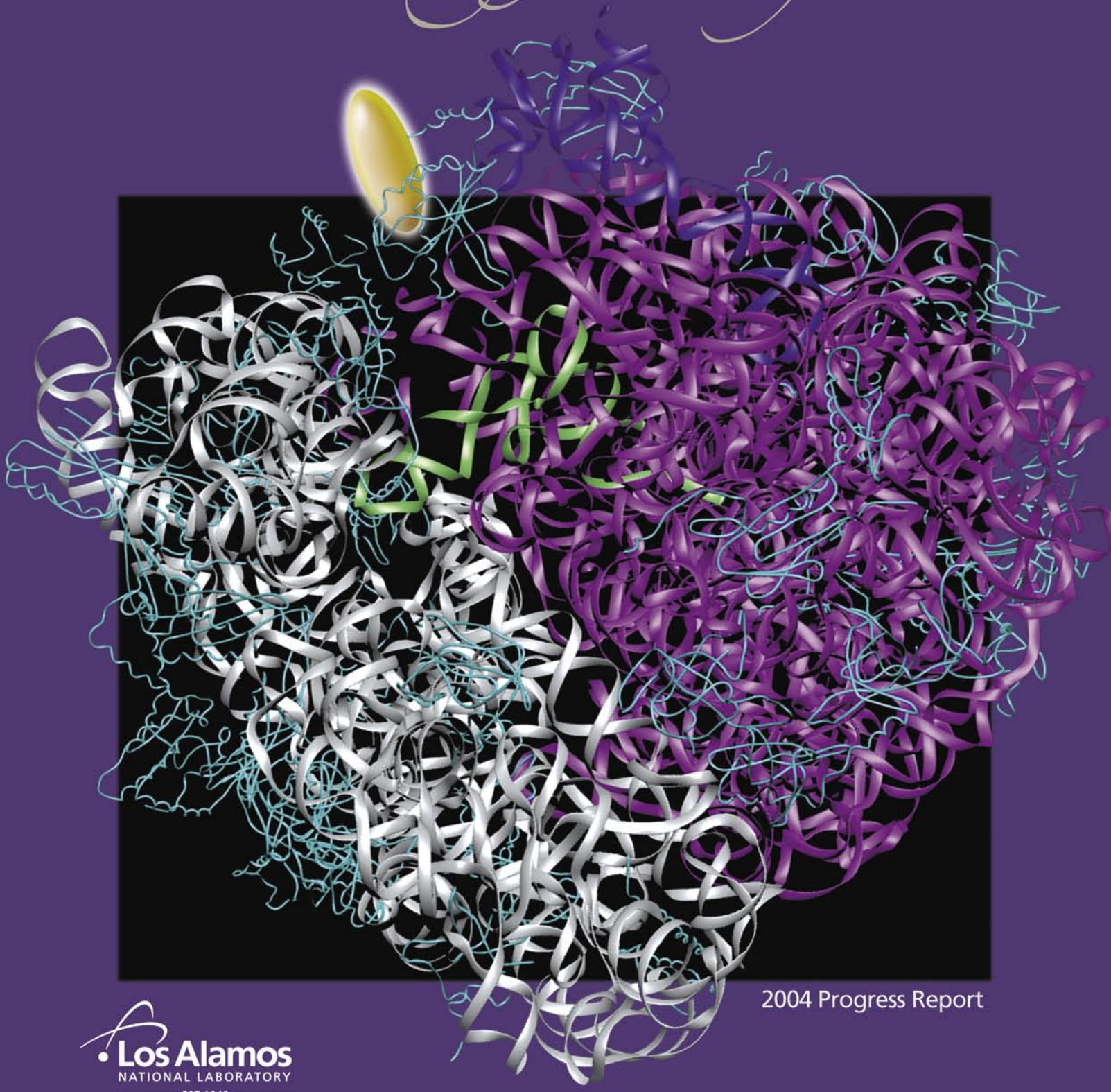
LOS ALAMOS NATIONAL LABORATORY

Technology Transfer



2004 Progress Report

Los Alamos
NATIONAL LABORATORY
EST. 1943

LALP-05-058

About the Cover: *A fluorescing drug molecule (glowing gold oval) binds to a protein (twisted-and-coiled thin teal "rope") within a "ribbon" representation of a bacterial ribosome, a frequent target for antibiotic drugs. This binding of the native drug to protein molecule would be unambiguously detected by MESA (measuring enzyme-substrate affinities) label-free measurement technology, one of the many technologies the Laboratory has licensed to the private sector for commercialization.*

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Los Alamos
NATIONAL LABORATORY

Los Alamos National Laboratory

From its origins as a secret Manhattan Project laboratory, Los Alamos has attracted world-class scientists and applied their energy and creativity to solving the nation's most challenging problems. That tradition remains today. As one of the U.S. Department of Energy's multi-program, multi-disciplinary research laboratories, Los Alamos thrives on having the best people doing the best science to solve problems of global importance.

The University of California, which has operated the Laboratory since its founding by UC physicist J. Robert Oppenheimer, has contributed significantly to the scientific quality of the Laboratory's work and technical staff. The UC tradition of world-class science has always been 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 nation's nuclear stockpile. As a national research laboratory, success depends on remaining at the forefront of multi-disciplinary and robust science.

The Laboratory's ability to remain at the leading edge of discovery in science and technology is enhanced by ongoing collaborations with industry, academia, and other laboratories. Laboratory-industry partnerships bolster the U.S. economy and increase the nation's global competitiveness.

As one of the largest employers in Northern New Mexico, the Laboratory employs over 13,000 people—8,000 UC personnel, more than 3,500 contractor personnel, and approximately 1,800 postdoc and student personnel—with an annual budget of $2.2 billion. With its salary and benefits, statewide procurements, and community development programs, the Laboratory, represents significant economic impact for the region and the state. 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 come to Los Alamos from all over the world as visitors to participate in scientific projects.

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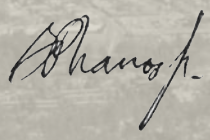
Introductory Messages

Laboratory Perspective

Technology transfer is an important part of the Los Alamos National Laboratory mission. Our innovators have continually demonstrated that our world-class scientific achievements can and do serve the nation by helping to strengthen economic security through enhancement of U.S. industrial competitiveness. The Laboratory's reputation for excellence—earned through more than 60 years of scientific contributions to the nation—helps ensure trust in our ability to continue generating exceptional work to meet the challenges of a rapidly changing world. The efforts of our innovators to engage in technology transfer activities help the Laboratory attract new employees, program sponsors, and collaborators. These activities contribute to the accomplishment of our Laboratory mission and support not only our reputation for scientific excellence but also our efforts to achieve excellence in business and operations.

As we approach the twenty-fifth anniversary of "The Patent and Trademark Law Amendments Act," better known as Bayh-Dole, which provided the incentive for universities and nongovernmental institutions to patent their discoveries and license new technology for development into useful products, we take great pride in the level of interaction Los Alamos has been able to achieve with the private sector. Effective technology transfer ensures that the technology, knowledge, and information developed at the Laboratory are applied in applications that benefit society and contribute to our nation's economic competitiveness in which technology innovation is a critical component. It is this type of dedication and engagement with the external business community, both regional and national, that will help Los Alamos National Laboratory flourish in the years to come.



G. Peter Nanos, Jr.
Laboratory Director

Technology Transfer Division Perspective

The past year has been both an exciting and challenging time at Los Alamos National Laboratory. While the National Nuclear Security Agency is competing the contract to operate the Laboratory, the University of California and the Laboratory remain committed to aggressive pursuit of the mission activities, including technology transfer. This progress report provides several different views of commercial activities at Los Alamos.

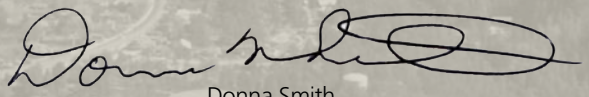
The first view provides a look at technologies that have been implemented in industry and the commercial sector as products. The fuel cell program at the Laboratory has contributed many fundamental technologies to industry from fuel cell stack designs through electrically conductive bipolar plate materials. Software for numerous applications from pattern recognition, manufacturing reliability, and chemical tracking to image compression has been implemented by a variety of companies in the private sector.

Laboratory technologies with strong commercial potential were again recognized by *R&D Magazine* as five new technologies received R&D 100 Awards in 2004. Since 1978, when the Laboratory first entered the R&D 100 Award competition, Los Alamos has received 94 awards.

The second view of commercial activities at the Laboratory focuses on our current research efforts and programs to encourage innovation and engage our staff in commercialization. In 2004, we had 183 different active research projects with industry and other collaborators. We continued our programs to support and encourage commercialization including training, education, and information sessions for Laboratory staff who wish to learn more about the commercialization process.

The third view of Laboratory technology transfer activities is from Northern New Mexico. We understand the large impact the Laboratory has on the economic health of Northern New Mexico. Therefore, we actively encourage the creation and growth of regional businesses using Laboratory technology and expertise. Regional companies that produce hardware and technology for nuclear detection and monitoring, drug screening, and flash computed tomography are all now in the market, thanks to the efforts of our regional spinoffs. Alternatively, we are expanding the capacity of the Cumbres and Toltec Scenic Railroad through equipment from the Laboratory, which will also be the foundation of a new training program venture between the railroad and Northern New Mexico Community College.

These and many other activities were successfully completed despite one of the most challenging times at the Laboratory. The contract competition and suspension of Laboratory operations for several weeks to address safety and security concerns slowed many operations and delayed a number of agreements. While these caused disruptions in all Laboratory operations, the Technology Transfer Division and Laboratory staff remained committed to commercialization of Laboratory research and technology and engagement in development of the Northern New Mexico economy.



Donna Smith
Technology Transfer Division Leader

During 2004, the Technology Transfer Division launched an online search capability for its licensing database providing easy access to hundreds of Lab technologies available for licensing at www.lanl.gov/partnerships/licensing/technologies.

Technologies to Market

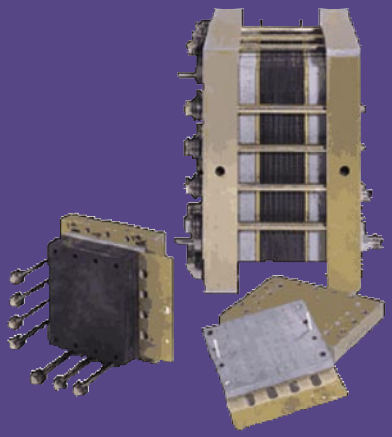
While the primary business of Los Alamos National Laboratory is research and development related to our national security mission, this R&D often results in inventions that can be patented or copyright protected and licensed to industry for product development or process enhancement. During 2004, a number of Los Alamos technology-based products were in the marketplace, contributing to U.S. economic competitiveness and growing the global economy. Additional Los Alamos technologies in the market are described in the Regional Economic Development and Entrepreneurial section to highlight how they contribute to the Laboratory's contributions to regional business growth.

Seeing is Believing

In 2003, Leica Geosystems HDS Inc. (formerly Cyra Technologies) introduced the **HDS 3000**, 3D Laser Scanner used in High-Definition Surveying (HDS) to the market. The HDS 3000 is the third generation of a product introduced in 1998 that uses sub-microsecond interval timing technology (the "Offset Stabilizer for Comparator Output" patent) licensed from Los Alamos. The HDS 3000 is attractive for a broader range of everyday, as-built, detail and engineering surveys for civil, architectural, and plant projects. The new product works up to 80% faster than its predecessor. The maximum vertical 270° field of view can be achieved without moving or re-orienting the tripod setup, which has significant advantages when capturing detail on objects with vertical relief such as bridges, buildings and plants. The Los Alamos technology contributes the ability to maintain the high accuracy of 6 mm at 50 m (1.5 mm for extracted targets), reducing or eliminating costly return visits to a site. It also contributes to more accurate, complete as-builts for retrofit design projects, which translates into better retrofit designs. This sub-microsecond interval timing ensures that each interval is absolutely equal to other intervals. Such accurate measurements from period to period are required in instrumentation used in the weapons program at Los Alamos.

Compounding Enhances Conductivity

A bulk molding compound (BMC), introduced to the market as **BMC 940** by Bulk Molding Compounds, Inc. in 1999, was developed at the Laboratory to enhance electrical conductivity for fuel cell applications. Los Alamos licenses the intellectual property for the graphitized vinyl ester bipolar plate material to BMCI. BMC 940 is an electrically conductive bulk-molding compound that offers corrosion and creep resistance and high thermal and electrical performance at a significantly lower cost than metals. BMC 940 addresses the requirements of bipolar plates for the emerging residential and automotive fuel cell market.



BMC 940 is used for molding detailed bipolar plates used in fuel cells.

It is ideal for the molding of highly detailed bipolar plates because the composite provides extreme part flatness and dimensional stability at elevated operating temperatures. Applications also include semiconductor chip processing trays and circuit board racks.

Low Voltage Fuel Cell Applications

In August 2004, the Laboratory signed a nonexclusive license agreement with the Japanese company Daido Metal Co., Ltd. giving Daido rights to develop a portion of the Laboratory's fuel cell portfolio for the **Annular Feed Air Breathing Fuel Cell Stack.** Laboratory researchers Mahlon Wilson and Jay Neutzler developed the unique, cylindrical fuel cell design that is ideal for low-voltage, low-power applications such as flashlights, laptop computers, remote-controlled toys and radios. Daido, a bearing manufacturer, developed a fuel cell for cellular phones in 2000 and is currently marketing lighting fixtures and toy cars powered by fuel cells that get hydrogen from an attached gas canister. The company is also working with Honda Motor Co., Ltd. on the development of capacitors as a supplementary power source for fuel cell automobiles.

