

Advancing Science for National Security

2011 Annual Report
Los Alamos National Laboratory

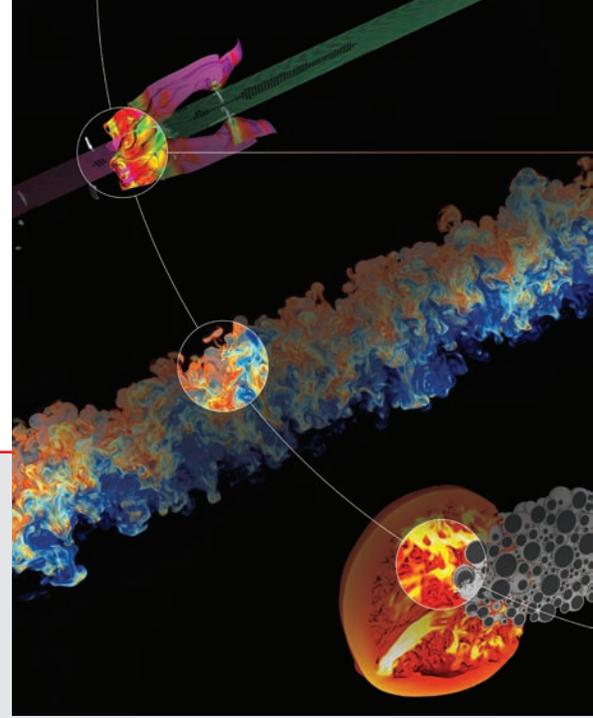
LOS ALAMOS
National Security, LLC

 **Los Alamos**
NATIONAL LABORATORY
EST. 1943

About the cover: / RVS QP RVMKRP HNRWRKMH RUCVP RWBR HUXOXSHURP SXMVTHDFKFDSEGG
of performing more than 1,000 trillion operations per second. The newer one, Cielo, was upgraded in 2011.

Scientists use this computing power to run the complex models and simulations of, for example, ocean warming or a nuclear explosion. Under the extreme conditions created by nuclear weapons, solid materials behave like fluids. Understanding the complex processes of instability and turbulence allows us to more
DFFXDMOIP RGHQWESHURP DCFHRIS P HUFV VIOXFODUJCHMUHQW

Top: Unstable intermixing of heavy (sulfur hexafluoride) and light fluid (air).
Middle: Turbulence generated by unstable fluid flow.
Bottom: Examining the effects of a one-megaton nuclear energy source detonated on the surface of an asteroid (see caption, page 11).



About Los Alamos National Laboratory

Located 35 miles northwest of Santa Fe, New Mexico, Los Alamos National Laboratory is a premier research and development institution focusing on national security science.

With more than 11,000 employees and an annual budget of more than \$2 billion, the Laboratory enhances national security by ensuring the safety and reliability of the U.S. nuclear stockpile, developing technologies to reduce threats from weapons of mass destruction, and solving challenging problems related to energy, the environment, health, and global security.

The Laboratory is operated by Los Alamos National Security, LLC (LANS), a team composed of Bechtel National, Inc., the University of California, The Babcock & Wilcox Company, and URS Energy and Construction, Inc., for the Department of (QHJ VJ DNRQDI XFODUS HFUXMS GP QVMDMRCI

Welcome LANL's New Director

Last summer, the LANS Board of Governors welcomed Dr. Charles McMillan as the 10th LANL director and the second LANS president. Charlie McMillan is an accomplished leader in the NNSA national security and weapons programs, with the experience and abilities necessary to lead the Laboratory into the future.

We extend our sincere appreciation to Dr. Michael Anastasio for his six years of service to LANS as Laboratory director and LANS president. His extraordinary 31-year career serving the nation in leadership roles at both LANL and Lawrence Livermore National Laboratory is unique and marked by exceptional distinction.

Much has been achieved by LANS since its formation, and the Board of Governors recognizes that much more can be accomplished. In Charlie McMillan, we have a director who will lead the Laboratory to even higher levels of performance.

