spinoff creation, the Laboratory, spearheaded by TT Division, has a variety of entrepreneurial and business development activities to benefit the northern New Mexico region. The following activities represent this effort:

- Business and entrepreneurial counseling for Laboratory innovators and regional entrepreneurs;
- Commercialization and entrepreneurial training programs;
- Access to TT Division's Technology Maturation Funds;
- An Entrepreneurial Leave-of-Absence Program;
- Regional networking events and assistance securing investment capital;
- Development of the regional technology infrastructure, including the Los Alamos Research Park; and
- An MBA Internship Program that provides business assistance to technical entrepreneurs and a pipeline to entrepreneurial and business talent within the region.

SatWest Profits from MBA Interns

Since the beginning of the MBA Internship Program, TT Division interns have contributed useful marketing help to regional companies, including non-Laboratory affiliated companies. Through TT Division, the Laboratory encourages the growth of regional companies and works with businesses interested in bringing employment, new opportunities, and revenue to the region.

As a local business, SatWest has taken advantage of the tremendously innovative, fresh minds of the interns. As a relatively young business, launched in 1999 by president and founder Brian Barnett, SatWest has proposed several projects that interns have researched.

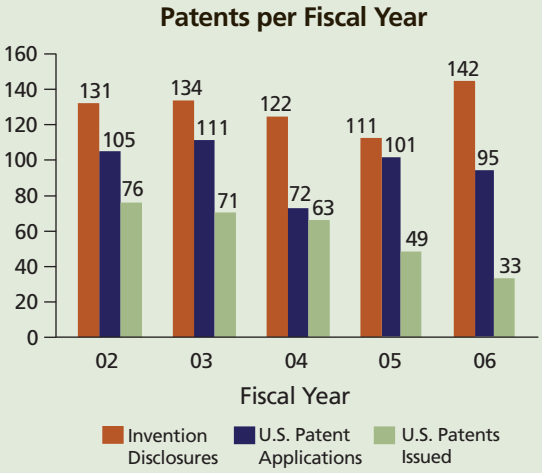
SatWest has developed its own flexible solar cell-phone charger plus a new company, SolStar, to sell the chargers. SatWest used the information and recommendations provided by interns to implement marketing strategies aimed at niche and target consumers and potential business partners.

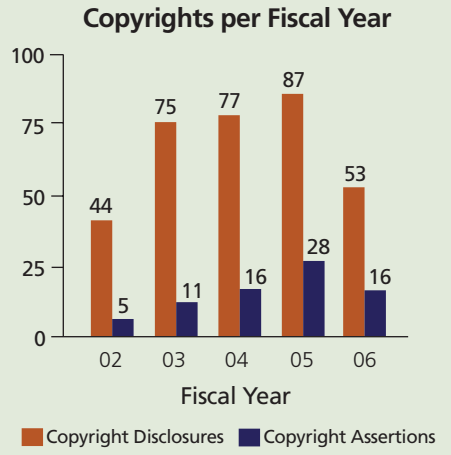
"The LANL MBA Summer Intern Program is the best way the national laboratories can assist small, high-tech, businesses in New Mexico. The MBA interns have had a definite impact on product development and the growth of SatWest LLC and SolStar Energy Devices," said Barnett.

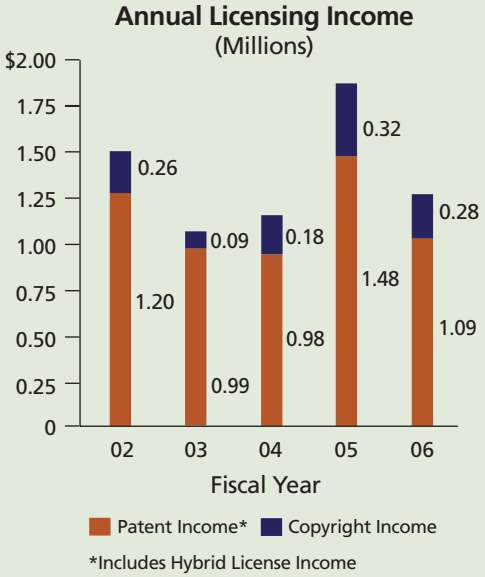
During the summer of 2005, a team of interns, led by Marcus Lucero of New Mexico State University, researched potential market niches and targeted device manufacturers for the chargers. By researching this information, Lucero was able to determine the consumer groups that would benefit most from purchasing and using SolStar's flexible solar chargers.

