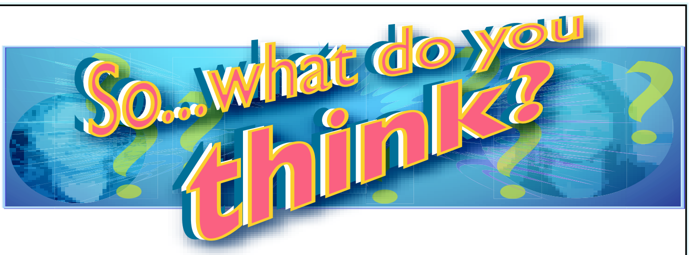
Los Alamos
NATIONAL LABORATORY
EST. 1943

NewsLetter

Week of July 19, 2004 | The World's Greatest Science Protecting America | Vol. 5, No. 15



Q: The Laboratory recently won five R&D 100 awards, which are presented each year by R&D Magazine to recognize the world's top 100 scientific and technological advances that show the most significant commercial potential. Over the past 17 years, the Lab has won a total of 83 of these awards.

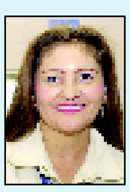
What do you think the Lab's ability to consistently win these awards says about the quality of science done here and do you think this trend will continue?

Cody Beavers of Utilities (SSS-UWGW)
The ability to consistently win these awards says that the Laboratory has some of the best scientists in the world and some of the best equipment ever made. The trend will continue as long as the money still is there.

Ivan Vitev of Subatomic Physics (P-25)
The consistent presence of the Lab among R&D 100 Awards recipients is recognition of its ability to both produce forefront science and to successfully export it for industrial applications. For this trend to continue, the Lab should maintain a proper balance between the scientific and technological aspects of its research.

John Kline of Plasma Physics (P-24)
I believe these awards do show that the science at the Laboratory does go to help the lives of everyday Americans, and the Lab is one of the leading scientific laboratories in the world. I hope that the Lab can continue to win more R&D awards. I believe this will depend on how congress views the Laboratory.

Annie Loweree of Communication Arts and Services (IM-1)
Obviously the scientific research at the Laboratory is "top notch." Will the trend continue? I'm not sure. Will the Laboratory itself continue?



Roberta Salazar of the Manuel Lujan Jr. Neutron Scattering Center (LANSCE-12)
It is evident that the Laboratory is home to some of the best science and has many of the brightest scientists in the world. The trend will continue if security and safety are taken more seriously.

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Laboratory captures five R&D 100 Awards

Los Alamos scientists captured five of R&D Magazine's 2004 R&D 100 Awards. The latest winners bring the Laboratory's total to 83 awards over the past 17 years. The projects recognized this year span a diverse range of scientific and technical areas — from innovative imaging techniques and advances in computing to revolutionary new materials. This year, Los Alamos was tied with its sister laboratory, Lawrence Livermore National Laboratory, for the largest number of awards received by a Department of Energy laboratory.

In recognizing the achievement, Laboratory Director G. Peter Nanos noted, "these awards demonstrate once again that Los Alamos is home to innovation and great science. I am extremely proud of each of our award recipients."

The R&D 100 awards program is designed to honor significant commercial promise in products, materials or processes developed by the international research and development community. Each year, R&D Magazine recognizes the world's top 100 scientific and technological advances with awards for innovations showing the most significant commercial potential. The five Laboratory technologies receiving R&D 100 awards this year are

- 10-Gigabit Ethernet
- Confocal X-Ray Fluorescence Microscope
- Clustermatic
- mpiBLAST
- Plasma-Torch Production of Spherical Boron Nitride Particles.

Over the past 17 years, the R&D 100 awards have become just one measure of Los Alamos' technical contributions to society. Technologies from the Laboratory are nominated in open competition and judged by technical experts selected by the Illinois-based R&D Magazine.

Tom Meyer, associate Laboratory director for strategic research, right, congratulates all the R&D 100 Awards participants recently at a recognition ceremony in the Bradbury Science Museum. Pictured with Meyer are, from left to right, John Straw, deputy division leader of weapons engineering and manufacturing; Jonathan Phillips and Doug Hemphill of Weapons Materials and Manufacturing (ESA-WMM); Suzanne Peterson and her husband, Dean Peterson of the Superconductivity Technology Center (MST-STC); and Cindy Boone of the Technology Transfer (TT) Division. This year, the Laboratory submitted 14 technologies to R&D 100 Magazine and captured five of the 2004 R&D 100 Awards. Photo by Richard Robinson, Imaging Services (IM-4)

For Your Safety

Keeping cool in the summer heat

Warm weather means activities and fun under the sun. Whether you love putting on shorts and feeling the warm outdoors or find it hot and sticky, everyone must be careful not to let a heat-related illness spoil the day.

Normally, the body has ways of keeping itself cool, by letting heat escape through the skin and by evaporating sweat (perspiration). If the body does not cool properly or does not cool enough, one may suffer a heat-related illness. Anyone can be susceptible although the very young and very old are at greater risk. Heat-related illnesses can become serious or even deadly if unattended.

Preventing Heat-Related Illness

• Dress for the heat. Wear lightweight, light-colored clothing. Light colors reflect away some of the sun's energy. It is also a good idea to wear hats or to use an umbrella.

• Drink water. Carry water or juice and drink continuously even if you don't feel thirsty. Avoid alcohol and caffeine, which dehydrate the body.

• Eat small meals and eat more often. Avoid foods that are high in protein, which increases metabolic heat.

• Avoid using salt tablets unless directed by a physician.

• Slow down. Avoid strenuous activity. If engaging in strenuous activity, do it during the coolest part of the day, which is usually in the morning between 4 and 7 a.m.

• Stay indoors when possible.

• Take regular breaks when engaged in physical activity on warm days. Take time out to find a cool place. If you recognize that you, or someone else, is showing the signals of a heat-related illness, stop activity and find a cool place.