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From the Board of Governors and Laboratory Director



Norman Pattiz

With high performance and record levels of work, 2011 was an extremely successful year for Los Alamos National Laboratory.

National Security

We are tasked with solving the most difficult problems in weapons and global security. Doing this requires excellence in science, collaboration, creativity, and innovation, along with world-class experimental facilities.

priority to deter potential adversaries and to assure U.S. allies and other security partners that they have the capability to detect, identify, and destroy weapons, improved technologies for the detection of weapons of mass effect, and used science derived from nuclear weapons research to address, for example, a shortage of medical isotopes.

Science: From Algae on Earth to Minerals on Mars

In 2011, the Laboratory won three R&D 100 awards, licensed a breakthrough in quantum cryptography, led an alliance for advanced biofuel research, designed instruments for the Mars Curiosity rover, and achieved a world-record magnetic pulse at the LANL-hosted National High Magnetic Field Laboratory.

We continue to advance national security science through key investments. Our Laboratory Directed Research and Development program was recognized as among the finest in the Department of Energy enterprise. Our postdoctoral staff numbers reached an all-time high, providing a pool of superior talent for our future workforce. Two dozen LANL scientists were honored by their peers as Fellows in their respective disciplines, and two members of the Laboratory staff won E.O. Lawrence Awards from DOE.

To compete for exceptional talent, LANL continued building and renovating laboratory space.

LANL continued building and renovating laboratory space.

Shaping the Future

As we enter 2012, the Laboratory stands at a crossroads. The LANS Board of Governors is confident that the Laboratory leadership team, working with our incredibly talented employees, will meet the challenges of reduced funding, changing requirements, and difficult political environments with strategies that are well thought out and based on strong core scientific capabilities.

Already a trusted source for unbiased technical information about stockpile stewardship and the future of nuclear energy, the Laboratory is committed to enhancing the value of this unique and irreplaceable asset vital to the security and scientific leadership of the United States.



Craig Albert



Charles McMillan

Norman Pattiz
Chairman
LANS Board of Governors

Craig Albert
Vice Chairman
LANS Board of Governors

Charles McMillan
LANS President and
LANL Director

Nuclear Deterrence

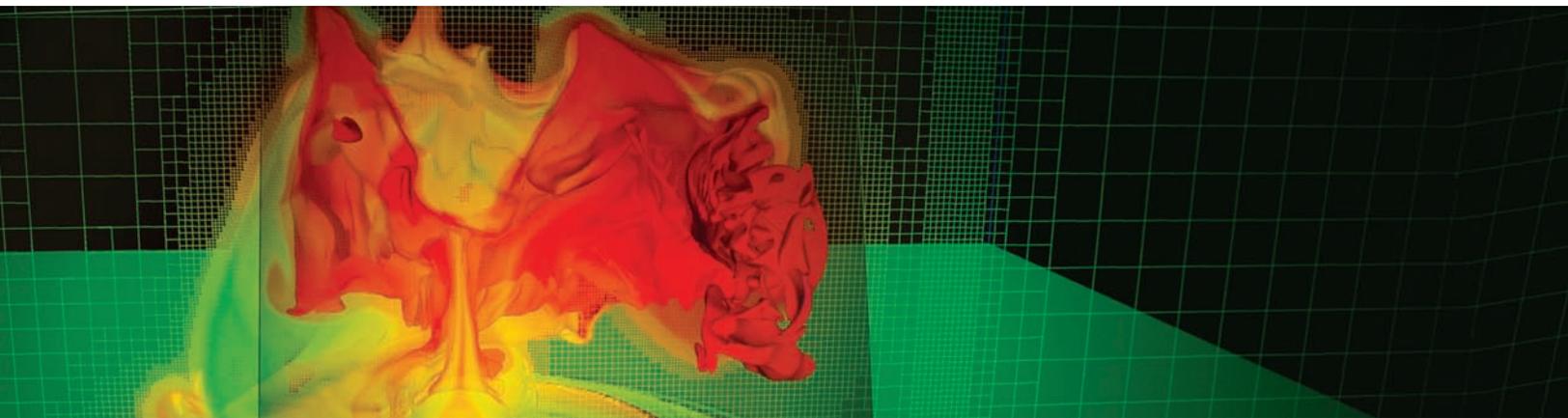
The Laboratory contributes cutting-edge research and vital scientific leadership to assure the safety, reliability, and performance of the nation's stockpile.