"This project was one of the many projects I worked on over the summer and it was an excellent project because I learned a great deal about how to conduct a technical marketing analysis," Lucero said. "The internship was invaluable because of the experience learned through a variety of projects that I had the opportunity to work on and knowing that in the end your projects actually make a difference."

Appendix







FY 2005 and FY 2006 Performance Summary

Patent and Copyright Activity

Due to factors such as the FY 2004 Laboratory shutdown and the pending contract competition/transition in FY 2005, the Laboratory generated only 111 invention disclosures in FY 2005, the lowest total for inventor-submitted disclosures in over five years. With the implementation of IDEAS (Invention Disclosure Electronic Application System) and the previous year's distractions behind, the Laboratory's technical staff generated 142 disclosures in FY 2006—an increase of 28 percent and the highest one-year total ever recorded at Los Alamos. Patent applications submitted dropped to pre-FY 2005 levels and one of the lowest percentages of applications per disclosure (54 percent) in the Laboratory's technology transfer history. The number of patents issued is dependent upon the U.S. Patent and Trademark Office (which has an overwhelming backlog of applications to review) and the number of applications submitted. Over the last five years, the number of patents issued has trended down—a pattern that will likely continue as a result of the USPTO backlog—but probably, and more importantly, reflective of the reduced number of applications Los Alamos is able to submit. The Laboratory has recognized this issue and initiated actions to reverse this trend.

Copyright disclosures dropped significantly in FY 2006 after a five-year upward trend. The significant drop can be attributed to the FY 2004 shutdown when technical staff were not permitted to work in their laboratories but were able to write—thus creating a significant amount of copyrightable material in FY 2005. Over the two-year period, TT Division received 140 software disclosures; 44 of these were asserted for copyright.

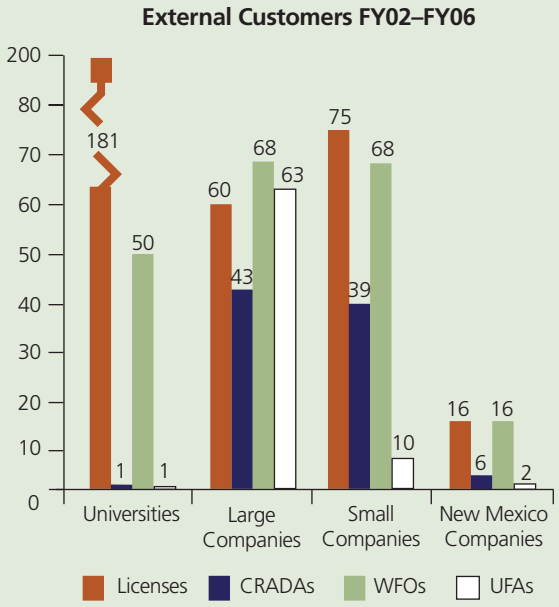
Licensing Activity

The Laboratory's licensing program continues to grow, as reflected by the number of newly executed licenses over the last two fiscal years. A total of 170 new fee-bearing licenses (including fee-bearing Bailments and Material Transfer Agreements) were executed over the past two fiscal years making this period the most productive in the Laboratory's licensing history.

The Laboratory earned over $3.1 million in license and royalty revenue during the past two fiscal years. A total of 124 commercial licenses and 25 noncommercial licenses were responsible for this income and, while valuation estimates were not available at this writing, the Laboratory also took equity in four new companies during this time period. Over half of this income was reinvested by the Laboratory for technology transfer, education, and R&D purposes. The balance was disbursed as personal income to Laboratory innovators.