Los Alamos NATIONAL LABORATORY

NewsLetter

The World's Greatest Science Protecting America

The *Los Alamos NewsLetter,* the Laboratory bi-weekly publication for employees and retirees, is published by the Public Affairs Office in the Communications and External Relations (CER) Division. The staff is located in the IT Corp. Building at 135 B Central Park Square and can be reached by e-mail at *newsbulletin@lanl.gov*, by fax at 5-5552, by regular Lab mail at Mail Stop C177 or by calling the individual telephone numbers listed below. For change of address, call 7-3565. To adjust the number of copies received, call the mailroom at 7-4166.

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Los Alamos National Laboratory is operated by the University of California for the National Nuclear Security Administration (NNSA) of the U.S. Department of Energy and works in partnership with NNSA's Sandia and Lawrence Livermore national laboratories to support NNSA in its mission.

Los Alamos enhances global security by ensuring safety and confidence in the U.S. nuclear stockpile, developing technologies to reduce threats from weapons of mass destruction and improving the environmental and nuclear materials legacy of the Cold War. Los Alamos' capabilities assist the nation in addressing energy, environment, infrastructure and biological security problems.

NNSA National Nuclear Security Administration

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FROM THE TOP

Researchers commended for diligence and creativity

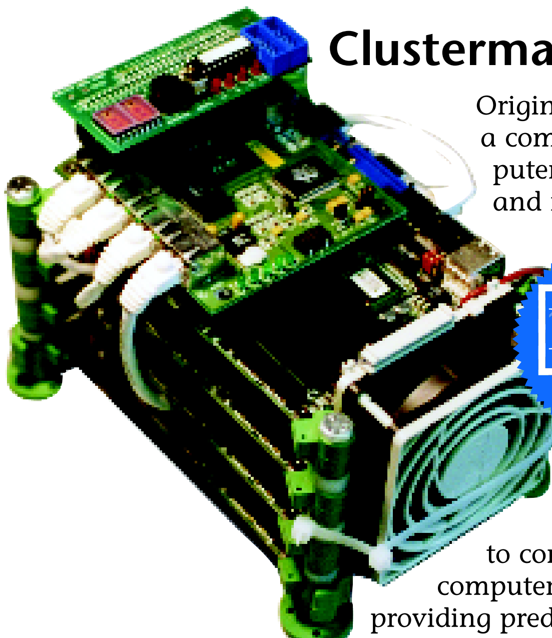
I want to extend my personal congratulations to everyone associated with this year's submissions to R&D Magazine's annual R&D 100 Awards competition. While five of our 14 proposals were chosen for award, to me each and every one of them is a winner.

Laboratory Director G. Peter Nanos

The creativity and technical expertise demonstrated by all of these innovations illustrate why this Laboratory plays the leading role that it does in our nation's defense. The potential applications of these technologies span the gamut: entertainment, medicine, data acquisition, weather and climate simulation, integrated circuit packages, water purification, facility safety, air-pollution control, aerospace industry, commercial and military auxiliary power, smuggling and weapons proliferation, superconductor and computer chip manufacture, oil and natural gas production, and, of course, our daily focus on national security and defense. Where else could anyone work and find this range of expertise and, dare I say, genius?

The R&D 100 submissions are a clear demonstration of why I love being associated with Los Alamos National Laboratory. They exemplify the talent and commitment of our work force and the tremendous range of ability and knowledge found here. Please join me in congratulating the individuals and teams represented, and my thanks to all of you for the outstanding work done at Los Alamos National Laboratory.

R&D 100 Winners ...



Clustermatic

Originally designed as a low-cost version of a supercomputer, a computer cluster consists of a group of connected computers that work together as one. Unfortunately, setting up and managing such clusters is tedious and prone to mistakes, thus making clusters much more difficult to use than supercomputers. To address this problem, researchers developed the Clustermatic software suite. Clustermatic increases reliability and efficiency, decreases node autonomy, simplifies programming, reduces administration costs and minimizes a user's reliance on unpredictable software. As a result, Clustermatic enables commodity-based cluster networks to compete with their higher-cost and higher-profile supercomputer cousins by scaling to largest cluster configurations, providing predictive monitoring that reacts to mode failures, and creating a one-system view of an entire cluster.

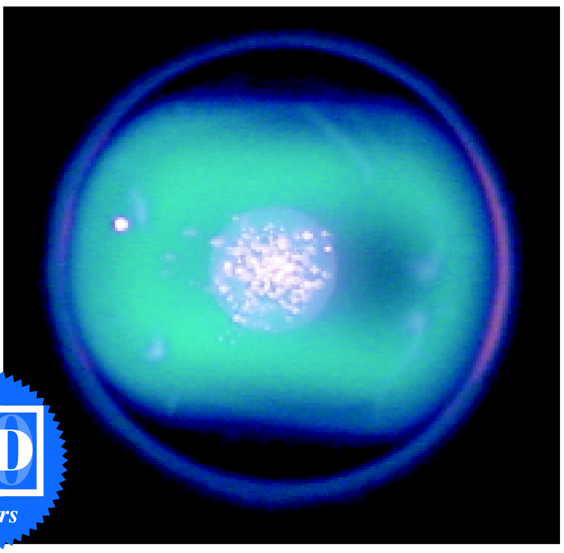
Applications

• High-performance computing applications include
—nuclear weapons and other defense programs
—weather-pattern and climate simulation, forest-fire data gathering and viral modeling

• Applications related to LinuxBIOS include
—motherboard manufacturing
—embedded systems (such as iRobot.com's PakBot)
—caching appliances for Web content, DVD players and fiber-channel analyzers.