Streamlining Safeguards Monitoring Equipment

Los Alamos licensed its **Advanced Multiplicity Shift Register (AMSR)** copyright portfolio to the ORTEC® business unit of AMETEK Advanced Measurement Technology, Inc., a leading global manufacturer of electronic instruments and electric motors with annual sales in excess of $1 billion in 2000. AMETEK now markets the **AMSR-150** product to meet today's needs in neutron coincidence counting in nondestructive assay and safeguards applications. The AMSR-150's easy-to-carry packaging makes it highly suitable for use in mobile applications such as safeguards inspections. It incorporates the latest generation of Los Alamos **Intelligent Shift Register (ISR)** electronics in a package specified in collaboration with the IAEA.

Counting on Los Alamos Counters

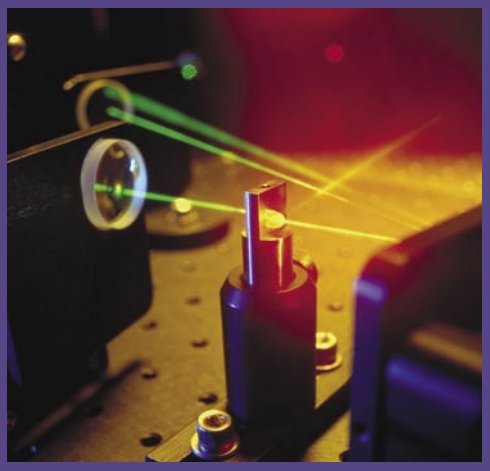
The Laboratory has been involved in technical collaborations with Canberra Industries, Inc., a leading international supplier of analytical instruments, systems, and services for radiation detection and monitoring for more than a decade. At least 10 of Canberra's commercial products incorporate or are based on technologies the company licenses from Los Alamos. These products include neutron coincidence counters (e.g., the Portable Shift Register, PSR), continuous air monitors, gamma ray and neutron detectors—GRaND and **MiniGRaND**—and monitors, and Neutron-Assay, PSR, and Fixed Energy Response Function Analysis with Multiple Efficiency software.

Lighting the Way

A patent jointly held by Los Alamos and Sandia National Laboratories for the "method and apparatus for measuring the intensity and phase of an ultra short light pulse" is used in the FROG (Frequency Resolved Optical Gating) part of the **Ultrafast Amplifier Systems** marketed by Coherent Inc. Coherent is a world leader in providing photonics based solutions to the commercial and scientific markets.

MiniGRaND

The Miniature Gamma Ray and Neutron Detector electronics package (MiniGRAND) is one of the latest developments in a new generation of the Mini-Instrument family that has evolved over the last several years. Originally developed by Los Alamos National Laboratory's Safeguards Science and Technology group, the MiniGRAND is a compact, modular instrument intended primarily for measuring and monitoring gross gamma rays and neutrons. The MiniGRAND is the first LANL-designed instrument designed specifically for unattended monitoring applications. It can also be used in attended mode using a terminal emulator (low-level interface) or a front panel emulator (high-level interface). The MiniGRAND may be configured as a benchtop instrument or as a board stack that can be built into integrated detectors. Its small size and low power allow the unit to be mounted close to the detector, preferably in a sealed boundary shared by the detector and MiniGRAND.



Ultrafast Amplifier Systems by Coherent, Inc.

Chemical Tracking Improves Safety in the Workplace

A chemical software input database developed at Los Alamos and licensed by ChemSW, Inc. is being marketed under the name **ECID™** for "Everybody's Chemical Inventory Database." ECID™ is a database of 53,000 chemical mixtures containing hazard, health, and physical properties and National Fire Protection Association ratings for some of the most common chemicals used in the laboratory. The ECID™ database contains most of the information needed to populate the CIS (Chemical Inventory System)–CISPro® program, a high-performance, relational database system for tracking chemicals and other laboratory supplies. ChemSW is a worldwide leader in asset management software for laboratories.

A New Approach to Manufacturing Reliability

PowerFactoRE is the result of a very successful, long-term, cooperative research and development agreement between Los Alamos and manufacturing giant Procter & Gamble. PowerFactoRE has created a paradigm shift in manufacturing. It comprises a unique set ("toolkit") of proven reliability engineering methods, statistical and analytical tools, simulation software, customized procedures, and training to help manufacturing line managers understand reliability losses and prevent problems before they occur. PowerFactoRE incorporates intellectual property licensed by the Lab to P&G. The product, which has helped P&G streamline its manufacturing operations and realize significant cost savings, is currently being licensed to other manufacturers through P&G's marketing partner BearingPoint.

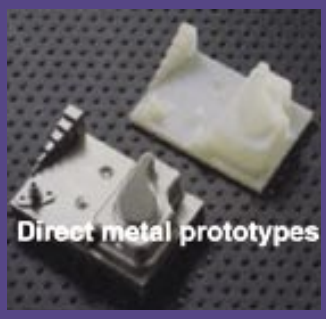
MrSID streamlines image processing for Geographic Imaging Systems.

Imaging the Future

Los Alamos licensed **MrSID (Multiresolution Seamless Image Database)** to LizardTech, Inc., in the mid 1990s. LizardTech focuses on developing software solutions that make it significantly easier to manage, distribute and access digital content such as aerial photography, satellite imagery, and scanned color documents. MrSID is currently used in the product GeoExpress, which creates, manages, accesses, and distributes massive geospatial imagery more quickly and cost-effectively than competitors. GeoExpress with MrSID streamlines image processing and sets a new standard in functionality and interoperability giving geospatial professionals the most from their geospatial imagery. It is supported in more than 300 GIS applications and used in millions of desktops around the world with exabytes (2^{60} bytes) of MrSID data around. GeoExpress is heavily used by clients such as the National Geospatial Intelligence Agency, United States Department of Agriculture, and many state and local government agencies.

Casting the Die

In 2004, the Laboratory successfully completed negotiations with The POM Group, Inc., for an exclusive license to a portfolio of patents relating to **Directed Light Fabrication** technology for rapidly fabricating metal components. The POM Group has a product called Direct Metal Deposition (DMD™) that uses the licensed patents. DMD™ is a laser-based, revolutionary, additive metal process that fabricates fully dense, highly accurate molds and dies in record level lead times. The first major advance in metalworking in decades, DMD™ produces tooling with superior material properties in less time and at a lower cost than is possible with traditional fabrication technologies, increasing productivity in the molding, die-casting, hydro-forming, forging, and stamping industries. The company specializes in the design and build of mission critical tooling systems used to cast, stamp, or injection mold high volume products.



Technology Maturation Fund

The Technology Transfer Division's Technology Maturation Fund was established in December 2002 to help Los Alamos technologies mature from laboratory scale to the prototype stage necessary for potential commercialization.

Bringing Small-Scale Science to the World

The Technology Maturation Fund, derived from a combination of licensing/royalty revenues and monies earmarked for this purpose under Appendix M of the Laboratory's prime contract with UC, awards moderate dollar amounts (up to $50,000) to technologies on the cusp of commercialization. Generally, a prototype must be built or perfected, computer code written, or a concept that works in the lab proven out in a near-commercial product.

The Tech Mat Fund provides funding through a competitive proposal process. In the last two years, 46 proposals involving 80 technical staff members in 11 different divisions have been evaluated and 24 have been funded at an average project size of about $38,000. Approximately 40% of the proposals have come from the Materials Science and Technology Division and the Chemistry Division. Proposals are accepted every month with average time from proposal submission to funding being six weeks. Within approximately two weeks, every proposal receives detailed written feedback. In several instances, rejected proposals have been improved, resubmitted, and funded because they have become better aligned with strategic objectives. Perhaps most importantly, the results of these small projects have been significant compared to the funding with six new invention disclosures, six technology licenses, and three industry cooperative research and development agreements (CRADAs) attributed to Tech Mat funded projects.

The Tech Mat Fund proposals funded in 2004 include the following:

- Tape Casting of Mixed Potential Sensors
- High Power Density Direct Methanol Fuel Cell Stack
- Nucleic Acid-Based Dipstick for Clinical Disease Diagnosis and Field-Use Pathogen Identification
- Light Emitting Devices Using Hybrid Colloidal Semiconductor Nanocrystals/ Epitaxial GaN Structures
- Plasma-Assisted Combustion Demonstration
- Autonomous Robot based on the Cat's Visual System
- Bugbrowser Software
- Desorption/ionization Mass Spectrometry from Mesoporous Silica

Awardee Moves Toward Commercialization

Electrochromic Rearview Mirrors

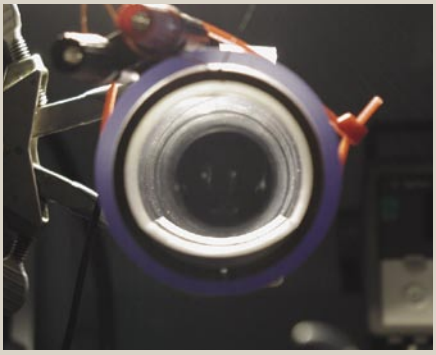
The purpose of this project was to build and test prototype electrochromic rearview mirrors based on ionic liquid technology. These mirrors have better durability and coloration evenness properties than existing propylene carbonate based mirrors. During the project, mirrors were built, tested in the lab, and tested in automobiles. When the project was proposed, the technology was already the subject of licensing inquiries. During the course of the project, the automotive engineering firm ElectroChromiX, Inc. exclusively licensed all four patent applications covering the technology. This project, in conjunction with the extensive engineering work performed by ElectroChromiX, has allowed the company to approach major automotive parts manufacturers to explore options for large-scale manufacturing, including acquisition of ElectroChromiX or sublicensing of the technology.

Examples of electrochromic rearview mirrors

Awardee Moves Toward Commercialization

Acoustic Concentrator for Engine and Machine Exhaust

The goal of this Tech Mat funded project was to help move the technology closer to a marketable state by testing the technology, which generates focused, resonance-based sound pressure to concentrate aerosols, under a variety of environmental conditions. Relying on an inexpensive, low maintenance, piezoelectric device, researchers use sound pressure to locally concentrate many types of aerosols ranging from smog particulates to suspended microorganisms, allowing hazardous and toxic pollutants to be isolated for analysis. The grant enabled the team to evaluate its quasi-elliptical line of concentrators with extremely promising results. The team is currently working with a commercial enterprise very interested in the technology to test its effectiveness on diesel exhaust systems.



Suspended against the force of gravity by sound pressure, a ring of aerosol droplets hovers within the cavity of the quasi-elliptical cylinder.

"The objective of the Technology Maturation Fund is to provide small amounts of funding for highly focused projects to move early stage technologies along the road to commercialization," notes Erica Sullivan, fund administrator.

The Tech Mat Fund is an example of a successful strategy to promote Los Alamos technologies. Unlike many types of funding within the Laboratory, these awards are not for a specific time period but rather to achieve a specific milestone in a defined development path leading to commercialization. The funds are meant to remove specific hurdles to development of early stage technologies in the Laboratory.

For Los Alamos researcher John Ramsey and his team the Tech Mat Fund was just what they needed to build a prototype fuel cell stack to prove their technology and to fulfill the requirements of a small Colorado company, Mesoscopic Devices, working under contract to the Army.

Soon after Ramsey's team successfully completed its working prototype, the design was transferred to Mesoscopic for use under a government use agreement with the Laboratory. According to Ramsey, Mesoscopic's Los Alamos-based fuel cell stack has the highest power-to-weight ratio on the market. "It was that number and the clean packaging that attracted Mesoscopic," said Ramsey.

Direct methanol fuel cell/battery hybrid integrated power system developed by Mesoscopic Devices, LLC in collaboration with Los Alamos National Laboratory.

Photo courtesy of Mesoscopic Devices, LLC.

Recognizing Excellence

Throughout the year Los Alamos researchers have multiple opportunities to gain recognition for the value of their inventions to the rest of the world through awards specifically designed to recognize technology transfer. One of the most popular and prestigious competitions is sponsored by* R&D Magazine*. During 2004, Los Alamos inventors also received recognition from* The Wall Street Journal*, the Council for Chemical Research, and honors bestowed annually upon Laboratory employees whose work has received a patent or been licensed during the preceding year.

R&D 100 Awards

The Technology Transfer Division coordinates Laboratory participation in *R&D Magazine's* annual R&D 100 Awards competition by submitting the Lab's most innovative technologies available for commercialization during the past calendar year. The competition, which celebrated its 42nd year during 2004, 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 before they are entered. Entries are strengthened when private-sector interests such as CRADAs, joint ventures, licenses or other contractual industrial arrangements exist. The R&D 100 Awards competition is the only industry-wide competition recognizing the practical applications of science.

Entries are judged by technical experts selected by the Chicago-based magazine, which uses technical and commercial criteria to select the 100 most significant, unique, or promising entries from the nominated field. Projects span a diverse range of scientific and technical areas—from software, analytical instruments, energy systems and life science to materials, thin films, and nanotechnologies. Los Alamos has been competing successfully since 1978 with many of its winning technologies developed in collaboration with private-sector companies and other scientific institutions. In 2004, the Laboratory won **five awards,** bringing the total number of awards won by Los Alamos to 94, more than any other national laboratory has received.