External Customers

The figure at right shows that the bulk of TT Division's customer base in the five-year period between FY 2002 and FY 2006 was split between universities and large businesses. The Laboratory's technology transfer interactions with universities have been centered predominantly around the field of licensing, whereby most of these licensing agreements have been for Laboratory-developed software. The Laboratory's other significant external private industry customer is large business. Our large business interactions are somewhat evenly split across the four selected categories with the Work-for-Others interactions slightly ahead. This figure also shows the breadth of our customer base and the variety of agreements we have with both large and small companies and with New Mexico companies.



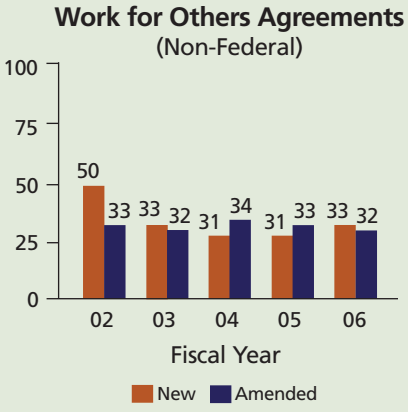
Sponsored Research

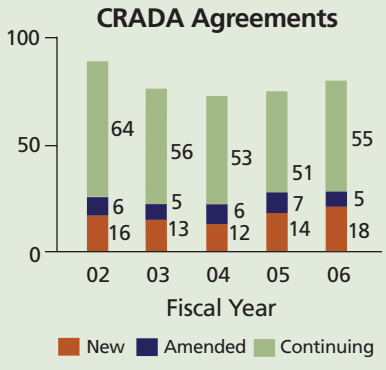
Work for Others

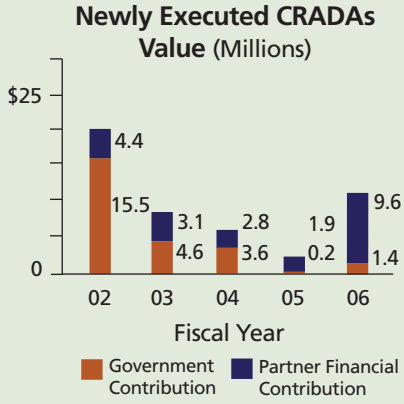
The Work-for-Others (WFO) agreement establishes a contract between a nonfederal partner and Los Alamos National Laboratory to perform a defined scope of work or list of tasks. The number of WFO agreements executed during FY 2005 and FY 2006 remained consistent with activity during the previous two years. The total value of amended agreements executed during this period exceeded the total value of new agreements for the first time since FY 2004, indicating tremendous satisfaction on the part of our research partners and bright expectations for future activities.

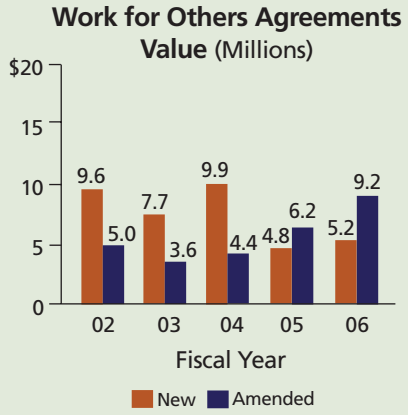
Cooperative Research and Development Agreements

Cooperative Research and Development Agreements (CRADAs), the contractual agreements that enable industry, academia, and/or a nonprofit entity to collaborate with the Laboratory and help it meet its programmatic goals and mission, dropped somewhat in FY 2005 for continuing and amended agreements while new agreements remained constant.