Team members: Ron Minnich, Erik Hendriks, Sung-Eun Choi, Greg Watson, Matt Scottile, Li-Ta Lo and Adam Sulmicki of CCS-1

Plasma-Torch Production of Spherical Boron Nitride Particles



Particles of heat-dissipation filler can be added to the resin packaging around an integrated circuit to improve thermal management. Crystalline boron nitride, with the highest thermal conductivity of any ceramic, would be the most effective filler material except that it naturally forms as irregular platelets. Only spheres have the right rheological (material flow) characteristics for semiconductor packaging tools and techniques. Researchers have succeeded in melting crystalline

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R&D 100 Winners ...

(hexagonal) boron nitride by injecting the natural platelets into a hot (>3,500 degrees Kelvin) plasma, whose nitrogen-atom-rich environment stabilizes boron nitride, allowing it to be heated to its melting point. The particles melt, form spheres and retain that shape when cooled. This is the first process to produce crystalline boron nitride spheres.

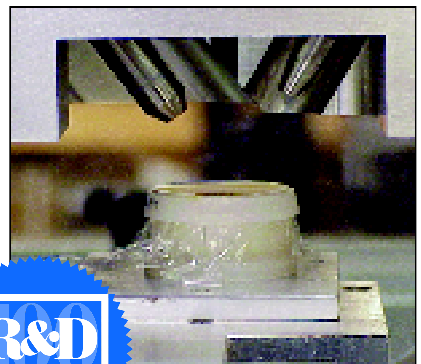
Applications

The plasma-torch method produces a variety of materials

- Spherical crystalline boron nitride for integrated-circuit packages
- Oxide spheres for integrated-circuit packages
- Carbon nanotube threads with the highest strength-to-weight ratio for ropes and other structures
- Photocatalysts for hydrogen generation and water purification
- Supported metal catalysts for crude-oil refinement, catalytic converters and polymers
- Metallic and carbon-coated metallic nanoparticles as fuel components
- Oxide nanoparticles, possibly for next-generation armor.

Team members: Jonathan Phillips and Seth Gleiman of Weapons Materials and Manufacturing (ESA-WMM); and Chun-Ku Chen (former Lab employee)

Confocal X-Ray Fluorescence Microscope



The Confocal X-Ray Fluorescence Microscope uses x-ray fluorescence to nondestructively measure the concentrations of elements within a tiny quasi-spherical "probe volume." The microscope moves the X-ray probe volume on or through an object to measure elemental concentrations on the object's surface, beneath a specific spot on the surface or throughout the object's interior. The microscope measures the concentrations of a wide range of elements with parts-per-million sensitivity. It can analyze objects as thick as a few millimeters with a spatial resolution of 15 micrometers.

Applications

- Analysis of fine-art paintings, such as nondestructive studies of valuable paintings in situ
- Identification of elements present in radioactive waste for conversion to forms suitable for long-term storage
- Inspection of space shuttle thrusters
- Quality control of pharmaceuticals
- Characterization of new types of films for the semiconductor industry
- Analysis of crime scene evidence — enhances forensic information provided by other types of microscopes.

Team members: George Havrilla of Analytical Chemistry Sciences (C-ACS) and Ning Gao of X-ray Optical Systems Inc.

10-Gigabit Ethernet Adapter

Have you ever tried to download a high-resolution graphic, movie or video game from the Internet? Such downloads can take hours, and if you're lucky, your computer will not lock up and the download will be successful. Now, imagine that by installing a simple adapter into your computer, you could transfer information up to 148,000 times faster than a high-speed modem connection and up to 23,000 times faster than a DSL connection. This "super-adapter's" plug-and-play installation, reliability and unprecedented speed will revolutionize how computers and the Internet positively impact our lives.

Applications

- Entertainment markets: video editing and animation, video- and music-on-demand, video games and file-sharing applications like iTunes, Kazaa, Napster and Gnutella
- Worldwide modeling and simulation markets: global weather and wildfire predictions, contagious disease communicability, galaxy formations and supernova explosions, financial market forecasting and human genome sequencing
- Data acquisition and data mining markets: military intelligence and reconnaissance, basic-science research (fusion, bioinformatics and aerospace) and data warehousing
- Medical applications: interactive distance education (for patients and medical personnel), expedited patient care and enhanced diagnostic imaging.

Team members: Wu-Chun Feng and Justin Hurwitz of the Advanced Computing Laboratory (CCS-1); and Matthew Baker of Intel Corp.

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Los Alamos National Laboratory R&D 100 Award Winners 1978–2004

1978
- Diamond Machining of Optics
- Electronic Identification System
- Electronic Device for Treating Tumors — Hyper Thermic Cancer Treatment

1980
- Wee Pocket Radiation Detector
- Portable Multichannel Analyzer

1981
- Radio Frequency Quadrapole Linac

1982
- WC Field Computer System

1983
- Transuranic Waste Assay System

1984
- Superconducting Magnetic Energy System

1985
- BHTP — A Unique Scintillation Compound

1986
- Aurora Laser Beam Alignment System

R&D 100 Winners continued

1988
- Optical Microrobot Single-Cell Manipulator/Analysis System
- Nuclear Material Solution Assay System
- 32-Stepper Motor Position Controller
- Mobile Beryllium Monitor
- HTMS Reference Electrode
- Oriented, Highly Anisotropic Conducting Polymer
- Photoinjector for RF Linac Accelerators
- Lattice Gas Algorithm

1989
- Fourier Transform Flow Cytometer (FTCS-1)
- Noncontact Superconductor Screening
- Conductive Lattices

1990
- Coolahoop
- Universal Process for Fingerprint Detection
- Fast Agarose Gel Electrophoresis (FAGE)
- Solid-State NO2 Sensor
- Upconversion Solid-State Laser
- A Broadband (ABB) Mw Absorption Spectrometer for Liquid Media
- MdS2/SC Composites (Molybdenum Disilicide/Silicon Carbide)

1991
- Semi-Insulator Detector
- Optical High-Acidity Detector
- Resonant Ultrasonic Inspection (RUI)
- Single Molecule Detector

R&D 100 Winners ...

mpiBLAST: A high-speed software catalyst for genetic research

BLAST, an open-source software package distributed by the National Center for Biotechnology Information, has become the ubiquitous genomic-sequencing tool in molecular biology.