Laboratory Captures Five R&D 100 Awards

10-Gigabit Ethernet

The 10-Gigabit Ethernet is a network card developed by the Laboratory and Intel Corporation that delivers information electronically at speeds 148,000 times faster than a modem connection and more than 23,000 times faster than a DSL connection. This innovation has the potential to vastly increase the speed of electronic transmissions and data transactions,

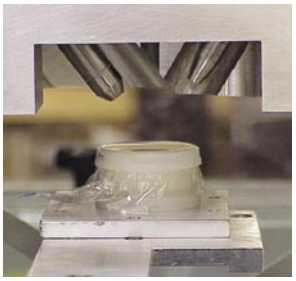
Wall Street Journal

Technology Innovation Award Recognition

Clustermatic, a Laboratory-developed software suite for managing and operating cluster-based supercomputers, was selected in the fall of 2004 by *The Wall Street Journal, The Wall Street Journal Europe,* and *The Asian Wall Street Journal* as a runner-up in the software division of the first WSJ global Technology Innovation Awards competition. The awards recognize technological breakthroughs by individuals, companies, and organizations around the world in a wide range of areas, including medicine, software, hardware, the Internet, wireless and broadcasting.

The Laboratory's Clustermatic Team from Computer and Computational Sciences, led by Ron Minnich, was also the recipient of a 2004 R&D 100 Award. Innovations are required to break with conventional processes and should go beyond marginal improvements in existing products and services. Judges, who included CEOs of major corporations and high ranking members of academia, were drawn to large impact technologies presenting big challenges—novel solutions rather than modest improvements, and entries supported by rigorous data from real-world performance. The judges selected Gold, Silver and Bronze winners overall, as well as a winner in each of the 12 industry categories, plus 23 runners-up and two honorable mentions. Winners and runners-up come from the U.S., Canada, Finland, Israel, Japan, the Netherlands, Portugal, Singapore and the United Kingdom.

such as those that take place in commerce, banking, medicine, scientific modeling and simulation and even the Internet.

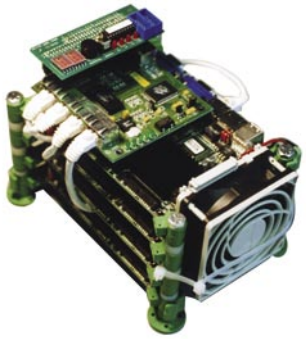


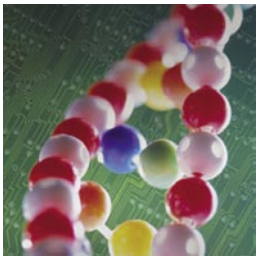
Confocal X-Ray Fluorescence Microscope

The Confocal X-Ray Fluorescence Microscope is an analysis instrument capable of doing elemental depth profiles and three-dimensional elemental images of material composition. The microscope uses X-ray fluorescence to nondestructively measure concentrations of elements within a small area. The instrument could be used for crime scene evidence analysis, and the *in situ* analysis of fine-art paintings.

Clustermatic

Clustermatic is a revolutionary software suite for managing, monitoring, administering and operating clusters on network-connected computers running as a high-performance system. Clustermatic increases reliability and efficiency, decreases node autonomy, simplifies computer programming, reduces administration costs, and minimizes a user's reliance on unpredictable software, enabling commodity-based cluster networks to compete with the higher-cost supercomputers.



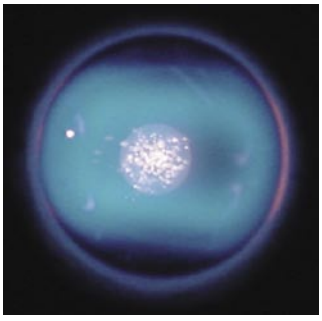


mpiBLAST

mpiBLAST is an open-source enhancement of BLAST, an open-source software package distributed by the National Center for Biotechnology Information that has become the ubiquitous genomic-sequencing tool in molecular biology. mpiBLAST reduces the search time of a genomic sequence from nearly 1,346 minutes (or 22.4 hours) to less than seven minutes. Such substantial time reductions could decrease costs in the field of genomic sequencing.

Plasma-Torch Production of Spherical Boron Nitride Particles

Crystalline boron nitride has the highest thermal conductivity of any ceramic. As the name implies, the plasma-torch production of spherical boron nitride particles technology is an innovative method for producing particles that can be used as filler in integrated circuit packages, enabling electronic devices to run cooler and faster. The method is useful for producing a variety of materials beyond spherical crystalline boron nitride, including carbon nanotube threads with high strength-to-weight ratio for ropes, metallic and carbon-coated nanoparticles for fast burning fuel components, and even oxide nanoparticles, that might be used for a next-generation class of armor.



Council for Chemical Research Recognizes Collaboration Success

Researchers from the Laboratory's Decisions Applications Division, who have worked for nearly a decade in collaboration with Proctor & Gamble, received a government/industry collaboration award from the Council for Chemical Research (CCR) in 2004. The Collaboration Success Award was presented at CCR's annual meeting in Tampa, Fla., to the developers of the PowerFactoRE suite of reliability engineering tools for optimizing the manufacturing process.

Emerging as the result of an extremely timely and successful collaboration between P&G and the Laboratory, the PowerFactoRE toolkit was created and adapted to address manufacturing problems for P&G.

Technology Transfer Division Leader Donna Smith notes, "The joint discovery and major breakthrough of PowerFactoRE would not have happened if P&G had not had the foresight to divert from their usual research partners to a much less likely collaboration with Los Alamos. It was truly a surprising connection that proved to be mutually beneficial."

The PowerFactoRE methods and tools, which have been proven effective in small-scale nuclear materials processing applications in the DOE complex, have been successfully applied to large-scale manufacturing processes and currently are being applied to a variety of other large-scale industrial processes. Software licensed by Los Alamos to P&G is a component of the toolkit that P&G uses in 200 of its plants worldwide. P&G claims savings of more than $1 billion and today licenses the PowerFactoRE toolkit to other manufacturers through its marketing partner BearingPoint.

The CCR Collaboration Success Award recognizes a collaborative team that has made outstanding contributions to the progress of chemistry-related science and/or engineering. The CCR award is not the first for the PowerFactoRE team; the technology was one of the Laboratory's eight R&D 100 Award winners in 2003.

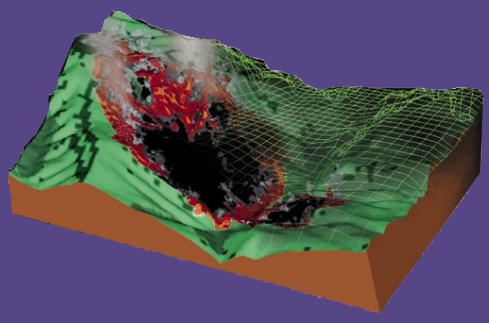
Federal Laboratory Consortium Honors Los Alamos Employees and Technologies

In 2004, five Laboratory employees received recognition from the Federal Laboratory Consortium for accomplishments in technology transfer and one received recognition for outstanding work as a member of the FLC executive committee.

Regional Awards for Tech Transfer Activities

Chemistry Division technical staff member Ben Warner received a Mid-Continent Region Distinguished Service Award for his entrepreneurial activities and two Los Alamos technologies received Notable Technology Achievement awards: **FIRETEC** and the **Reagentless Optical Biosensor (ROB)**. FIRETEC, developed by Earth and Environmental

Left to right, Charley Eberhard from Proctor & Gamble receives the Collaboration Success Award from Dady Dadyburjor of the Council for Chemical Research, as Mike Hamada from Los Alamos National Laboratory looks on.



FIRETEC creates physics-based, 3D, wildfire models.

Sciences staff member Rodman Linn, is a physics-based, three-dimensional (3D) computer code designed to simulate the constantly changing, interactive relationship between fire and its environment. ROB, is a hand-held biosensor that quickly identifies and quantifies pathogenic proteins in complex fluid samples such as serum. The ROB team was represented by co-team leader Basil Swanson of the Bioscience Division.

Since the focus of this year's FLC Mid-Continent Region meeting was on clean cities, emergency response, public safety, fuel reduction and fire fighting technologies, the winning Los Alamos technologies were extremely appropriate.

Vic Chavez (l) of Sandia National Laboratory, Deputy Coordinator of the FLC Mid-Continent Region, and Susan Sprake, Los Alamos, Coordinator of the FLC Mid-Continent Region with Rod Linn, a Los Alamos recipient of a Notable Technology Award for his FIRETEC software.

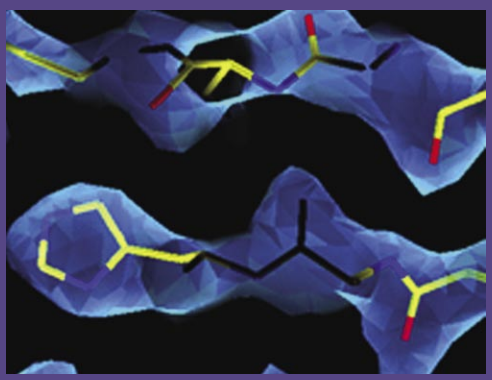
National Awards of Excellence in Technology Transfer

Laboratory employees Wu-chun Feng of the Computer and Computational Sciences Division and Laboratory Fellow Tom Terwilliger of the Bioscience Division received 2004 Awards of Excellence in Technology Transfer from the FLC for their outstanding work with industry in turning Los Alamos technologies into commercially useful products.

Wu-chun Feng received two awards—one for **Green Destiny** and **mpiBLAST** and another for his **10-Gigabit Ethernet Adapter.** Feng calls Green Destiny the world's most efficient computer—up to 10 times higher performance/power ratio than other supercomputing platforms. mpiBLAST is an open-source parallelization of BLAST, an open-source software package distributed by the National Center for Biotechnology Information. The Lab has dramatically enhanced BLAST's throughput and minimized its response time. For example, a search of a 300-kilobyte query that took 1,346 minutes (22.4 hours) using BLAST takes only a few minutes with mpiBLAST running on Green Destiny.

Feng describes the 10-Gigabit Ethernet Adapter as a "super-adapter" whose plug-and-play installation, reliability and unprecedented speed will revolutionize how computers and the Internet positively impact our lives. The Lab optimized Intel's® PRO/10GbE LR Server Adapter and its associated subsystems, thereby enhancing its performance by 300 percent.

Tom Terwilliger received an award for his work on **SOLVE/RESOLVE**. In the world of proteomics, SOLVE/RESOLVE are complementary software packages that help researchers get clear pictures of protein structures, allowing researchers to develop new pharmaceuticals and to understand how proteins work. SOLVE



SOLVE/RESOLVE's 3D images of protein molecules are in high demand in the biotech and pharmaceutical fields. This software represents the Laboratory's most frequently licensed technology.

automatically interprets X-ray crystallography data to generate an electron map, while RESOLVE uses a statistical approach to integrate experimental data with a knowledge base to refine the electron density map.

Federal Laboratory Consortium Representative of the Year

Technology Transfer Division partnership executive Susan Sprake received the FLC Representative of the Year award for her work both as Mid-Continent Coordinator of the FLC and as an executive committee member of DOE Technology Partnerships Working Group (TPWG) for bringing together, for the first time ever, a combined FLC and TPWG National Meeting last May in San Diego. As Mid-Continent Regional Coordinator, Sprake was responsible for bringing many new groups to the table from complementary organizations, such as New Mexico Institute of Mining and Technology, the U.S. Forest Service, International Association of Fire Chiefs, the National Interagency Fire Center, the DOE's Technology Partnerships Working Group, the Clean Cities Program, Manufacturing Extension Partnership, Texas A&M University, and the Department of Homeland Security's Emergency Response Technology Program.

Patent and Licensing Awards

The Laboratory's seventh annual Patent and Licensing Awards Ceremony, held in February 2005, honored innovators whose work was issued patents or copyrights during 2004 as well as those whose inventions generated license or royalty income during the preceding year. This annual festivity, which recognized more than 250 employees for their direct contribution to the Laboratory's technology transfer mission during 2004, was co-sponsored by the Technology Transfer Division and the Laboratory Legal Counsel.

Laboratory Director Pete Nanos congratulated innovators for their achievements and praised them for their role in getting their technologies commercialized to help pump economic growth into the broader community. He noted that much of the innovation for which this nation is famous results from small-scale science—the type of science from which most patents and copyrights arise.

Hal Avery, publisher of *R&D Magazine*, the sponsor of the annual R&D 100 Awards, was the evening's keynote speaker. He reminded attendees how important their participation in the patenting process is to the Laboratory's mission and to the economic interests of the nation. Avery said that 70% of the economic growth in this country is the direct result of research and development, which is measured by intellectual property assertions—patents and copyrights.

Overall the event recognized 116 individuals for the 62 new patents issued in FY 2004 and 141 individuals for their involvement in licensing that has earned them, collectively, $451,000 in license income. In addition, the Laboratory retains $634,000 in license and royalty income to apply to R&D, education, and technology transfer activities.

Distinguished Awards were made in three categories: Distinguished Patent, Distinguished Licensing, and Distinguished Entrepreneur.