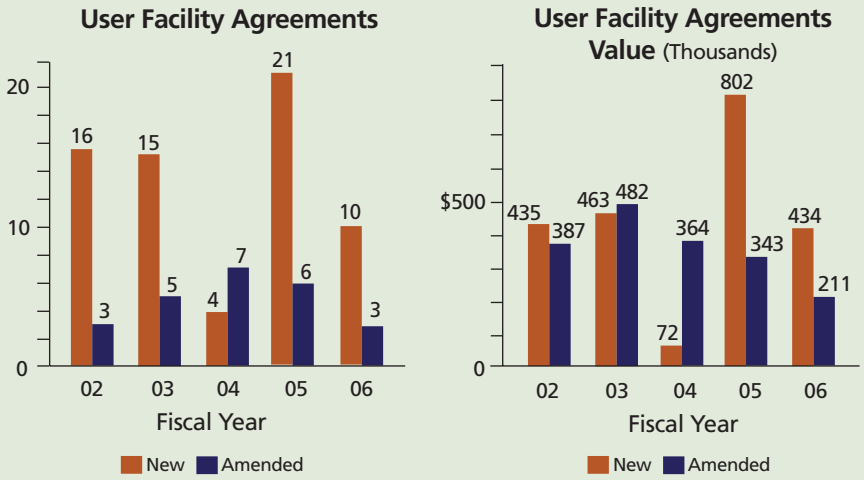






User Facility Agreements

The User Facility Program, which permits outside users, including scientists and engineers from industry, universities, and other governmental agencies, to conduct research using the Laboratory's unique facilities, skyrocketed in FY 2005 to over 550 percent above the previous year's activity with the value of these agreements increasing by 321 percent. Fiscal year 2006 saw a return of the program to realistically sustainable numbers. Two facilities within the Laboratory's catalog of facilities continue to lead the way in ability to attract usage. The Weapons Neutron Research facility and the Research Library—Library Without Walls—continue to experience significant use by commercial and academic entities.



Acronyms

AUTM	Association of University Technology Managers
CRADA	Cooperative Research and Development Agreement
DOE	Department of Energy
FLC	Federal Laboratory Consortium
IHFCR	Institute for Hydrogen and Fuel Cell Research
IP	intellectual property
LANS	Los Alamos National Security
NHMFL	National High Magnetic Field Laboratory
NMSU	New Mexico State University
P&G	Procter & Gamble
R&D	research and development
SBIR	Small Business Innovation Research
SDSU	San Diego State University
STTR	Small Business Technology Transfer
TAP	Trapped Annular Pressure
TMF	Technology Maturation Fund
TT	Technology Transfer
UC	University of California
UCSD	University of California, San Diego
UFA	User Facility Agreement
UNM	University of New Mexico
WFO	Work-for-Others Agreements

Agreement Types, Definitions, and Conditions

Agreement	Rights in Intellectual Property	Laboratory Resource Commitment	Industry Resource Commitment
Cooperative Research and Development Agreement (CRADA): Enables industry, academia, and non-profit entities to collaborate with the Laboratory for the purpose of joint R&D activities.	Rights to IP generated under a CRADA are negotiated separately.	When program dollars are available, the Laboratory cost shares. In the absence of program dollars, sponsor is responsible for full cost recovery.	Cost-shared through contributions of personnel, equipment, services, materials, facilities, and funds.
Non-Federal Work for Others (WFO) Agreement: Enables a non-federal partner to ask the Laboratory to perform a defined scope of work or list of tasks that draws upon the unique capabilities of the Laboratory. It may not place the Laboratory in competition with the private sector. (Also known as a funds-in agreement or a sponsored research and development agreement.)	Rights to Laboratory inventions generated under a WFO Agreement may be available to a sponsor under DOE's Class Waiver.	Personnel, equipment, materials, and facilities are used.	Sponsor covers the cost of all Laboratory work (including personnel and materials) to be completed under the Statement of Work signed by both parties.
Personnel Exchange Agreements: Industrial Fellow Agreements allow Laboratory staff members to work at a partner company.	All are subject to negotiation.	The Laboratory and partner cost-share the Industrial Fellow.	Partner pays percentage of salary; provides office space, laboratory, and associated support costs.
Industrial Assignment Agreements allow Laboratory staff members to work in the private sector.		Loan of Laboratory personnel (subject matter expert).	Company pays costs (salary and benefits) for Laboratory staff on assignment to company.
Industrial Staff Member Agreements allow private-sector staff to work at the Laboratory.		Office space, laboratory, and support costs for Industrial Staff Members assigned to the Laboratory.	Company pays costs for Industrial Staff Member assigned to the Laboratory.
User Facility Agreement: (UFA) Permits outside users from industry, universities, and other governmental agencies, to conduct research using the Laboratory's unique experimental research equipment and facilities.	User retains rights.	Partner covers all costs associated with using the facility for the tasks defined in the scope of work.	Partner covers all costs associated with using the facility for the tasks defined in the scope of work.
Non-Disclosure Agreement (NDA): Protects proprietary information exchanged between parties during initial interactions and discussions between the Laboratory and another party on specific technical areas.	None—no IP is generated by either party under an NDA.	None	None
Memorandum of Understanding (MOU) Nonbinding document signed by parties interested in pursuing a comprehensive agreement for the transfer of technology that defines specific technical areas of interest and the ground rules for interactions and discussions between the parties.	None—no IP is generated under an MOU.	None	None