With mpiBLAST, an open-source parallelization of BLAST, the Laboratory has dramatically enhanced BLAST's throughput and minimized its response time. The mpiBLAST software uses a new process known as in-memory database segmentation, in which a database is chopped into memory-sized pieces so that each compute node searches only a distinct portion of the database. When each portion has been searched, the message-passing interface (mpi) handles the communication to merge the results from each compute node. Thus, a search of a 300-kilobyte query that took 1,346 minutes (22.4 hours) using BLAST takes only a few minutes with mpiBLAST.

Applications

- Enables quick identification of previously unknown viruses, such as the SARS coronavirus, West Nile virus, and different strains of AIDS and cancer
- Accelerates complete genomic sequencing of organisms and drug discovery, reducing bioterrorism threats via pathogen detection and identification
- Contributes to other medical efforts, such as phylogenetic profiling and pairwise genome alignment
- Provides a more effective data-mining technique, such as helping identify and correlate intelligence and reconnaissance information and parallelize Internet search engines.

Team members: Wu-Chun Feng and Aaron Darling of CCS-1

Those also nominated

Editor's note: The following technologies were nominated this year for an R&D 100 Award.

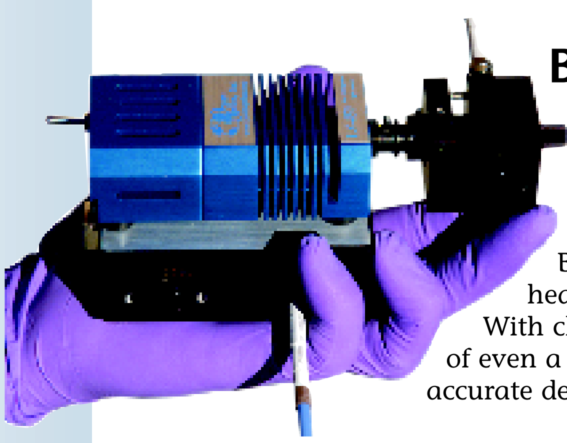
Aerosonic: Acoustic Concentrator of Aerosol Contaminants

An inexpensive, low-maintenance, piezo-electric device, Aerosonic generates focused, resonance-based sound pressure to concentrate aerosols. The concentrated aerosols can then be directly isolated for analysis. Alternatively, when added as a front-end concentrator to existing low-sensitivity, hand-held detectors, Aerosonic increases detector sensitivity. Its light weight and low power consumption make it an ideal add-on. Functioning independently as a "filterless" filter, Aerosonic can — by removing the concentrated material — eliminate such air pollutants as diesel-engine combustion particulates, toxic byproducts from restaurant-kitchen exhaust and airborne bacteria in hospitals.

Applications

- Facility safety: Front-end sensitivity enhancer for hand-held detectors such as optical classifiers and particle sizers
- Air-pollution control: "Filterless" filter for diesel-exhaust particulates, combustion exhaust from restaurant kitchens, and airborne bacteria in hospitals
- Homeland security: Concentrator for aerosol chemotoxins and biotoxins to facilitate their analysis.

Team members: Greg Kaduchak, Dipen Sinha, Chris Kwiatkowski, David Lizon and Shulim Kogan of Electronic and Electrochemical Materials and Devices (MST-11)



Be Safe: Assay for Rapid Environmental Beryllium Detection

A 30-minute assay for the presence of workplace beryllium, Be-Safe provides an unambiguous method for assessing the health and safety risks of workers from exposure to beryllium. With chronic, degenerative lung disease, the potential consequence of even a small and transient exposure to beryllium particles, a fast, accurate detection assay is needed for industries that use beryllium in

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R&D 100 Nominations ...

manufacturing products such as electronics, sporting goods, tools, jewelry and dental apparatus. Be-Safe provides a convenient and inexpensive method for frequent and reliable workplace testing, thereby promoting prompt remediation and preventive measures.

Applications

Workplace beryllium detection in the following:

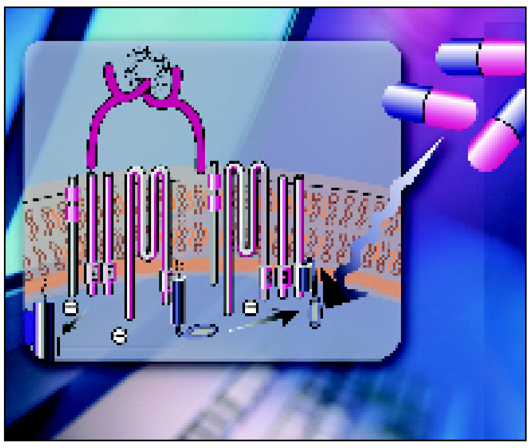
• Department of Energy complex, where beryllium is widely used in weapons manufacture and maintenance

• Manufacturing environments producing electronics, sporting goods, tools, jewelry and dental apparatus

• Aerospace industry and other R&D environments in which beryllium and its alloys are used in development of new electrical and mechanical components.

Team members: T. Mark McCleskey, Deborah Ehler, Gavin Collis, Edel Minogue, Anthony Burrell and Kevin John of Actinide, Catalysis, and Separations Chemistry (C-SIC)

BioNetGen: Software for Modeling Biological Signaling Complexity



BioNetGen is a software package that creates precise and comprehensive models for a wide array of biological regulatory systems, which often cause disease when they function abnormally. These models facilitate the design of more-focused experiments to test actual cellular signaling configurations (i.e., molecular species and reactions) and to evaluate the therapeutic potential — and potential side effects — of candidate drugs and drug targets inside cells. With its modeling flexibility, the software narrows the field for drug targets and defines what are potentially the most useful drugs, thus promoting the development of novel drugs and helping to reduce R&D costs in the pharmaceutical industry.