LANL's DARHT facility executed six successful hydrotests in 2011. The hydrotests are used to study the implosion of mock nuclear weapons.



Molten plutonium in a crucible.



The petascale computing conducted on the Cielo supercomputer supports stockpile stewardship work and other scientific missions.

Annual Assessment of the Stockpile

Los Alamos completed the 16th assessment of the safety, reliability, and performance of the nuclear weapons stockpile. The assessment advises President Barack Obama on the state and health of the nuclear weapons stockpile. Consistent with direction from the Secretary of Energy, an Integrated Nuclear Weapons Assessment Process was implemented whereby the Laboratory director received a detailed warhead brief by experts on specific systems. In 2011, the LANL director was briefed by Lawrence Livermore staff on the LANL W78 warhead, and the W87 warhead.

W88 Plutonium Pit Completed

LANL completed in 2011 the manufacture of the 29th war-reserve quality plutonium pit for the W88 warhead, as part of the Stockpile Stewardship Program. The W88 is the backbone of the nuclear weapons stockpile.

of these pits, the Laboratory successfully conducted small-scale plutonium experiments, analyzed legacy test data, performed groundbreaking materials science and extensive statistical analysis, adapted computer weapons codes, and refined a pit-manufacturing process to increase efficiency and lower costs.

Maintaining the Stockpile

Several key milestones (Phase 6.2/2A) of the B61 Life Extension Program were completed in 2011. The Nuclear Weapons Council approved transition to the next phase (Phase 6.3) in November 2011. Entry into Production Engineering (Phase 6.4) and First Production (Phase 6.5) will be determined in the future. These milestones provide the foundation for modernizing a key component of the nuclear weapons stockpile.

Plutonium Experiments Executed

We executed all planned Barolo experiments at the Nevada National Security Site. These consist of the Barolo Confirmatory, Barolo A and B, Bacchus Confirmatory, Bacchus, and static



The United States continues its extended deterrent commitment to its allies through modernization of the B61 bomb and its delivery platforms.

plutonium step wedge calibration experiments. The experimental data will provide LANL weapons designers and modelers with important material information that will inform Advanced Simulation and Computing program design codes used in certification efforts.

New Diagnostic Capability

Working with Lawrence Livermore, LANL completed the Energy Balance I milestone. The assessment results showed significant improvement in understanding major weapon physics phenomena, thereby significantly improving the predictive capability for modeling and assessing the nuclear stockpile.

LANL provided an important new diagnostic capability by delivering and fielding the neutron-imaging system at the Livermore National Ignition Facility. Related to this effort, LANL conducted experiments at the Omega Laboratory for Laser Energetics in New York supporting high-energy-density science experiments.

Successful DARHT Experiments

At the Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT), we continued to meet National Hydrotest Plan requirements by successfully executing planned experiments for both LANL and Lawrence Livermore. LANL also executed two Advanced Certification Campaign hydrotests at DARHT. With DARHT fully operational and producing highly detailed radiographs, scientists are studying the physics of weapons primaries. This information is critical in supporting nuclear weapons life-extension activities, resolving significant finding investigations to ensure the continued safety and reliability of nuclear weapons in the enduring stockpile, and furthering our scientific understanding of nuclear weapons behavior.

The Cielo Supercomputer Delivers

The Cielo supercomputer delivered on applications from all three national security laboratories, showing a significant performance improvement with its recent upgrade to 1.35 petaflops at peak performance. One petaflop is 1,000 trillion operations per second. Cielo represents a 6- to 10-fold increase in the classified computing capability over its predecessor. This performance enables exascale computing (1,000 times faster than the petascale), which is required for stockpile stewardship work and support of our other scientific missions. Cielo is ranked sixth on a list of the world's 500 most powerful computing systems.