Hal Avery, publisher of* R&D Magazine *gives keynote address at the Patent and Licensing Awards ceremony.

Distinguished Patent Award

Former Laboratory researcher Arlene Wise and current members of the Bioscience Division, Tom Terwilliger and Cheryl Kuske, were joint recipients of the 2004 Distinguished Patent Award for their patent "Detection of Phenols Using Engineered Bacteria." This patent covers the creation of novel bacteria capable of detecting the presence of a number of phenolic compounds at the low levels typically found in contaminated soil and water.

Cheryl Kuske accepts award from Lab Director Pete Nanos.

The team set out to identify and genetically engineer regulatory proteins capable of detecting the group of phenolic compounds listed by the Environmental Protection Agency as priority pollutants. The three created a suite of mutant bacteria useful in detecting low concentrations of the EPA's phenolic priority pollutant chemicals, thus enabling inexpensive biosensor detection of contaminated soil and water.

This award, honoring inventors whose patented invention exhibits outstanding innovation, is nominated by the Laboratory Fellows in recognition of a premier patent exemplifying significant technical advance, adaptability to public use, and noteworthy value to the mission of Los Alamos National Laboratory.

Distinguished Licensing Award

From left, Michael Hamada and Harry Martz receive their Distinguished Licensing Award from Director Pete Nanos.

Harry Martz Jr. and Michael Hamada of the Statistical Sciences group within the Decision Applications Division were the joint winners of the 2004 Distinguished Licensing Award. Recipients of this distinguished award are champions for the Laboratory's Licensing Program, recognized for their role in confirming the benefits of proactive technology commercialization activities. Martz and Hamada are the principal team members in an ongoing collaboration with Proctor & Gamble to develop innovative manufacturing reliability methods and systems.

PowerfactoRE, the product of this collaboration, is a comprehensive suite of reliability engineering methods, tools, and procedures to help manufacturing line managers understand reliability losses and prevent problems before they occur. Subsequent to executing a license agreement with Los Alamos, P&G implemented PowerFactoRE in more than 200 manufacturing plants worldwide, saving the company more than $1 billion in operating costs. The Laboratory's ability to meet its mission needs in stockpile stewardship continues to benefit through improved expertise and retained government use rights from the collaboration.

Interactions between P&G and Los Alamos expanded over the course of PowerFactoRE's decade-long development to include more than a dozen agreements valued at almost $30 million in technology areas from molecular modeling to bioinformatics.

This award recognizes innovators who proactively engage in commercialization activities at the Laboratory and make a positive impact on its Licensing Program. The exemplary

work of Martz and Hamada sets a standard of excellence in support of the Laboratory's technology transfer mission.

Distinguished Entrepreneur Award

Doxcelerate, a Laboratory spinoff company, was the recipient of the 2004 Distinguished Entrepreneur Award. In 2000, three Laboratory employees took advantage of the Entrepreneurial Leave of Absence program to join the small company in order to accelerate its product growth and market penetration. Jim McDonald, Rebecca Hults, and Marilyn Pruitt joined the company as Vice President of Business Development, Senior Applications Engineer, and Director of Product Management and Customer Service, respectively. All three were part of a Laboratory group involved in developing the early software that was the basis for the service the company offers its clients. In addition, Thierry Theilliez, Steve Donahue, and Leon Sonntag opted to risk leaving secure Lab jobs to explore the entrepreneurial world. This award recognizes the group for their courage to "take the leap," their ability to grow the business in the region, and their tenacity to grow and sustain a business in Northern New Mexico.

The company, originally named Innovative Web Applications, offers proprietary software that helps government agencies and private corporations automate how they develop policy, procedures, regulations, standards, and compliance. IWA was founded in 1996 in response to the overwhelming need for commercial information management tools and Web-based search and retrieval applications. Under its new name, Doxcelerate presented at the 2004 New Mexico Equity Capital Symposium in Albuquerque to more than 100 potential investors. Doxcelerate is currently on a growth trajectory, hoping to raise funds to significantly grow the company and, most importantly, to remain in Los Alamos.

This award honors an individual or group of individuals whose hard work, ingenuity, innovation, and perseverance have contributed significantly to the Laboratory's ongoing efforts in commercialization and entrepreneurship, specifically in the region. Award winners are pioneers in helping to create a new and vibrant entrepreneurial community in Northern New Mexico. They also serve as successful role models for others considering the pursuit of an entrepreneurial venture in the region.

Doxcelerate president Jim McDonald (l) discusses the company's bright future with Rebecca Hults, Marilyn Pruitt, and Thierry Theilliez.

Partnering with Industry

In addition to licensing Laboratory technologies to industry for commercial development, our strongest suit in the process of transferring technology to the private sector has always been our ability to help industry solve problems in areas where it lacks expertise, equipment, facilities, or a combination of these. Our talented research staff as well as our unique facilities and one-of-a-kind equipment capabilities allow us to find solutions for the private sector as long as the work aligns well with the Laboratory's national security mission. We do this through cooperative research and development agreements (CRADAs), Work-for-Others agreements, personnel exchanges, and User Facility agreements.

Highlights from 2004 Partnerships

Listening to Wells

The Laboratory signed a CRADA with ChevronTexaco Energy Technology Company of Houston, TX, in April 2004 to investigate and demonstrate "proof of principle" for the Laboratory's advanced radio frequency (RF) telemetry and sensor technology for collection and transmission of oil well data. From the well to a central data collection station, and from down-hole sensors to above the ground, this project is exploring data gathering both in the drilling operation as well as in producing wells. The importance of being able to enhance such data gathering has implications for improving well yields, hence, for national energy security. Los Alamos' Physics Division brings unique, patented and patent pending RF and sensor technology to the partnership as well as electronics support facilities not available elsewhere. ChevronTexaco is an internationally recognized oil company whose expertise compliments the Laboratory's skills.

Detecting Highly Enriched Uranium (HEU) in Shipping Containers

In September 2004, the Laboratory signed a CRADA with a small, woman-owned Los Alamos business, Alme and Associates, to collaborate on the development of "A Pulsed Power Intense Neutron Source for Detecting HEU in Shipping Containers." Alme and Associates has expertise in high voltage power systems and applications of such systems to X-ray source development and plasma source development. The company, with offices in Los Alamos and Alexandria, VA, was looking for help with inertial electrostatic confinement (IEC) research and a facility in which to demonstrate the intense neutron production developed in the Laboratory's Plasma Physics group. The CRADA proposes building a fusion-based intense neutron source that uses an IEC system. An active nuclear assay system using the proposed neutron source would be capable of detecting special nuclear materials, such as HEU, in shipping containers, a high priority mission for the Homeland Security Department. Another potential application is the identification of

Los Alamos industry partner ChevronTexaco and its partner, Transocean Inc., achieved an industry record when Transocean's drillship Discoverer Deep Seas spudded Tonga, the deepest well ever drilled in the U.S. Gulf of Mexico, at a total vertical depth of 31,824 feet.

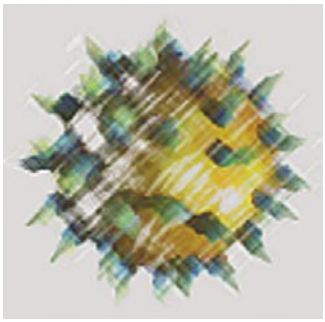
Photo courtesy of ChevronTexaco

unexploded ordnance and land mines. This industrial partnership is expected to significantly impact the Laboratory's national security mission.

Supersonic Cooling

In March 2004, Los Alamos established a Work-for-Others agreement with Lambda-Vision, Inc. of Chicago, IL. The Laboratory's Physical Chemistry and Applied Spectroscopy group is working with the company to understand flow conditions sufficiently to optimize X-ray laser performance by developing a model for gas flow through a nozzle, constructing a nozzle expansion apparatus to characterize flow through the nozzle, testing the experimental results, and, finally, by comparing the predicted results with the experimental results. The main modeling task is to design nozzles for the supersonic cooling of lasing gases (Xe, N2). Los Alamos has the unique capability to perform both the model development and the experimental program.

Expanding the HIV Database



Los Alamos created and maintains the Human Immunodeficiency Virus Genetic Sequence Database (HIV Database), which is unique to the world and serves as a valuable tool to HIV researchers, clinicians, epidemiologists and companies developing treatments and vaccines for AIDS. In 2004, the Laboratory partnered with Massachusetts General Hospital through an NIH-funded study to better understand patient response to HIV infection and mechanisms of HIV drug resistance and to work towards development of a vaccine that will be effective at preventing infection by the many strains of HIV currently infecting people. As part of this project, the Laboratory will use its skills, databases, and facilities to process genomic, immune, and disease progress and treatment information from AIDS patients and to track their HIV strains. This information will be disseminated to researchers worldwide through the HIV Database. Los Alamos is creating new tools in the database to help researchers tap into the expansion of available information. Ultimately, the HIV Database is expected to help in the understanding of genetic drift of the virus, mechanisms of infection in different populations and individuals, and HIV drug resistance.

It's Elemental . . .

In June 2004, the Laboratory signed a Work-for-Others agreement with the California Institute of Technology Jet Propulsion Laboratory for the Space, Science and Applications group to develop, fabricate, calibrate, operate, and perform data analysis on data received from the gamma-ray neutron spectrometer instrument for the NASA Dawn Space Mission. This involves development of a combined gamma-ray and neutron detector (GRaND) that will map the major elements and trace element composition of the asteroids Ceres and Vesta. Development of GRaND will be based on the highly successful gamma-ray neutron spectrometer developed by Los Alamos for the Lunar Prospector Space Mission. This work will also represent a significant technological advance in the use of CZT (cadium-zinc-telluride) isotope detectors for gamma-ray observations.

Additional Agreements Developed in 2004

- SpectraPath, Inc., a small, Florida based start-up company founded by a former Los Alamos scientist, licensed a Laboratory patent with the intent to commercialize *in vivo* cancer screening and detection using noninvasive optical techniques.
- Singulex, Inc. (formerly BioProfile), an early stage biotechnology company, licensed Los Alamos technologies for "Flow Cytometry Temperature Regulation" and "Single Molecule Tracking" for use in the development of instruments for highly sensitive molecular detection.
- Thirty-eight percent of the Laboratory's FY 2004 licenses supported our continual efforts in research software agreements with industry for the SOLVE and PARMELA software applications.
- Twenty-one percent of all executed agreements were Inter-Institutional Agreements for jointly held inventions with Louisiana State University, Mississippi State University, and University of Tennessee-Battelle (Oak Ridge National Laboratory).

Tracking Wiley Viruses

Los Alamos has been a leader in developing and maintaining pathogen genome databases used by researchers around the world to further our understanding of these organisms and the diseases they cause. The Laboratory's Influenza Sequence Database (ISD) contains a vast compilation of human and animal influenza virus sequences and has a much-needed set of tools and analytic capabilities that help researchers understand viral strain differences, virulence, and evolution of individual strains. Understanding the evolution of individual strains is critical for vaccine development and monitoring for viruses jumping from animal to human hosts. In May 2004, St. Jude Children's Research Hospital in Memphis, TN, partnered with Los Alamos' ISD research team through a Work-for-Others agreement to further study influenza evolution. The Lab will modify the ISD and develop additional analytic tools to help determine the minimum amount of viral sequence information required to accurately monitor viral evolution. This project should set new sequencing guidelines for use by influenza researchers when they are developing new vaccines and monitoring viral evolution that may affect the pathogenesis of new viral strains in humans and animals.

Stacking Our Energy Future

Mesoscopic Devices, LLC, of Broomfield, CO, under contract to the Army Research Laboratory to build a 20 W direct methanol fuel cell/battery hybrid, lacked the fabrication capability necessary to complete the stack system. In June 2004, the Laboratory signed a Work-for-Others agreement for its Electronic and Electrochemical Materials and Devices group, currently the only potential source for stacks that meet MD's requirements, to allow the company to build its first demonstration system incorporating a stack built by Los Alamos. By transferring the technology from the Laboratory to the company, Los Alamos is helping MD bring the stack capability in house, enabling the company to develop and eventually sell the systems.

Direct methanol fuel cell stack

Laboratory Industrial Fellow Nurtures Partnership with Procter & Gamble

For more than a decade, Los Alamos and Procter & Gamble have worked closely on more than a dozen projects of mutual interest. While the overlap of interests between a national security laboratory and a consumer products manufacturer may not at first be obvious, a large number of areas exist in which the science needed to solve problems is the same for both. The best example of this so far has been in manufacturing reliability. A seven-year collaboration resulted in the R&D 100 Award-winning PowerFactoRE approach to manufacturing. PowerFactoRE has provided over $1 billion in savings for P&G and improvement in the Laboratory's ability to deliver on its core mission.

However, even with a strong history of working together, navigating the R&D warehouses of two enormous institutions to find and create valuable collaborations is not a trivial task. Los Alamos and P&G each have annual research budgets of around $2 billion. In addition, there is a culture and mission difference to bridge in order to form successful collaborations. In the effort to overcome this hurdle, P&G has embraced the Laboratory's Industrial Fellow program (see sidebar). Starting in 2001, Deb Summa, a Los Alamos staff member, spent a two-year assignment shuttling between P&G and Los Alamos. P&G was so impressed with the Industrial Fellow program that at the completion of Summa's

Industrial Fellow Program

The Industrial Fellow Program assigns experienced Laboratory professionals to work with senior managers at a host company for at least one year, preferably longer. The Industrial Fellow assignment provides an ideal opportunity for Los Alamos staff members to work for carefully selected companies with the goal of building strategic technical alliances. Such alliances tend to evolve when researchers from very different backgrounds work together on projects of mutual interest.

pre-negotiated assignment term, P&G asked the Lab to provide another Fellow for an additional two-year assignment. Kevin Jakubenas started his assignment in March 2004.