Applications

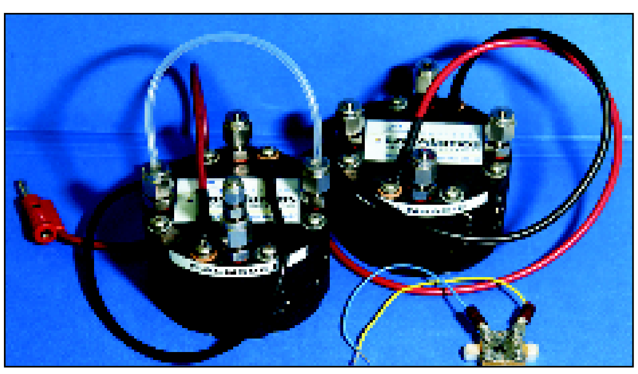
• Predicting the possible and probable signaling configurations in various cell types (guides experimenters in designing the potentially most informative protocols)

• Analyzing the molecular forms and complexes that arise within the dynamics of signaling reactions

• Identifying promising strategies for drug intervention, thereby directing design initiatives for drug synthesis

• Evaluating the probable effects on signaling of candidate drugs that act inside cells — before animal or human testing.

Team members: Michael Blinov, William Hlavacek and James Faeder of Theoretical Biology and Biophysics (T-10)



DMFC-20 Portable Power System

The DMFC-20 is a compact, highly energy-efficient, direct methanol fuel-cell power system that is designed to deliver 20 watts of electric power for use in portable military applications. Portable devices also are in great demand in the civilian sector, and potential industrial partners are interested in moving the DMFC-20 to the commercial market. When operated for a month, the DMFC-20 can provide up to 10 times the energy density (or specific energy) of batteries. A lightweight, integrated methanol sensor ensures that the DMFC-20 operates with maximum fuel-conversion efficiency. The DMFC-20's high specific energy and very efficient fuel conversion distinguish this system from other direct methanol fuel cells.

Applications

• Commercial applications: portable electronics, battery chargers, household tools, long-operating air-quality sensors (e.g., carbon dioxide sensors), remote road signs, camping equipment and electric scooters (hybrid systems with rechargeable battery)

• Military applications: auxiliary power, battery chargers and deployed field sensors.

Team members: Piotr Zelenay, John Davey, Piotr Piela, Bryan Pivovar, John Ramsey, John Rowley, Mahlon Wilson and Christine Zawodzinski of MST-11; Dennis Lopez of Isotope and Nuclear Chemistry (C-INC); and Geraldine Purdy of Actinide Analytical Chemistry (C-AAC); Christian Eickes of Umicore AG & Co. KG; Francois Le Scornet of Haute Etude Commerciales; Yimin Zhu of Renew Power Inc.; and Jeffrey Schmidt, Bob Cook, Phil Hebner, Bob Kohl, Rodger Lucero, Tim Quakenbush, Larry Trubell and Bill Wildhaber of Ball Aerospace and Technology Corp.

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R&D 100 Winners *continued*

1992
- Thermal Neutron Multiplicity Counter
- Plastic Laser Dye Rods
- Cryogenic Diamond Turning
- Portable Laser Spark Surface Mass Analyzer (PLASSMA)
- Zeeman Refractive Index Detector
- Animated Display of Inferred Tongue, Lip, and Jaw Movements During Speech

1993
- Selenium-Based Reagents for the Evaluation of Chiral Molecules
- Phase-Sensitive Flow Cytometry
- Ultrafast Infrared Spectometer
- Mini Elastic Backscatter Lidar

1994
- Ultrasensitive Ultrasonic Transducer
- Telemetric Heat Stress Monitor
- Optical Biopsy System
- Lattice Boltzmann Permeameter
- Directed Light Fabrication of Complex Metal Parts
- Bartas Iris Identification

1995
- The Indigo-830
- ARS Chemical Fill Detector
- Hydride-Dehydride Recycle Process
- HIPPI-SONET Gateway
- Microsensor for VOCs
- Polymer Filtration System

R&D 100 Winners continued

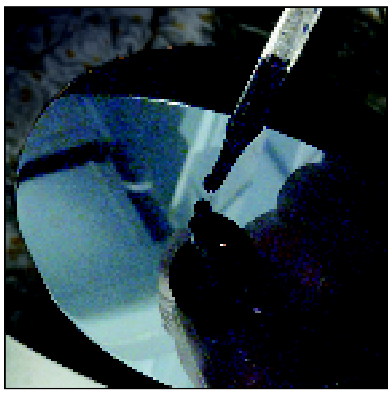
1996
- TRACER (Transportable Remote Analyzer for Characterization & Environmental Remediation)
- PLASMAX (Plasma Mechanical Cleaner for Silicon Wafers)

1997
- Falcon: Breakthrough Software for Simulating Oil Reservoirs
- Rapid Size Analysis of Individual DNA Fragments
- ASR Detect—Diagnostic Method for Analyzing Degrading Concrete
- Dry Wash
- Plasma Source Ion Implantation for Enhancing Materials Surfaces
- High Performance Storage

1998
- Cyrax_™ — Portable, 3-D Laser-Mapping and Imaging System
- Low-Smoke Pyrotechnics
- SOLVE — Creating 3-D Pictures of Protein Molecules from X-Ray Diffraction Spots
- Underground Radio

1999
- Acoustic Stirling Heat Engine
- Atmospheric Pressure Plasma Jet
- CHEMIN: A Miniaturized X-Ray Diffraction and X-Ray Fluorescence Instrument
- PREDICT — A New Approach to Process Development
- Real-Time, Puncture-Detecting, Self-Healing Materials
- REED-MD: A Computer Code for Predicting Dopant Density Profiles in Semiconductor Materials
- The Sulfur Resistant Oxymitter 4000™

R&D 100 Nominations ...