LANL cast plutonium pits for the W88 warhead. Before they could enter the stockpile, the Lab verified that the quality and performance of those pits equaled or exceeded that of the pits wrought at the Rocky Flats production plant in Colorado.

Global Security

We provide science and engineering solutions to address complex threats.



Three LANL technologies are aboard the Mars Science Laboratory mission's Curiosity rover.



LANL technologists installed the high-average-current electron gun for the U.S. Navy free-electron laser prototype.

Safeguarding Radiological Material

With other DOE-NNSA colleagues, LANL plays an instrumental role in securing vulnerable nuclear weapons and weapons-usable nuclear and radiological materials by improving security and safeguards to protect these materials from theft and sabotage. In October 2011, Secretary Chu acknowledged the DOE-NNSA spent fuel to a long-term storage site under strict safeguards. The 14-year effort entailed moving the spent fuel, which contains 10 metric tons of highly enriched uranium and 3 metric tons of weapons grade plutonium, more than 3,000 kilometers in 12 shipments, safely storing and securing enough material for 775 nuclear weapons.

Improved Detection of Nuclear Hazards

One of the gravest threats the United States and its allies face is the acquisition of nuclear weapons or other weapons of mass destruction by terrorists or rogue nations. Detection and interdiction technologies play a critical role in mitigating this potential threat. LANL provides technologies and expertise through programs (such as the Second Line of Defense) that

systematically strengthen the capability to detect and interdict illicit trafficking of nuclear and other radioactive materials across international borders. Deployment of radiation detection instrumentation at border crossings, rail crossings, airports, and post offices, is part of this effort.

Aboard the Mars Mission

international quest to unravel the mysteries of Mars. Three LANL Curiosity rover, which is set to touch down on the surface of the Red Planet in August 2012. Los Alamos radioisotope batteries are providing power and heat to Curiosity, and will help drive the

2 mast and will use extremely powerful pulses of laser light to vaporize pinhead-sized areas of the Martian surface from as far away as 23 feet. The tiny flashes created by these pulses will be analyzed by a spectrometer to provide scientists with crucial information about the composition of Mars surface materials. Another LANL technology, CheMin, will use X-ray diffraction to determine the composition of samples that are collected and dropped into a funnel on the rover.

Defeating Threats to the Navy

LANL successfully tested a new high-current electron injector, a device that can be scaled up to produce the electrons needed to build a high-power free-electron laser prototype for the U.S. Office of Naval Research. Operating at the speed of light, the by defeating multiple incoming missiles in different maritime environments with a high-power beam of wavelength-tunable light.

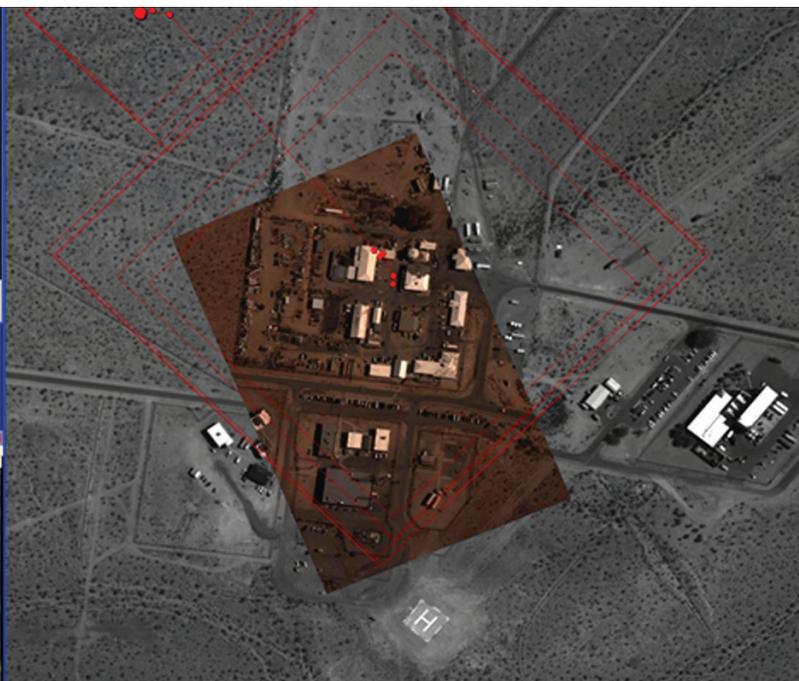


LANL's portal monitor technology helps detect nuclear materials in transit across international borders.