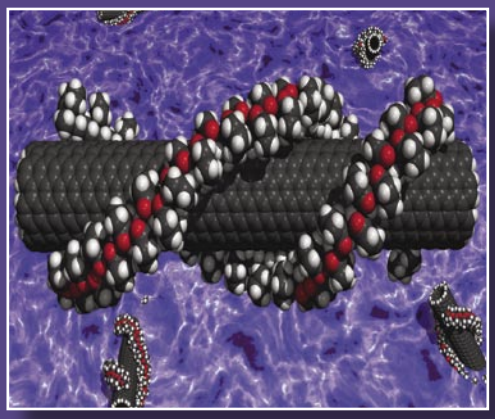
Jakubenas combines his background as a one-time researcher in federal labs and at a nanotechnology start-up company with a broad knowledge of Los Alamos technology from his work in the Technology Transfer Division. He spends approximately half his time at P&G facilities located principally in Cincinnati, Ohio, as well as in Brussels, London, Frankfurt, and Kobe, Japan. During a typical week, Jakubenas will meet with five to ten P&G researchers to discuss problems P&G is facing and the relevant resources available at Los Alamos. In addition, he routinely meets with senior R&D managers at P&G to formulate technology strategies and provide updates on project performance.

Within the first six months of his assignment, Jakubenas had screened over 70 potential joint projects resulting in approximately a dozen emerging projects that may continue to evolve into CRADAs, Work-for-Others agreements, or technology licenses. These potential projects touch almost every area of P&G's business from hair care to healthcare/pharma to laundry detergents and paper products. In addition, an Industrial Fellow works continuously at building lasting personal and professional connections between Laboratory and P&G researchers that involve staff from almost every Los Alamos technical division.

Technology Transfer's Kevin Jakubenas keeps a busy schedule as a Laboratory Industrial Fellow at P&G, traveling between Los Alamos, Cincinnati, and P&G's international sites to nurture this productive partnership.

Small Technology, Big Partnership

On May 24, 2004, the Laboratory held a groundbreaking ceremony for the Center for Integrated Nanotechnologies (CINT) Gateway to Los Alamos Facility. This facility, a 36,500-square-foot laboratory office building located adjacent to the Laboratory's Superconductivity Technology Center, will contain roughly 11,000 square feet of laboratory space dedicated to nanobioscience and nanomaterials science. The $18.2 million project includes laboratory experimental equipment and is part of a larger $73.8 million CINT construction program. The remaining funds are allocated to building the CINT Core Facility in Albuquerque at Sandia National Laboratories. This partnership between Los Alamos and Sandia in the DOE's new CINT is not the first time in recent decades the two laboratories have teamed to solve problems of vital importance to the DOE defense mission. Los Alamos partnered with Sandia, Livermore, and Oak Ridge National Laboratories, and DOE's Kansas City Plant during the 1990s to develop multi-site research and



Computer simulation of a carbon nanotube: Cylindrical carbon molecules are very similar in structure to a fullerene, or buckyball, but instead of being a sphere, the nanotube is tubular in shape. These microscopic molecules are usually a few nanometers in diameter, or a billionth of a meter.

development agreements for cooperative R&D with industry as part of the congressional mandate to transfer federal lab technologies with dual-use (defense and commercial) applications to U.S. industrial partners for commercialization. Based on this experience, Los Alamos and Sandia participated in several umbrella CRADAs with industrial partners that involve shared, cooperative R&D among the two laboratories and their industry partners. Prior to these collaborative tech transfer projects, the two labs partnered for many years on weapons development tests at the Nevada Test Site and on the highly successful B61 project.

As one of five DOE/Office of Science Nanoscale Science Research Centers operating throughout the U.S., CINT joins DOE's extensive network of National User Facilities dedicated to basic research in a broad spectrum of scientific specialties. CINT's role as a National User Facility devoted to establishing the scientific principles that govern the design, performance, and integration of nanoscale materials, i.e., the "basic science" of nanotechnology, makes it a very unique project but not an unusual one. Los Alamos' National High Magnetic Field Lab (a partnership with Florida State University and the University of Florida) and the Lujan Neutron Scattering Center at LANSCE, and Sandia's Combustion Research Facility are among DOE's major User Facilities. CINT will be an additional User Facility for each New Mexico lab. Through its core facility in Albuquerque with gateways to both Los Alamos and Sandia National Laboratories, CINT provides open access to tools and expertise needed to explore the continuum from scientific discovery to the integration of nanostructures into the micro and macro world.

DOE's Office of Basic Energy Sciences runs about 20 User Facilities all over the country for neutron and X-ray scattering, electron probes, special purpose research, and nanoscale science (CINT is one of five such centers). These facilities offer world-class staff and instrumentation to the scientific community for peer-reviewed open research, hosting about 10,000 users annually from all corners of the globe. User Facilities like the Lujan Center and CINT represent a major component of outreach and recruitment for the laboratories. The partnership advantage for CINT is the unique contributions each partner brings to the table: Los Alamos contributes a strong emphasis and capability in bioscience and theory, while Sandia brings depth in microsystems research and synthesis of nanoscale materials. Although the new buildings at the two labs will not begin operations until March 2006, the CINT user program is already running under "Jump Start" funding—$1.5 million allocated to each facility to jump-start operations—with about 35 projects per year being carried out under this program using equipment and staff from both laboratories.

The Core Facility, being constructed in Albuquerque, will be the single point of entry for the CINT user community and will provide the multi-disciplinary research environment needed to explore scientific challenges associated with nanoscience integration. In order to ensure open access to the user community, the Core Facility will be constructed on DOE property outside of Kirtland Air Force Base.

Regional Economic Development & Entrepreneurship

As shown in the Technologies to Market section of this report, a number of Los Alamos technology-based products were in the marketplace during 2004, contributing to U.S. economic competitiveness and growing the global economy. Many of the companies that provide these products were established and remain in New Mexico. At Los Alamos we take pride in the efforts to support regional business development. In Tech Transfer, we strive to ensure that economic and public benefit of the technology and expertise developed at the Laboratory accrues to our community in the form of new companies, jobs, and wealth.

Regional Business from Lab Technologies

To Catch a Thief

Wisdom & Sense®, a Los Alamos-developed pattern recognition software, was the basis for a spinoff from the Laboratory in the mid 1990s. The software was developed by Los Alamos for DOE for use in fraud detection. One unique quality is that W&S® runs on a separate workstation from the computer being monitored so that it enhances security and a potential thief cannot detect that W&S® is monitoring the computer. TXN, Inc., started by Henry Vaccaro, initially used specialized equipment borrowed from the Lab with the software to translate supermarket point-of-sales data. The software generates sets of rules from historical transactions and monitors transactions to detect unusual events. In 1997, Data Ventures, LLC purchased TXN and today W&S®, licensed by Los Alamos to Data Ventures, is being used at the New York Mercantile Exchange (NYMEX) for the Profile Analysis Workstation II (PAW II) broker compliance system. Data Ventures continues to maintain a technology support office in Los Alamos, NM, in addition to offices in North Carolina and the United Kingdom.

Surface Treatments Jet into Future

The Los Alamos-developed **Atmospheric Pressure Plasma Jet (APPJ®)** technology was the basis on which APJeT, Inc., a Lab spinoff located in Santa Fe, NM, was founded. The APPJ® technology that APJeT licenses from the Laboratory can be used for multiple surface treatment applications including photoresist ashing, non-aqueous cleaning, adhesion promotion, etching, and film deposition. APJeT products include a downstream plasma jet, a thin-film deposition jet, stackable and large area linear jets, and a continuous operation roller jet to treat flexible substrates such as textiles, paper, plastics, and

APJeT's textile and plastic coating machine treats a bolt of fabric using the APPJ® technology.

Encouraging Entrepreneurship

Taiwan/New Mexico Workshop on Technology Commercialization and Research Parks: Best Practices Between Taiwan and New Mexico

This workshop assessed how research parks in Taiwan and New Mexico can attract new business opportunities based on technology development. Los Alamos' involvement focused primarily on supporting Senator Jeff Bingaman's office in preliminary discussions with the Taiwan delegation regarding possible future technical collaborations. Sandia National Laboratories coordinated the workshop. Key participants included Taiwan's National Science Council, Taiwan's Science Park Administration Agency, Hsinchu Science Park, National Tsing Hua University, Los Alamos and Sandia National Laboratories, Air Force Research Laboratory, the University of New Mexico, New Mexico State University, New Mexico Tech, Technology Ventures Corporation, Sandia Science and Technology Park, and Los Alamos Research Park (LARP). In addition to the discussions and comparisons of how science parks play a role in technology commercialization, various workshop participants and the Taiwan delegation signed Memorandums of Understanding outlining a high level, general commitment to work together in the future on technology commercialization opportunities. The Laboratory and the LARP did not sign an MOU at this time.

natural or synthetic fibers. APJeT's APPJ® products produce a low-temperature, stable, homogeneous discharge with 50–1000 times greater production capability of active chemical species than older, competing atmospheric pressure plasmas such as dielectric barrier or corona discharges.

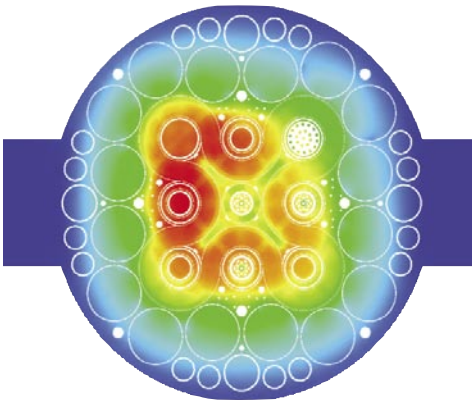
Drug Screening Process Gains Speed

The **LightSpeed Kinase** platform, based on QTL Biosystems, Inc.'s patented technology that eliminates the need for antibodies or radioactive labels, incorporates a technology originally developed at Los Alamos by the founders of QTL (for quencher-tether-ligand) and licensed for commercial use. Lightspeed assays target the performance demands of high throughput drug screening. The platform delivers single-step, easy to use assays optimized to work at low conversion rates where enzymologists are looking for potential hits. Building on the introduction of the Lightspeed Kinase platform and the recent launch of a Universal Kinase Assay Kit, the company plans to introduce an additional nine kinase assays during 2005. QTL kinase assays are universal, mix-and-measure assays that can be applied to peptide, native protein, lipid and polynucleotide substrates.

QTL Biosystems employee Matt Kofke uses ultra violet illumination to excite the superquenching polymer coating of the QTL Lightspeed® sensor. The sensor is the core component of the QTL Lightspeed® bioassay system used in academic and drug discovery research.

Radiation Modeling for Health and Safety

Radiation transport simulations, which computationally predict the macroscopic behavior of radiation, play a critical role in a broad range of applications including nuclear power, oil exploration, fuel transport and storage, and radiological safety. Los Alamos spinoff Transpire, Inc. (formerly Radion Technologies) was launched when Los Alamos licensed the **Attila** radiation transport solver to its developers, the co-founders of Transpire, Inc. This technology was proven to have an unrivaled combination of speed and accuracy and is the product of numerous man years of algorithm and code development work in the Laboratory's national defense programs. Since then, Transpire has substantially improved Attila's ease-of-use, performance and capabilities and now provides Attila as a complete radiation transport software system which can substan-



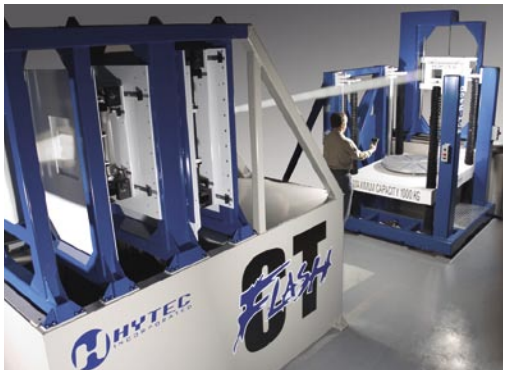
Attila reactor analysis core simulation image from the Advanced Test Reactor at the Idaho National Engineering Laboratory. Image provided by the ATR Physics Group at INL.

tially improve product safety, performance, and reliability. Transpire is actively expanding its technologies to benefit a broad range of industries including cancer therapy, medical imaging, and homeland security.

Safer Matches Seeking Market

In January 2004, the Laboratory signed an Exclusive Patent License Option Agreement with Nanotechnologies, Inc. of Austin, TX, for commercialization of Los Alamos' **"Lead-Free Electric Match"** technology. This technology, developed by Mike Hiskey et al. of the Laboratory's Dynamic Experimentation Division, consists of an electric match composition, including nanoscale particulates of an energetic material and a binder. Electric matches may be used for multiple applications including igniting pyrotechnics; triggering explosives for the mining, demolition, and defense industries (e.g., blasting caps); and vehicle airbag initiators. Electric matches are advantageous because they can be remotely fired upon a user's command. Other advantages include zero lead content, low friction sensitivity, low impact sensitivity, low thermal sensitivity, and low electrostatic sensitivity. The company is evaluating the possibility of establishing a subsidiary company in New Mexico that would be responsible for manufacturing this and other related technologies.