PAD: Polymer-Assisted Deposition of Metal-Oxide Films

PAD uses an organic polymer and one or more metal compounds dissolved in water to deposit high-quality films of nearly any metal oxide on nearly any shape or substrate. The organic polymer binds to the metal ions or complexes in the solution to prevent them from precipitating or forming other inorganic compounds. The result is a stable, homogeneous chemical solution that coats objects uniformly — an essential part of PAD's ability to form high-quality films.

PAD produces higher-quality films with a greater range of chemical compositions than is possible with other chemical solution deposition techniques. Vacuum deposition techniques also can produce high-quality metal-oxide films. But because PAD does not require a vacuum system, PAD is easier and less expensive to use.

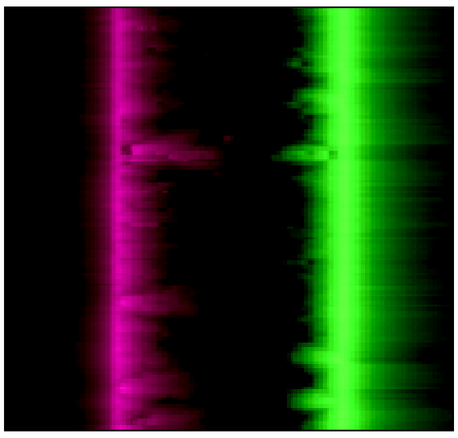
PAD can deposit amorphous, polycrystalline, or epitaxial films with thicknesses of 10 nanometers to hundreds of nanometers or more. The only requirement for the substrate is that it be stable in oxygen up to 400 degrees Celsius or slightly more. Metals, ceramics, glass and silicon can be used as substrates.

Applications

PAD can be used to make films for
- Flat-panel displays
- Microchips
- Solar cells
- Superconducting tapes.

Team members: Wu-Chun Feng and Aaron Darling of CCS-1

MIST: Magnetic Imaging of Superconducting Tape

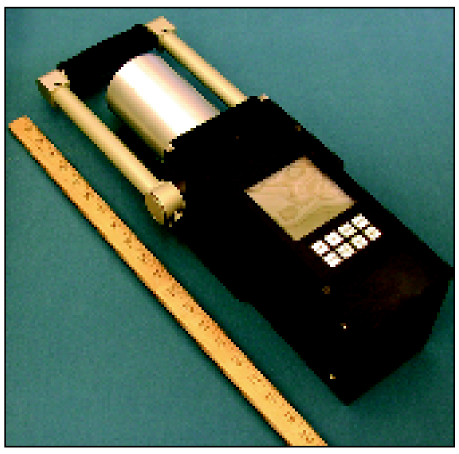


One of the stumbling blocks in manufacturing thin objects, such as superconductors, and miniscule objects, such as computer chips, is minimizing and perhaps even eliminating defects and imperfections. In many instances, defects and imperfections lead to less-than-stellar performance and even costly malfunctions. But how can one detect nanosized defects in objects that are so tiny to begin with? To address this problem, researchers have developed a combination of magnetic sensors and computer software known as MIST (Magnetic Imaging of Superconducting Tape) that noninvasively and nondestructively detects microscopic defects in superconducting tape and minuscule objects, such as integrated circuits and other nanotechnological devices. For superconducting tape, MIST tests the fabricated tape for defects so that the manufacturing process can be adjusted to avoid producing "bad" coated conductors.

Applications

- Detecting microscopic and gross defects and imperfections in superconducting tapes likely to play an important role in generating and transmitting electrical power
- Testing currents in electronic and computer circuits
- Optimizing magnetic-hard-drive storage
- Enhancing quality-assurance/quality-control in the manufacture of nanosized objects.

Team members Fred Mueller, J. Yates Coulter and Dean Peterson of the Superconductivity Technology Center (MST-STC); Marilyn Hawley, Holger Grube and Geoff Brown of Structure/Property Relations (MST-8); and Yi-Yuan Xie and Venkat Selvamanickam of SuperPower, Inc.



GN-5: A Portable Gamma-Ray and Neutron Instrument

GN-5 is a lightweight, robust, versatile instrument with the following key features: (1) detects gamma rays with high energy resolution using a high-purity germanium crystal; (2) uses a bismuth germinate scintillator to suppress parasitic Compton signals that can obscure gamma rays; (3) compares gamma-ray signals with an extensive library of relevant gamma-ray energies; and (4) includes

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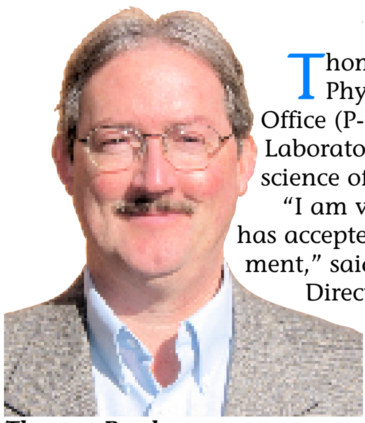
Bowles named Lab's Chief Science Officer

by Chris Roybal



Thomas Bowles

Thomas Bowles of the Physics Division Office (P-DO) is the Laboratory's new chief science officer.

"I am very pleased Tom has accepted this assignment," said Laboratroy Director G. Peter Nanos. "I have every confidence that he has the requisite skills, energy and leadership to help direct the Laboratory's science programs."

Nanos tasked two groups — the Laboratory Fellows and an ad hoc group of senior scientists with whom the director has been meeting on a regular basis — to provide recommendations for a Laboratory structure that would ensure that science has a strong voice in the management and operation of the Laboratory. Both groups proposed the establishment of a chief science officer.