New Inventions in 2005

Reduced AC Losses in HTS Coated Conductors
U.S. Patent 6,800,321

Method for Monitoring the Crystallization of an Organic Compound from a Liquid
U.S. Patent 6,800,487

Buffer Layers on Metal Alloy Substrates for Superconducting Tapes
U.S. Patent 6,800,591

Waveguide-Based Optical Chemical Sensor
U.S. Patent 6,800,677

Continuous Time-of-Flight Ion Mass Spectrometer
U.S. Patent 6,806,467

Single Rotor Turbine
U.S. Patent 6,807,802

Direct Methanol Fuel Cell and System
U.S. Patent 6,808,838

In-Situ Leak Testing of Glovebox, Isolator, or Containment Unit Gloves
U.S. Patent 6,810,715

Optical Amplifiers and Lasers
U.S. Patent 6,819,692

Water Purification Using Organic Salts
U.S. Patent 6,821,439

Monitoring
U.S. Patent 6,822,238

Low-Temperature Synthesis of Actinide Tetraborides by Solid-State Metathesis Reactions
U.S. Patent 6,830,738

Use of Prolines for Improving Growth and Other Properties of Plants and Algae
U.S. Patent 6,831,040

Automated Video-Microscopic Imaging and Data Acquisition System for Colloid Deposition Measurements
U.S. Patent 6,836,559

Piperazine-Based Nucleic Acid Analogs
U.S. Patent 6,841,675

High Temperature Superconducting Composite Conductors
U.S. patent 6,843,898

Composition and Method for Removing Photoresist Materials from Electronic Components
U.S. Patent 6,846,789

Electrolytes for Electrooptic Devices Comprising Ionic Liquids
U.S. Patent 6,853,472

Method and Apparatus for In-Process Sensing of Manufacturing Quality
U.S. Patent 6,857,553

Method and Apparatus for Detecting Chemical Binding
U.S. Patent 6,858,148

Reversible Electrooptic Device Employing Aprotic Molten Salts and Method
U.S. Patent 6,862,125

Improved Direct Methanol Fuel Cell Stack
U.S. Patent 6,864,004

Method for Determining and Modifying Protein/Peptide Solubility
U.S. Patent 6,867,042

Biaxially Textured Composite Substrates
U.S. Patent 6,884,527

Noninvasive Characterization of a Flowing Multiphase Fluid Using Ultrasonic Interferometry
U.S. Patent 6,889,560

Method and Apparatus for Biological Material Separation
U.S. Patent 6,890,740

Influenza Sensor
U.S. Patent 6,893,814

Electron Radiography
U.S. Patent 6,894,278

Dual Ion-Beam Assisted Deposition of Biaxially Textured Template Layers
U.S. Patent 6,899,928

Capillary-Discharge Based Hand-Held Detector for Chemical Vapor Monitoring
U.S. Patent 6,900,734

System Level Analysis and Control of Manufacturing Process Variation
U.S. Patent 6,901,734

Fast Pulse Nonthermal Plasma Reactor
U.S. Patent 6,906,280

Production of Stable, Nonthermal Atmospheric Pressure RF Capacitive Plasmas Using Gases other than Helium or Neon
U.S. Patent 6,909,237

Canister, Sealing Method and Composition for Sealing a Borehole
U.S. Patent 6,910,537

Method for Brazing and Thermal Processing
U.S. Patent 6,917,010

Substrate Structure for Growth of Highly Oriented and/or Epitaxial Layers Thereon
U.S. Patent 6,921,741

Borehole Sounding Device with Sealed Depth and Water Level
U.S. Patent 6,923,252

Likelihood-Based Modification of Experimental Crystal Structure Electron Density Maps
U.S. Patent 6,931,329