Airborne Image Surveillance

TAOS is the follow-on to the Angelfire system, an airborne image surveillance method developed at LANL and used in Iraq to provide imagery-based surveillance to ground forces. Testing is under way, with deployment scheduled to Afghanistan in 2012. Angelfire was deployed during the 2011 Las Conchas Fire that threatened the Laboratory. It proved the quickest way to develop a comprehensive understanding of the fire front and terrain conditions, helping responders hone strategies for mitigating and suppressing fire.

Airborne image surveillance technology developed at LANL will help troops in Afghanistan.



Minimizing Global Radiological Hazards

The Air Force Technical Applications Center acknowledged the LANL Shared Forest Team for its outstanding technical analysis of radiological samples and consequence management support following the earthquake- and tsunami-induced damage to the Fukushima Daiichi nuclear power plant. The results were critical in helping the United States and Japan determine options for minimizing the impact of radiological hazards on the global population and the environment.

Reducing Proliferation Threats

LANL has played a significant role in mitigating proliferation in multiple areas. This expertise spans more than 40 years of direct support to the International Atomic Energy Agency (IAEA), including the development of nearly every nuclear materials assay technology, training for every IAEA inspector, and more than 50 ongoing safeguards technology development projects. LANL also provides continuous treaty verification support, including support for the New START treaty and the Comprehensive Nuclear Test Ban Treaty.

As another measure to reduce proliferation threats, LANL continues to employ Advanced Recovery and Integrated Extraction System (ARIES) technologies to convert weapons-grade plutonium to blended mixed oxides for use in commercial nuclear power reactors. In 2011, LANL exceeded a production milestone by converting 240 kilograms of plutonium.

Innovative Science and Technology

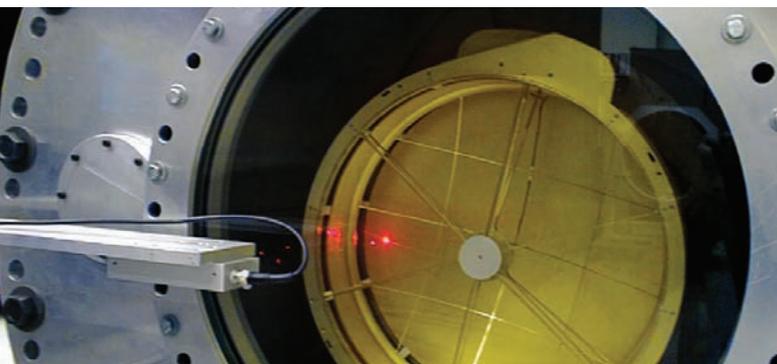
Our science and technology underpin all the national security missions of the Laboratory.



LANL is working on influenza surveillance technology.



A LANL breakthrough in hydrogen storage technology could lead to the practical use of hydrogen fuel in cars.



LANL equipment took the first oxygen and nitrogen measurements of the Sun.

Exploring Energy Sources

The New Mexico Consortium was formed by three New Mexico universities under a teaming agreement with the University of California to partner with LANL and advance scientific research and education in New Mexico. The Consortium will construct a new building and greenhouse in the town of Los Alamos to accommodate research activity, with help from Los Alamos County. Los Alamos scientists will explore such projects as improving the efficiency of plant photosynthesis, improving the techniques for producing and harvesting algae, and understanding the biochemical and biophysical processes of algae and other energy plants.