The CSO position is not a line- or program-management position. As CSO, Bowles will report to Nanos. Bowles' administrative responsibilities will focus on enhancing science at the Laboratory, and he will serve a three-year limited term. In addition to being a member of the Senior Executive Team, Bowles will have a limited-term deputy who will succeed him.

As CSO, Bowles will have various duties and responsibilities, including the following:

- Review and provide recommendations regarding performance in the focus and quality of science across all technical directorates;
- Provide a quality review of designated programmatic research;
- Advocate for both fundamental and applied science and for their coordination; help remove unnecessary administrative obstacles and assist in Labwide efforts to reduce the cost of doing scientific research;
- Facilitate more effective and balanced integration of science into programs;
- Oversee the Laboratory Directed Research and Development program;
- Advise Director Nanos on science policy and on strategic directions in science, including producing and updating a Laboratory scientific roadmap.

Bowles also will become chair of the Science Council, which will consist of six practicing scientists appointed by Nanos and Bowles. Council members will have expertise and interests that cover a wide range of Laboratory programs, and each member will be supported at the 20-percent level by the Director's Office. Bowles and SC members also will be active in division review committees.

"I am very honored to be appointed by the director as the chief science officer," said Bowles. "I view this as a tremendous opportunity to make a positive change in our ability to do science at Los Alamos. I believe it is essential to the Laboratory's future to find ways to relieve the stress that the applied and basic research programs face. Unless we can do that, I see tremendous difficulties in being able to guarantee the long-term viability of the stockpile and to maintain a world-class effort in basic research. I will certainly do my utmost to make Los Alamos a better place to do science."

Bowles began at the Laboratory in 1979 and will celebrate his 25th anniversary Aug. 1 — up to now, his entire Laboratory career was spent in the Physics (P) Division. When he first arrived at Los Alamos, Bowles founded P Division's effort in weak interaction physics that has gone on to be recognized as one of leading efforts in neutrino physics and fundamental symmetries in the world. He has been a key player in several neutrino experiments and the principal investigator on the Laboratory's Ultra-Cold Neutron program, while also serving as the Nuclear Physics Program manager.

During his time at the Laboratory, Bowles has received a number of awards and served in various positions. In 2000, Bowles was one of the recipients of a Distinguished Performance Award for work on the UCN program. Last year, the Institute for Nuclear Research of the Russian Academy of Sciences honored Bowles with the M.A. Markov Prize for his work as a principal investigator of the Soviet-American Gallium Experiment, a major solar-neutrino investigation.

In addition to being a both a Laboratory Fellow and a Fellow of the American Physical Society, he is an affiliate professor at the University of Washington. Bowles has been coordinator of the Laboratory Fellows program and chair of the post-doctoral committee. He also served for a period on former Laboratory Director John Browne's advisory board.

Outside the Laboratory, Bowles served on the Nuclear Science Advisory Committee and the executive committee of the Division of Nuclear Physics of the American Physical Society. He continues to serve as a reviewer for both Department of Energy and National Science Foundation projects and on several national and international advisory and editorial boards.

Bowles earned his bachelor's degree in physics and mathematics from the University of Colorado and his doctoral degree in physics from Princeton University.

This month in history …

July

1776 — Declaration of Independence ratified on July 4.

1788 — Congress announced the United States Constitution had been ratified by the required nine states and that a committee had been appointed to make preparations for the new American government.

1804 — Former Vice President Aaron Burr kills Secretary of the Treasury Alexander Hamilton in a duel.

1814 — George Stephenson constructs first effective steam locomotive.

1867 — Alfred Nobel demonstrates his new invention, dynamite, for the first time.

1898 — The radio is patented by Guglielmo Marconi.

1908 — Federal Bureau of Investigation formed.

1914 — The first World War begins when Austria-Hungary declares war on Serbia.

1933 — The first All Star Baseball game is played; the American League wins 5 to 2.

1928 — First color TV transmission, made by John Logie Baird.

1943 — The first nuclear physics experiment is conducted at Los Alamos (the measurement of Pu-239 fission neutron yield), inaugurating it as a functioning laboratory.

1944 — The Manhattan Project is granted the highest project-wide procurement priority (AA-1).

1945 — Final preparations begin at the New Mexico test site, the Jornada del Muerto at the Alamagordo Bombing Range, for the first atomic bomb test, code named Trinity. The date is set for July 16. The experimental atomic bomb "Fat Boy" was set off at 5:30 a.m. in the New Mexican desert, creating a mushroom cloud rising 41,000 feet. The bomb emitted heat three times the temperature of the interior of the sun and wiped out all plant and animal life within a mile.

1953 — The Korean War ended with the signing of an armistice by U.S. and North Korean delegates at Panmunjom, Korea. The war had lasted more than three years.

1955 — Disneyland opens in Los Angeles, Calif.

1962 — Telstar, the first private communications satellite, launches.

1969 — A global audience watched on television as Apollo 11 Astronaut Neil Armstrong took his first step on the moon. As he stepped onto the moon's surface he proclaimed, "That's one small step for man, one giant leap for mankind."

1975 — The United State and USSR launch the Apollo-Soyuz Test Project spacecraft and link up in space.

1979 — Skylab space station re-enters Earth's atmosphere. Pieces land in the Indian Ocean and in Australia.

1984 — First flight of space shuttle "Discovery."

1997 — The Georgia O'Keeffe Museum in Santa Fe officially opens with more than 80 of her paintings, drawings and sculptures on display.

1999 — John F. Kennedy Jr. dies in a plane crash off Martha's Vineyard.

And this from the July 1965 Atom … The LASL Main Library … will become a "public" library on July 6. The action is one of the Laboratory's moves to extend use of its facilities to other qualified researchers.