Quick Impressions



In a very successful CRADA collaboration with the Laboratory, HYTEC, Inc., a Los Alamos based company, and the Laboratory jointly developed the Flash Computed Tomography (CT) software during the mid 1990s. In combination with HYTEC's hardware, the product **FLASH CT®** was born. Today, FLASH CT® has multiple applications for all types of computed tomography including process control, component inspection, nondestructive evaluation and testing, and material defect detection. Since 2000, when HYTEC exclusively licensed the Laboratory's portion of the intellectual property for FLASH CT®, HYTEC has been offering high-speed, high-throughput, X-ray computed tomography 2D and 3D scanning using the FLASH CT® technology. Scanning dental impressions is one of the major applications for which the technology is currently being used. The FLASH CT® technology generates a higher resolution output than either optical or destructive scanning techniques for impression and plaster scanning and is quicker and more cost effective for customers.

Encouraging Entrepreneurship

Carlsbad Seminar on Entrepreneurial Opportunities and Resources Available for Scientists and Technical Personnel in New Mexico

This seminar, conducted in Carlsbad, NM, was hosted by the Carlsbad Department of Development and Technology Ventures Corporation (TVC) assisted by Tech Transfer staff from both Los Alamos and Sandia National Laboratories. Technical staff members from both labs had an opportunity to learn about the resources available to help them pursue technology transfer activities within the state. They were briefed on the resources available at the labs to encourage technical staff to engage in migrating technology from the lab environment to the private sector. TVC has appointed a full time staff member to provide support for the growth of new technology-based businesses in southern New Mexico.

Garett Vail (Dartmouth College MBA candidate) explains the commercialization goals for Los Alamos' "Plasma Assisted Combustion Technology" to the screening panel.

Current Los Alamos employees with industry experience recruited through the MBA Internship include:

Doruk Aytulu, 2001 MBA Alumnae,
San Diego State University
BS Mechanical Engineering,
Kocaeli University, Turkey
TT Business Development Executive

Erica Sullivan, 2002 MBA Alumna,
San Diego State University
BA Economics and Biology,
Loyola Marymount University
TT Business Development Executive

Brad Morie, 2002 MBA Alumnae,
University of North Carolina, Chapel Hill
BS Chemistry, BA German,
Wake Forest University
TT Business Development Executive

Marc Oettinger, 2004 MBA Alumnae,
Babson College
MS Environmental Engineering,
Colorado School of Mines
BS Environmental Engineering,
Saint Michael's College
TT Business Development Executive

Jennifer Rudnick, 1997 MBA Alumna,
University of New Mexico
BA Biology, Colorado College
B Division Technical Chief of Staff

Summer Interns Help Move Technologies to Market

In August 2004, eight MBA summer interns from the Technology Transfer Division presented 11 projects to a panel of reviewers at the Los Alamos Technology Screening Initiative (LATSI) at the Los Alamos Research Park. The primary goal of this joint project between the Laboratory's 2004 MBA Summer Internship Program and local business developers, including Los Alamos Commerce and Development Corporation (LACDC) and Technology Ventures Corporation (TVC), was to give some commercial exposure and critical feedback to Laboratory inventors and to facilitate the process of technology sourcing, screening, and portfolio development in Northern New Mexico.

Michael Erickson (San Diego State University MBA candidate) presents his market opportunity assessment for the Laboratory's "Quantum Dots Sunscreen Applications" to the panel.

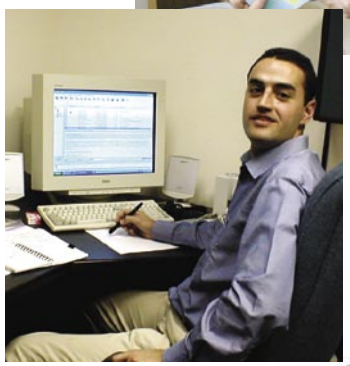
"The outcome of the presentations and review is a 'diagnostic' on each technology or idea, evaluating the future commercial potential and providing specific next steps to further the development," said LACDC Executive Director Kevin Holsapple. "This project will contribute to forming a Northern New Mexico 'deal pipeline' in support of technology business deal flow.

According to intern facilitator Marc Oettinger (2004 Babson College MBA), some projects represented dramatic technological advances. For example, in the future, a trip to the doctor's office could be like a walk in the park, thanks to technology under development at Los Alamos."A portable biosensor platform may eventually have the capability of detecting any pathogen or cancer marker in a person's body through a painless saliva test," said Oettinger.

The review panel included venture capitalists, entrepreneurs, economic development professionals, and market experts. The vSpring Capital group in Los Alamos, represented by Mike Connolly (a former member of the Lab's Tech Transfer Division), participated in the project. "We were presented with outstanding innovative projects from the MBA students," Connolly said. "The program is something that benefits all of us and we were glad to have an opportunity to participate." According to Holsapple, "This summer's activity is a prototype for potential future technology sourcing and screening not only of Laboratory technology, but other technologies developed outside the Lab as well."

Recruiting and Retaining Talent

According to a recent Fortune magazine article on what makes organizations great, "the single best predictor of overall excellence was a company's ability to attract, motivate and retain talented people." Through our Technology Transfer Division's MBA Internship Program, we attract the best and the brightest future business leaders—the hardest people to hold onto. Ultimately, it's foolish to believe you can trap good people. However, by staying in touch and turning them into advocates, information resources, and business partners, Tech Transfer has created a robust alumni network that has turned into a trusted pipeline of new talent for our division.



Through the MBA Internship Program, top-tier business school students evaluate Los Alamos inventions for commercialization potential, helping our staff develop strategies to transfer these technologies to the private sector through licensing agreements and start-up companies. The Tech Transfer Division has worked diligently to create a value proposition to encourage our MBA alumni to return to New Mexico. Over the last couple years, the Tech Transfer Division has begun to create the kinds of jobs talented MBAs want. In addition, New Mexico's relatively sparse population of seasoned management and savvy technology entrepreneurs offers rare opportunities for bigger challenges and greater responsibility at an earlier point in career development.

Since 1997, 15 out of 55 MBA internship alumni have returned to New Mexico—an approximate 27% return rate. Six former interns have taken full-time positions at the Laboratory, two at Sandia National Laboratories, one at the University of New Mexico, and seven are entrepreneurs working for New Mexico start-ups, business development centers, or small high-tech companies.

From the top: Marc Oettinger (2004 intern), Doruk Aytulu (2001 intern), and Brad Morie and Erica Sullivan (2002 interns) pump fresh ideas into tech transfer activities at Los Alamos.

An Intern's Perspective

"One of my favorite classes at Notre Dame was Negotiations, and one of the most useful concepts I learned was that of an 'indifference point.' For a choice between two things, dollars can be added to the less-desirable choice until one doesn't really care which thing to choose. Indifference at a price came up for me as I looked for positions following graduation. I was interviewing for buy-side stock analyst positions at a raft of I-banks in New York City. I have six children, so I thought Northern New Jersey would be the most reasonable place to live. I priced the houses and timed the commute (> 60 min). I considered the cost of food and the quality of life and compared that to my life in New Mexico during my summer internship in 2003. I came up with a rather high indifference price.

My experience as an MBA intern at the Lab showed me three things about Los Alamos: The landscape is beautiful, the people are nice, and the commute is 12 minutes. I already knew the public schools were phenomenal and the housing and living costs were small in comparison to those of NYC.

As I rode the subway back from my Morgan Stanley interview, I realized that I needed about $90,000 more in salary to be indifferent between a position in NYC and one in Los Alamos. The quality of life would be so much higher in New Mexico that I would need to have a huge salary to compensate for living in NYC."

Jeff currently works in the Tech Transfer Division, specializing in interactions with the venture capital community.

Jeff Stewart, 2003 MBA Internship Alumnae,
Notre Dame University
BS Molecular Biology,
Brigham Young University
MA Molecular Biology,
Princeton University
TT Business Development Executive

Photo by Carlos Llamas

The Cumbres & Toltec Scenic Railroad is one of the world's best preserved, narrow-gauge steam railroads.

Soni Honneger (l) delivers high-tech welding and machining equipment the Laboratory donated to the C&TSRR machine shop. C&TSRR employees Steve Montaño (c) and Ed Beard (r) happily accept the upgrade for their shop on behalf of the railroad.

Assisting the Cumbres & Toltec Scenic Railroad

The Cumbres and Toltec Scenic Railroad (C&TSRR) Working Group was created by New Mexico's Lt. Governor Diane Denish to help the C&TSRR create a self-sustaining business and operating plan, which, over time, should lessen the dependence of the C&TSRR on state government funding from New Mexico and Colorado. The Working Group has established the following high-level goals: To create

- a Technical Center of Excellence;
- an Associate Degree-based Welding and Machining Training Program;
- the C&TSRR Foundation; and
- a community-driven business and economic development strategy.

Los Alamos National Laboratory and Sandia National Laboratories, together with staff from the State Economic Development Department, State General Services Department, Northern New Mexico Community College (NNMCC), the Regional Development Corporation, and the Rio Grande Railroad Preservation Corporation (RGRPC, the C&TSRR operating company) form the foundation of the Working Group.

The Working Group is heavily engaged in the creation of the C&TSRR Technical Center of Excellence, which will include the development of a formal certification program led by NNMCC, to train welders and machinists onsite in Chama, NM. Through a training partnership with NNMCC, the Laboratory transferred several pieces of high-tech welding and machining equipment that it no longer needed to the C&TSRR machine shop to help the 19th century railroad operation enter the 21st century. Los Alamos' donations to the railroad's machine shop are part of an economic development plan to turn the railroad (the economic engine for the 2,100-person town) into a year-round tourist attraction.

The Laboratory, in partnership with the State Radio Communications Division of the State of New Mexico, is also leading the creation of new telecommunication capabilities for the coming season that will have the train in full voice and data contact with the railroad depots at both ends of the line. The Laboratory's Technology Transfer Division is leading the creation of the C&TSRR Foundation that will launch in early summer 2005 and will focus its maiden fund-raising effort on the construction of a 10,000 square foot, state-of-the-art, maintenance and manufacturing facility in Chama to house the Technical Center of Excellence.

The Working Group is launching an in-depth strategic and tactical planning exercise aimed at bringing the extended Chama community together and developing an economic and business development strategy for the valley that integrates the individual planning and tactical efforts of the Village of Chama government, the Railroad Commission, the RGRPC, the Chama Valley Chamber of Commerce, and others in order to align the efforts within the valley.

Through the leadership of the Tech Transfer Division, the Laboratory will continue to engage with the CTSRR in helping to bring the railroad forward toward attaining its goal of becoming a self-sustaining business entity. Consistent with the application of the Laboratory's technical and business development capabilities as they are exercised within the railroad's operating environment, this project clearly meets and supports our institutional and divisional objectives of supporting the expansion and diversification of the regional economy across Northern New Mexico.

Encouraging Innovation

Innovator's Perspective

By Benjamin Warner, Ph.D.

Like many scientists, I was attracted to Los Alamos National Laboratory from a sense of national service. My Los Alamos service began with actinide chemistry and national security chemistry. While weapon science is our first and foremost duty, the creation of dual use —government and civilian—technology allows us to serve both government needs and strengthen the U.S. economy.

Over the past several years, our team has focused on seeking such dual uses and working closely with the Laboratory's Technology Transfer Division and Intellectual Property Office to develop technology, package it for transfer to the private sector, and assist this transfer. Examples of such dual-use technologies are chemical and radiological assays (figures 1–3), energy efficiency technology (figures 4–6), and medical technology (figure 7).

Figures 1-3: Chemical and Radiological Assay Technologies. Radiation Litmus Paper (left) is a low-dose colorimetric radiation dosimeter useful for the military and first responders to a radiological incident. Berylliant (center) is a low-cost beryllium assay, that will reduce the cost of detecting this toxic but indispensable metal. SILM sensors (right) were developed for detecting chemical weapons, and also serve as very low-false positive smoke detectors.

The government needs are served from a massive leverage of private sector resources. For example, our energy efficiency technology was based on about $500,000 in government funding. The private sector partner has invested about $6 million to take the Los Alamos science to a reliable prototype that passes the gamut of engineering tests. The U.S. economy is served by the expansion of its high-technology economy. Other nations are beginning to imitate the U.S. high-tech industry. As a nation, we therefore have to innovate faster just to maintain our relative position. Actively pursuing technology transfer serves these goals.

Ben Warner is currently Project Leader for National Security Programs in the Chemistry Division. He is also founder of Caldera Pharmaceuticals, a 2004 spinoff from Los Alamos based on the MESA screening technology. He is author of fifteen Lab patents and co-founder of two other spinoff companies based on Lab technology. He has a B.S. in Chemistry from the University of the South and a Ph.D. in Chemistry from MIT. After securing funding for Caldera, Warner plans to take Entrepreneurial Leave of Absence to dedicate full-time to his start-up company.