High Temperature Superconducting Thick Films
U.S. Patent 6,933,065

Method for Contour Extraction for Object Representation
U.S. Patent 6,937,765

Diamond Silicon Carbide Composite and Method for Preparation Thereof
U.S. Patent 6,939,506

Particle Sizer and DNA Sequencer
U.S. Patent 6,942,773

Superconducting Structure
U.S. Patent 6,943,136

Cross-Linked Polybenzimidazole Membrane for Gas Separation
U.S. Patent 6,946,015

Meniscus Membranes for Separation
U.S. Patent 6,946,019

Apparatus and Method for Handheld Sampling
U.S. Patent 6,947,8 505-66

Microporous Crystals and Synthesis Schemes
U.S. Patent 6,949,238

New Inventions in 2006

Sample Desorption/Ionization from Mesoporous Silica
U.S. Patent 6,958,480

Noninvasive Characterization of a Flowing Multiphase Fluid using Ultrasonic Interferometry
U.S. Patent 6,959,601

Durable Electrooptic Devices Comprising Ionic Liquids
U.S. Patent 6,961,168

Methods of Conditioning Direct Methanol Fuel Cells
U.S. Patent 6,962,760

Method for Detecting Biological Agents
U.S. Patent 6,979,543

Fuel Cell Stack with Passive Air Supply
U.S. Patent 6,986,961

Buffered Coscheduling for Parallel Programming and Enhanced Fault Tolerance
U.S. Patent 6,993,764

Multilayer Composites and Manufacture of Same
U.S. Patent 6,994,775

Cross-Linked Polybenzimidazole Membrane for Gas Separation
U.S. Patent 6,997,971

Method for Producing Carbon Nanotubes
U.S. Patent 6,998,103

Methanol-Tolerant Cathode Catalyst Composite for Direct Methanol Fuel Cells
U.S. Patent 7,014,931

Influenza Sensor
U.S. Patent 7,018,792

Foil Electron Multiplier
U.S. Patent 7,019,446

Processing Materials Inside an Atmospheric-Pressure Radiofrequency Nonthermal Plasma Discharge
U.S. Patent 7,025,856

Through-the-Earth Radio
U.S. Patent 7,043,204

Radial-Radial Single Rotor Turbine
U.S. Patent 7,044,718

Method and Apparatus for Elemental and Isotope Measurements and Diagnostics—Microwave Induced Plasma-Cavity Ringdown Spectroscopy
U.S. Patent 7,054,008

Diamond-Silicon Carbide Composite
U.S. Patent 7,060,641

Nonthermal Plasma Processor Utilizing Additive-Gas Injection and/or Gas Extraction
U.S. Patent 7,063,819

Electrochromic Salts, Solutions and Devices
U.S. Patent 7,064,212

Preparation of DNA-Containing Extract for PCR Amplification
U.S. Patent 7,074,565

Chemical Synthesis of Chiral Conducting Polymers
U.S. Patent 7,074,887

Preparation of High-Strength Nanometer Scale Twinned Coating and Foil
U.S. Patent 7,078,108

Neutron and Gamma Detector Using an Ionization Chamber with an Integrated Body and Moderator
U.S. Patent 7,078,705

Letter-Box-Line Blackener for the HDTV/Conventional Analog Hybrid System
U.S. Patent 7,079,192

Vision-Based Obstacle Avoidance
U.S. Patent 7,079,924

Apparatus and Method for Temperature Correction and Expanded Count Rate of Inorganic Scintilation
U.S. Patent 7,081,626

Oxygen-Consuming Chlor-Alkali Cell Configured to Minimize Peroxide Formation
U.S. Patent 7,083,708

Catalysts for Lean Burn Engine Exhaust Abatement
U.S. Patent 7,083,765

Method for Removing Atomic-Model Bias in Macromolecular Crystallography
U.S. Patent 7,085,653

Identification Coding Schemes for Modulated Reflectance Systems
U.S. Patent 7,095,311

Methanol-Tolerant Cathode Catalyst Composite for Direct Methanol Fuel Cells
U.S. Patent 7,101,635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