The information in this column comes from several sources including the online History Channel, the Newsbulletin and its predecessors, the atomic archive.com, Echo Vitural Center, Science & Technology, Real History Archives, and Carey Sublette, "Chronology for the Origin of Atomic Weapons" from www.childrenofthemanhattanproject.org/ MP_Misc/atomic_timeline_1.htm.

Submissions are welcome. Please be sure to include your source.

R&D 100 Nominations ...

sophisticated electronics and software for accurate, real-time radioisotope identification with minimal user training. Operated alone, the BGO scintillator can be used to quickly scan containers for evidence of radioactivity. Once gamma rays are detected, the HPGe detector identifies the radioisotopes present. Comparison of the count rates from the two GN-5 neutron detectors (one shielded with cadmium) provides information about the possible presence of hydrogenous materials, such as explosives, in containers.

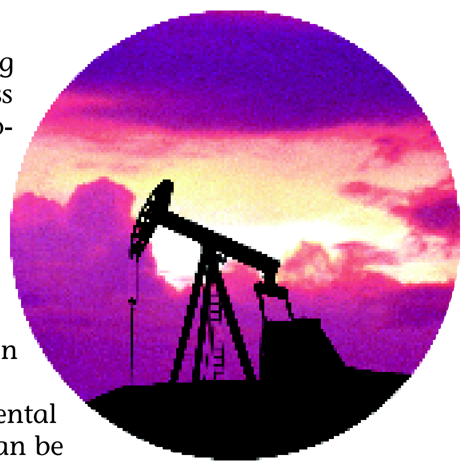
Applications

GN-5 can be used to detect smuggled nuclear and other dangerous materials or proliferation activities at many critical locations:

- Border crossings
- Harbors and airports
- Tunnels and bridges
- Office buildings, sports arenas and convention centers
- Vulnerable installations, such as dams and power plants
- Facilities where nuclear-proliferation activities are suspected.

Team members: Christen Frankle of Hydrodynamics and X-ray Physics (P-22); Kenneth Butterfield, Scott Garner, William Murray and Benjamin Sapp of Advanced Nuclear Technology (N-2); and John Becker, Jeffery Collins, Christopher Cork, Lorenzo Fabris and Norman Madden of Lawrence Livermore National Laboratory

Stripper Microhole Technology



Microhole technology is a paradigm shift for the drilling industry. It has the potential to allow much cheaper access to the remaining small pockets of oil in stripper fields (economically marginal fields that produce ~ 10 barrels of oil/well/day). In the past, 6- to 12-inch-diameter wells were necessary to support exploration as well as large-flow production during a well's commercial life. Drilling technology advances and progress in miniaturizing electronics and sensors have facilitated use of microholes (1-3/4 to 2-5/8 inch diameter) reducing oil recovery costs in shallow, economically marginal fields; increasing the number of accessible oil reserves; and reducing environmental damage. The Lab proved to a skeptical industry that "it can be done." Researchers integrated and adapted existing technologies into a drilling system that allowed construction of a 497-foot-deep demonstration stripper microhole at the Teapot Dome oil field near Casper, Wyo., in September 2003.

Applications

- Reviving production in economically marginal oil and natural gas fields
- Exploring for shallow oil and gas at a greatly reduced cost
- Acquiring high-quality seismic data through the drilling of inexpensive holes to place sensors in an ultraquiet environment
- Monitoring primary and enhanced production processes for reservoir management
- Producing coalbed methane at remote locations.

Team members: James Albright, Donald Dreesen and David Anderson of Geophysics (EES-11); James Thomson of Lithos Associates; Ralph Schulte of Rocky Mountain Oilfield Test Center; and Rhonda Lindsey Jacobs of National Petroleum Technology Office, National Engineering Technology Laboratory

Superhard, Ultratough Nanocomposites

Diamond is the material of choice for most abrasive applications because of its superhardness. Unfortunately, its use is limited because diamond is brittle and prone to fracture. Researchers have solved the brittle-fracture problem by developing a novel nanostructured composite that consists of diamond particles embedded in a matrix of nanocrystalline silicon carbide. This nanostructured matrix halts the growth of cracks that lead to fracture. The nanocomposites are the toughest, most durable diamond composites ever produced. They set a new performance standard for next-generation abrasives. In addition, the innovative synthesis technique can be extended to tailor the properties of other superhard materials. The diamond nanocomposites possess the performance-critical properties required to replace current tungsten carbide and diamond abrasives in a broad range of applications.

Applications

- Composite inserts for drilling bits in the oil and gas industry
- Super-abrasive components for high-impact mining, grinding and cutting environments
- High-speed tool surfaces for machining nonferrous alloys and hard ceramics
- High-temperature dies for wire drawing
- Anvils for high-temperature, high-pressure materials research.

Team members: Jiang Qian and Yusheng Zhao of the Manuel Lujan Jr. Neutron Scattering Center (LANSCE-12)

R&D 100 *Winners continued*

2000

- ANDE: Advanced Nondestructive Evaluation System
- Electroexploded Metal Nanoparticles

2001

- Free-Space Quantum Cryptography
- SCORR — Supercritical CO^2 Resist Remover
- Tandem-Configured Solid-State Optical Limiter

2002

- GENIE: Evolving Feature-Extraction Algorithms for Image Analysis
- HDF5 — Hierarchical Data Format

2003

- CARISS: Integrated Elemental and Compositional Analysis
- BASIS: High-Confidence Biothreat Detection and Characterization
- FIRETEC: A Physics-Based Wildfire Model
- Flexible Superconducting Tape
- FlashCT™
- Green Destiny
- PowerFactoRE: A Suite of Reliability Engineering Tools for Optimizing the Manufacturing Process
- Super-Thermite Electric Matches

2004

- 10 Gigabit Ethernet
- mpiBlast
- Clustermatic
- Plasma-Torch Production of Spherical Boron Nitride Particles
- Confocal X-ray Fluorescence Microscope