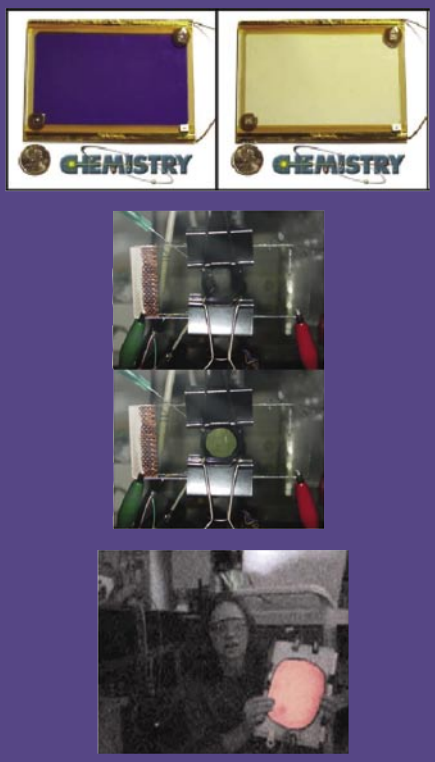


Figure 4-6: Energy Efficiency Technologies. The DOE estimates that energy inefficient windows cost 5% of the U.U.S. energy budget. Electrochromic (top) and electroreflective windows (center) will control unwanted solar heat gain. A minor change in the window construction changes it from an electrically controlled shade to a large area lighting source (bottom), opening the way for multifunctional "smart" buildings.

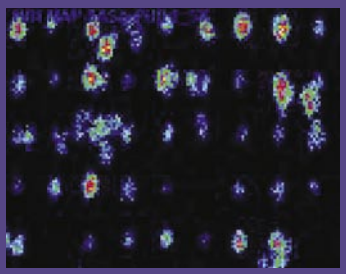


Figure 7: Medical Technologies. High-throughput proteomic technology will allow new drugs to be designed* in vitro*, which can reduce drug development costs by 30–60%.

Development of an industrial-scale natural gas liquifier is a prominent part of the thermoacoustics program directed by Greg Swift.

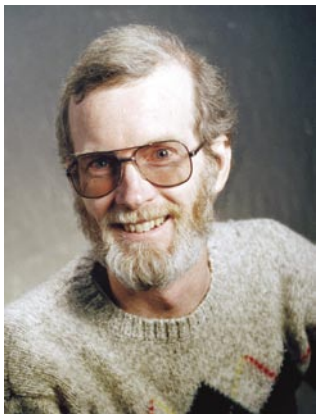
Innovator's Perspective

By Greg Swift, Ph.D.

My Ph.D. research in graduate school was in very esoteric physics. But I wanted to do something more useful, so I came to Los Alamos to do basic energy science and technology development, staying motivated to turn what I do into something useful.

While I've enjoyed tremendous support from DOE's Office of Basic Energy Sciences, to be useful, technology development needs eventual customers and, for me, those customers are corporate and industrial partners. Working with both has been splendid, letting my thermoacoustic team's research at Los Alamos cover the whole spectrum from basic discovery of new energy-related phenomena through quantitative analysis of such phenomena to demonstrations of powerful, efficient, energy-conversion hardware, and from there to working with industry toward specific products. By working in both the fundamental and the applied worlds, we bring vital motivation and focus from the applied world to the fundamental world, and we bring the latest fundamental insights from the fundamental world to the applied world—to the benefit of both worlds.

More personally, fundamental science is most fulfilling for me when it is firmly connected to industrial applications with patent-license agreements and CRADAs between the Laboratory and companies as the external evidence of those connections. The postdocs on our thermoacoustics team get a bonus from this arrangement too. Typically coming from the same kind of esoteric university environment that I experienced in graduate school, here they experience, or at least witness, the full spectrum from fundamental research to early stage product development so they learn for the first time what applied industrial R&D is like. Most of our postdocs have found the applied work surprisingly gratifying and have steered their careers accordingly.



Greg Swift, a technical staff member in the Materials Science and Technology Division's Condensed Matter and Thermal Physics group received the DOE's E.O. Lawrence Award in 2004 in the Environmental Science and Technology category for his record of experiments leading to a better understanding of the superfluid state and for the development of thermoacoustic engines. Swift is a Fellow of the Acoustical Society of America and was the recipient of that organization's Silver Medal in Physical Acoustics in 2000.

Greg Swift of the Materials Science and Technology Division was the recipient of the Laboratory's 2003 Distinguished Patent Award and the 2003 Distinguished Licensing Award. For more than 20 years, Swift's work has focused on thermoacoustic engine and cooling technologies. He has been a pioneer in the Laboratory's technology transfer activities as the principal investigator on one of the Lab's first cooperative research and development agreements.

New Training Initiatives Launched in 2004

In addition to offering a variety of training programs established in previous years, the Technology Transfer Division launched several new training initiatives during 2004. These initiatives include training opportunities both within the Laboratory and external to the Laboratory with a significant expansion of our training region.

Negotiating a License with Los Alamos

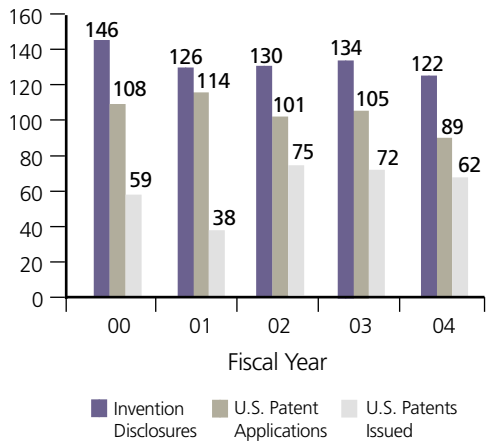
In April 2004, the Tech Transfer staff hosted the seminar "Negotiating a License with Los Alamos," in which Tech Transfer licensing executives prepared potential licensees for technology licensing negotiations. The goal was to prepare entrepreneurs to maximize the likelihood of achieving a mutually beneficial agreement. In addition to explaining the Laboratory's licensing process and providing an overview of technologies available for licensing, Tech Transfer staff instructed participants on terms to negotiate, royalty calculations, appropriate benchmarks, incorporation of business forecasts into the negotiation process, and tips for moving the process to completion.

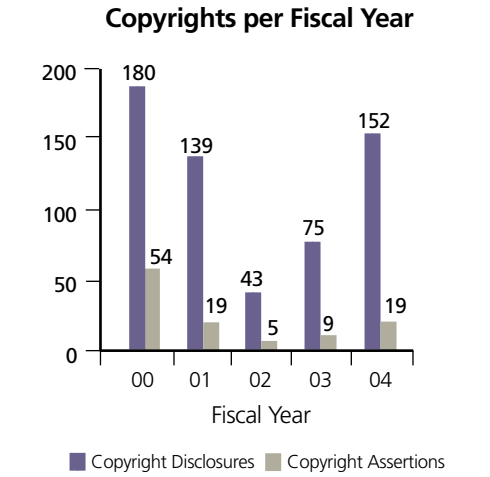
Commercialization Training for the Bioscience Division

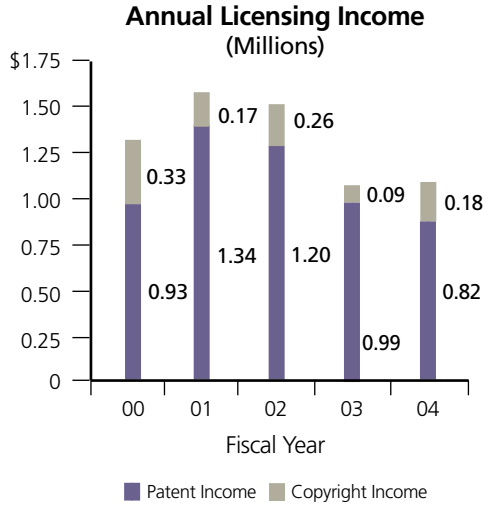
The Laboratory's Bioscience Division invited the Tech Transfer Division to discuss intellectual property and commercialization with B Division innovators. About 25 people learned about the process for protecting inventions and the tools available through the Tech Transfer Division for maximizing the value of those inventions for Los Alamos and U.S. industry. This event gave B Division staff an opportunity to meet the Tech Transfer Division team responsible for commercializing Los Alamos' biotechnology inventions.

Oak Ridge Business Plan Training

Los Alamos and Oak Ridge National Laboratories and the U.S. DOE National Nuclear Security Administration (DOE/NNSA) worked together to provide a business plan training program for the national nuclear authorities of Romania, Egypt, Peru, Morocco, and Portugal. The purpose of the business planning module was to help the nuclear authorities of the five countries advance the commercial potential of their research reactors. The training program provided the techniques participants will need for identifying new opportunities and finding new products and applications for their research reactors and to develop the skills necessary to create a proactive plan and strategy to create new revenue streams. Tech Transfer staff worked closely with Los Alamos and Oak Ridge representatives of the "Sister Laboratory Program" to design and deliver this program. Under the Sister Laboratory Program, DOE/NNSA has undertaken numerous technical collaborations over the past decade intended to promote peaceful applications of nuclear energy. The business plan training was facilitated by VentureQuest Ltd., LLC, a consulting, education and training firm.







Technology Transfer Statistics

Patent Activity

During the 12-month government fiscal year ending September 30, 2004, the Laboratory disclosed 122 new inventions through the Technology Transfer Division. This represents a decrease of 9% from the previous 12-month period when the Laboratory disclosed 134 new inventions, but given the Laboratory's safety and security standdown on July 16, 2004, which ultimately affected the Laboratory staff's ability to file disclosures, it is apparent that innovative science is still growing strong at Los Alamos.

The Laboratory continues to aggressively seek patent protection on these disclosures having consistently filed applications on over 70% of those disclosures submitted for the last five years. This is a direct reflection on the quality and likelihood of successful commercialization of the disclosures that the Laboratory continues to receive. The U.S. Patent and Trademark Office issued 62 patents to Laboratory researchers in FY 2004 bringing the Laboratory's total number of patents to 1540.

Copyright Activity

A copyright is a form of intellectual property protection given to original works of authorship fixed in a tangible medium of expression. Copyright assertion is the process by which the University of California (UC) claims ownership in a copyrighted work. The number of copyright disclosures increased dramatically in FY 2004 to 152 as a result of DOE's acceptance of Open Source Software (OSS). OSS is becoming the standard for development and distribution of software. The synergies gained through broad and diverse collaborations among a large user community typically results in a robust, full featured, and stable software product.

Licensing Activity

A license is a contract/agreement between at least two legal entities that accomplishes a grant of rights by one entity to another. It is not a transfer of ownership rights. A valid license must contain an offer, an acceptance, mutuality, consideration (exchange of something of value), and enforceability. If it contains these elements, a license is legally enforceable and governed by the law of contracts. The components of this license income include issue fees, maintenance fees, and other "milestone" payments that are received on specific dates or specific points in the product development process. In managing the license portfolio, the Laboratory must engage in compliance activities and ensure that the licensee exercises due diligence in developing inventions toward commercial application, making royalty and fee payments as required.

The Laboratory, on behalf of UC, executed 14 commercial licenses in FY 2004 bringing the total number of active commercial licenses to 140. More than half of the approximately $1 million income generated from these licenses for UC was reinvested by the Laboratory with a percentage disbursed as income to the innovators. After two years of declining licensing revenues, FY 2004 proved to be a flat year and, hopefully, the point from which revenues begin to rise.

Sponsored Research

Work for Others

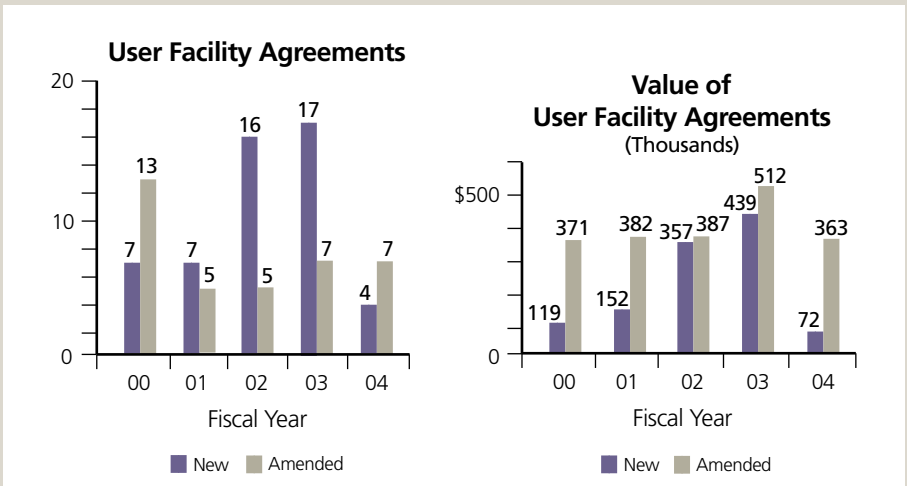
The Work-for-Others (WFO) agreement establishes a contract between a nonfederal partner and Los Alamos National Laboratory to perform a defined scope of work or list of tasks. The nonfederal sponsor covers the costs of all materials and personnel associated with the work performed under the contract. Tasks specified in the Statement of Work must draw on a unique capability of the Laboratory and may not place the Laboratory in competition with the private sector. The Laboratory saw a decline in WFO agreements for a second consecutive year. Predominately this downward trend is in direct relation to the total funding. The DOE programs are financially healthy, thus the ability to take on additional work for outside entities becomes limited. In addition, the Laboratory's standdown created a void in which the Laboratory was unable to accept new external work until such time as the affected facilities were operational. The funding for these agreements subsequently and logically declined as a result of lower than anticipated activity.

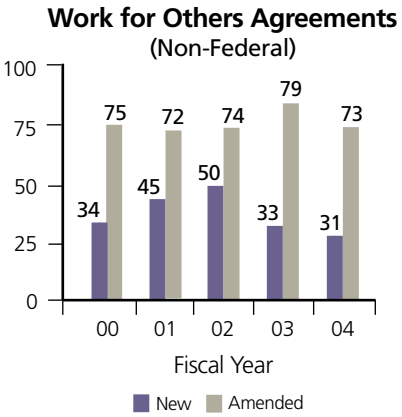
Cooperative Research and Development Agreements

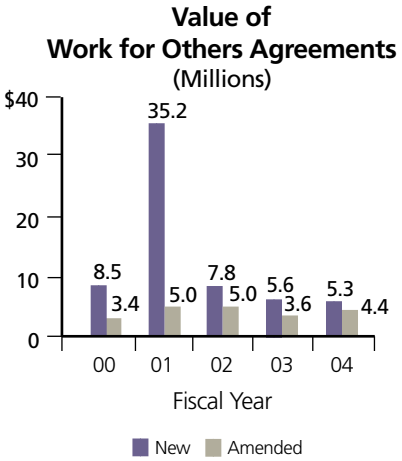
The Cooperative Research and Development Agreement (CRADA) is a contractual agreement that enables industry, academia, and/or a nonprofit entity to collaborate with the Laboratory. Used by most federal agencies for the purpose of advanced research and development activities, CRADAs help Los Alamos meet its programmatic goals and mission. A possible barometer of the high-tech industry, the activity within CRADAs jumped to a two-year high in continuing (36) and amended (19) CRADAs while new agreements with industry remained relatively flat. Thirteen new CRADAs were executed in FY 2004, an 8.3% increase from the previous year.

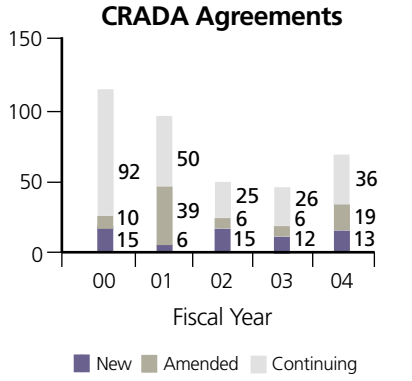
User Facility Activities

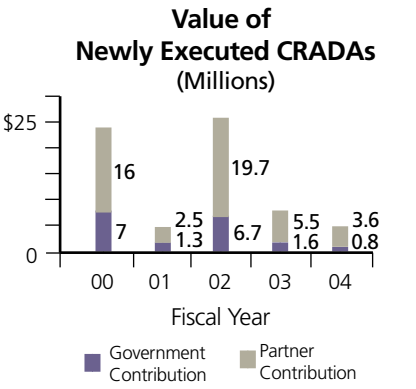
The User Facility program permits outside users, including scientists and engineers from industry, universities, and other governmental agencies, to conduct research using the Laboratory's unique experimental research equipment and facilities. As with the WFO programs, the User Facility program was sidelined by the sufficient programmatic resources and the safety and security shutdown by over 75% of its previous year activity. Funding for the program also dropped off significantly in FY 2004. Repeat business continues to show the value of the program as the average of an amended agreement far exceeds that of a newly initiated agreement.

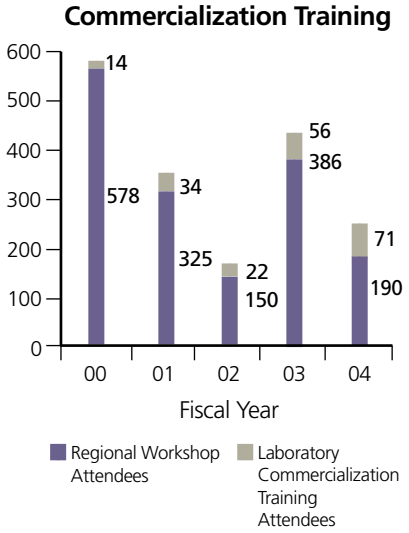


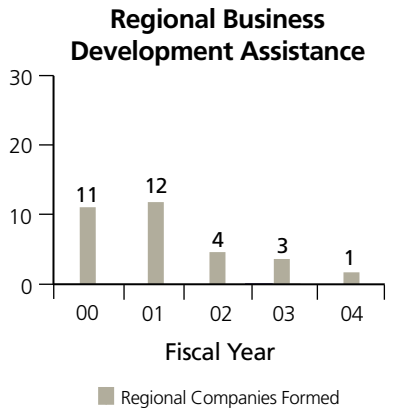












The Laboratory continued to encourage the growth of new companies in the region. Although the total number of new companies has decreased, the total number of new jobs continues to grow.

Training Activities

The Technology Transfer Division provides a number of training programs available to Laboratory staff as well as to the regional business community. In 2004, Tech Transfer continued to focus on providing internal training to help identify opportunities within the Laboratory and increase the pipeline of technologies available for commercialization. In addition, we continued to actively promote training events open to all provided through an agreement with Technology Ventures Corporation (TVC). These training opportunities are designed to educate both future and current entrepreneurs.

Commercialization Training for Laboratory Staff

Tech Transfer's Commercialization Training is designed to educate Los Alamos staff members about the process and options for commercializing their technologies. VentureQuest Ltd., LLC, a consulting, education and training firm that helps participants realize the value of innovation, conducts the series at the Laboratory. During 2004, five events were held with 71 attendees. Thirty Laboratory technologies were evaluated through the Commercialization training. From the technologies evaluated through the training sessions in 2004, the Technology Transfer staff is still working with over half of the participants and the technologies represented on some aspect of advancing the technology towards commercialization.

Managing Intellectual Property: A Guide for Laboratory Managers

This class is designed for all levels of Laboratory management to identify management responsibilities for managing intellectual property and to focus attention on the importance to the Laboratory of effective intellectual property management. By properly protecting our intellectual property, we can enhance the reputation of the Lab, attract sponsored research agreements, generate royalty income, create recruitment incentives, and help UC meet a contractual obligation to DOE. In 2004, the Laboratory's Training and Development group facilitated this training by staff from the Tech Transfer Division and the Laboratory Counsel's Intellectual Property Office. In 2004, due to the Laboratory shutdown, only one of the two scheduled events was conducted with 25 Laboratory staff in attendance.

Regional: Small Business Innovation Research (SBIR) and Small Business Technology Transfer Research (STTR) Training

The Technology Transfer Division also offers a variety of training focused on SBIR/STTR programs. These training events are designed to help educate regional businesses and Laboratory entrepreneurs on the funds available for small businesses through the federally sponsored SBIR/STTR programs and how to compete successfully for these grants. The training sessions are conducted by Greenwood Consulting Group, Inc. The Greenwoods have significant expertise in developing and managing small business incubators and assisting small firms in competing for SBIR/STTR funding. In 2004, Tech Transfer conducted six events with 91 participants. The events covered the following topics: Phase I Proposal Preparation, Cost dProposal Workshop, Phase II Proposal Preparation, and SBIR/STTR Q&A session.

Regional: Center for Commercialization and Entrepreneurial Training (CCET)

CCET is the education/training arm of TVC, in partnership with the National Nuclear Security Administration. The Technology Transfer Division actively supports and helps promote CCET events to Laboratory entrepreneurs and regional clients. CCET offers a broad array of training topics including but not limited to Marketing Research, Financial Management, Preparing and Presenting the Business Plan, and The Term Sheet and Lessons Learned. In 2004, 12 of these specialized training events were offered with over 99 participants.

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.	Each party may take title to its own CRADA-generated intellectual property. Partners have first rights to an exclusive license in a designated field of use. The U.S. Government retains a nonexclusive, royalty-free, irrevocable license to every subject invention under a CRADA.	Cost-shared through contributions of personnel, equipment, services, and facilities.	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. **Industrial Assignment Agreements** allow Laboratory staff members to work in the private sector. **Industrial Staff Member Agreements** allow private-sector staff to work at the Laboratory.	All are subject to negotiation.	The Laboratory and partner cost-share the Industrial Fellow. Loan of Laboratory personnel (subject matter expert). Office space, laboratory, and support costs for Industrial Staff Members assigned to the Laboratory.	Partner pays percentage of salary; provides office space, laboratory, and associated support costs. Company pays costs (salary and benefits) for Laboratory staff on assignment to company. Company pays costs for Industrial Staff Member assigned to the Laboratory.
User Facility Agreement: 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.	None	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 2004

Method for Improving Fuel Cell Performance

Circulating Heat Exchangers for Oscillating Wave Engines and Refrigerators

Production of High Specific Activity Copper-67

Line Sensing Device for Ultrafast Laser Acoustic Inspection Using Adaptive Optics

Mechanism and Apparatus for Rapid Stopping and Starting of a Thermoacoustic Engine

Cylindrical Acoustic Levitator/Concentrator Having Non-Circular Cross-Section

Noninvasive Characterization of a Flowing Multiphase Fluid Using Ultrasonic Interferometry

Ion Monitoring

Spherical Boron Nitride Particles and Method for Preparing Them

Method for Forming a Potential Hydrocarbon Sensor with Low Sensitivity to Methane and CO

Preparation of Energy Storage Materials

3,6-Bis(1H-1,2,3,4-Tetrazol-5-Ylamino)-1,2,4,5-Tetrazine or Salt Thereof

Cascaded Thermoacoustic Devices

Particle Size Analysis in a Turbid Media with a Single-Fiber, Optical Probe While Using a Visible Spectrometer

Particle Size Analysis in a Turbid Media with a Single-Fiber, Optical Probe While Using a Visible Spectrometer

Method and Apparatus for Fine Tuning an Orifice Pulse Tube Refrigerator

Energetic Powder

Web-Based Multi-Channel Analyzer

Geothermal Energy Production with Supercritical Fluids

Photopolymerization-Based Fabrication of Chemical Sensing Films

Laser Ignition

Technology for Fabrication of a Micromagnet on a Tip of MFM/MRFM Probe

Speech Processing Using Conditional Observable Maximum Likelihood Continuity Mapping

Meniscus Membranes for Separation

Method for Producing Metallic Nanoparticles

Crystalline Rare-Earth Activated Oxyorthosilicate Phosphor

Catalyst Inks and Method of Application for Direct Methanol Fuel Cells

Methods and Optical Fibers that Decrease Pulse Degradation Resulting from Random Chromatic Dispersion

Synthesis of Labeled Metabolites

Synthesis of [$^{2}H_{1}$,^{13}C], [$^{2}H_{2}$,^{13}C] and [$^{2}H_{3}$,^{13}C]Methylaryl Sulfides

High Temperature Superconducting Composite Conductors

Catalysts for Lean Burn Engine Exhaust Abatement

Maximum Likelihood Density Modification by Pattern Recognition of Structural Motifs

Speech Recovery Device

Surface Control Alloy Substrates and Methods of Manufacture Therefor

Surface Control Alloy Substrates and Methods of Manufacture Therefor

Synthesis of ^{2}H- and ^{13}C- Substituted Compounds

Traveling-Wave Thermoacoustic Engines with Internal Combustion

Method and Apparatus for Separating Mixtures of Gases Using an Acoustic Wave

Pulsed, Atmospheric Pressure Plasma Source for Emission Spectrometry

Tuning the Properties of Conjugated Polyelectrolytes and Application in a Biosensor Platform

Oriented Conductive Oxide Electrodes on Sio_{2}/Si and Glass

Method for the Detection of Specific Nucleic Acid Sequences by Polymerase Nucleotide Incorporation

Carbon Dioxide-Soluble Polymers and Swellable Polymers for Carbon Dioxide Applications

Method and Apparatus for Free-Space Quantum Key Distribution in Daylight

Method and Apparatus for Free-Space Quantum Key Distribution in Daylight

Transmission of Digital Images within the NTSC Analog Format

Synthesis of Labeled Oxalic Acid Derivatives

Dynamic Time Expansion and Compression Using Nonlinear Waveguides

Pulsed Width Modulated Push-Pull Driven Parallel Resonant Converter with Active Free Wheel

Method for Producing Metallic Particles

Buffer Layers on Metal Alloy Substrates for Superconducting Tapes

Bulk Superhard B-C-N Nanocomposite Compact and Method for Preparing Thereof

Nondegenerate Four-Wave Mixing Using Photoinduced Charge-Transfer Materials

Synthesis of [$^{2}H_{1}$,^{13}C], [$^{2}H_{2}$,^{13}C] and [$^{2}H_{3}$,^{13}C]Methylaryl Sulfones and Sulfoxides

Remote Down-Hole Well Telemetry

Detection of Phenols Using Engineered Bacteria

Volatile Chemical Reagent Detector

Handheld CZT Radiation Detector

Optimizing the Availability of a Buffered Industrial Process

Magnetic Vector Field Tag and Seal

Hydrogen Production from Carbonaceous Material

Method for Producing Chemical Energy

Sample Collection System for Gel Electrophoresis

Permeable Polyaniline Articles for Gas Separation


Los Alamos
NATIONAL LABORATORY
EST. 1943