Enhancing Personal Security

LANL scientists took a revolutionary step forward in 2011 with quantum cryptography by developing the QKarD, a device with miniaturized quantum technology that fits into a portable wireless device, such as a smartcard, smartphone wireless credit card, or identification card. The technology uses the quantum mechanical laws of physics rather than complex mathematical structures to encrypt information. QKarD includes reliable hardware and authentication and encryption techniques, and makes quantum cryptography broadly applicable, manufacturable, deployable, affordable, and mobile.

Increased Medical Isotope Production

In response to a national shortage of molybdenum-99, the Laboratory increased its production of medical radioisotopes for cardiac imaging. The LANL Isotope Program has a long history of supplying medical radioisotopes to the U.S. health care industry. In 2011, production doubled compared with FY10 levels, which had increased by 350% compared with 2005 levels. This increase was made possible by dedicating an additional 25 days of operation at Los Alamos Neutron Science Center (LANSCE) to produce the ^{99}Tc isotope.

World Record Set for Magnetic Field

Researchers at the National High Magnetic Field Laboratory set a new world record for the strongest magnetic field ever delivered by a nondestructive magnet. The scientists achieved 45.0 tesla, more than a junkyard magnet, and some 30 times stronger than the field delivered during a medical MRI scan.

New Theory in Magnetic Reconnection

A LANL physicist presented a new theory of how a fundamental process of magnetic reconnection is the continuous breaking and rearranging of magnetic field lines. The theory, based on work features the formation and turbulent interaction of helical magnetic flux tubes. The theory is supported by spacecraft observations of magnetic reconnection in the magnetosphere and in solar wind.



LANL researchers set a world record for pulsed magnet performance, putting them in a position to deliver a magnet capable of achieving the elusive 100-tesla goal, which would have a profound impact on scientific investigations.

Breakthrough in Hydrogen Storage

LANL researchers developed a significant advance in hydrogen storage, which makes hydrogen a more attractive fuel for vehicles or other transportation modes. The technology focuses on... a significant step toward the practical use of hydrogen as a transportation fuel.

Unlocking Biomass Energy

Researchers at LANL and the Great Lakes Bioenergy Research Center have found a potential key to unlock the energy potential from non-edible biomass materials, such as corn leaves and stalks, or switch grass. The potential pretreatment method could make plant cellulose more digestible by enzymes that convert cellulose into ethanol (a useful biofuel).



Algae science, for biofuel production and other applications, has been a growing field for the Laboratory.

Understanding Quantum Dots

Research by Los Alamos scientists published in *Nature* documented significant progress in understanding the phenomenon... ability of biologists to track single particles, or enable technologists to create novel light-emitting diodes and single-photon sources, and boost the efforts of energy researchers to develop new types of highly efficient solar cells.

Exascale Computing Partnership

Working with Sandia National Laboratories and the Oak Ridge National Laboratory, LANL has formed the Science Partnership for Extreme-scale Computing to help DOE meet the challenges and shape the future for exascale computing (supercomputers capable of handling a million trillion calculations per second). LANL was awarded leadership of a DOE-funded exascale project: the Exascale Co-design Center for Materials in Extreme Environments with Livermore, Oak Ridge, Stanford, and others as partners.

Investment in Innovative Technologies

Guided by our missions, the Laboratory Directed Research and Development program is key to achieving long-term science and... program strengthens our scientific reputation, helps recruit and retain top talent, and builds capabilities to meet national needs. LDRD impacts are particularly evident in the high number of publications, citations, patents, and awards that result from LDRD-funded work. The LDRD program enables us to invest in research... most difficult problems.

Scientists Unearth Megadroughts

The mysteries of climate change became a little less mysterious thanks to work by LANL researchers digging around in the nearby Valles Caldera National Preserve. Working with an international research team, LANL unearthed a 260-foot-long sediment core that peered back in climatological time to the world as it existed between 360,000 and 550,000 years ago.

The Southwest region of the United States apparently undergoes P H J D G U R X J K W D U P H U I G U H U S H U R G M D M D U K X C G U H G M R I years or more. These megadroughts appear in cycles, with the most recent one comprising a present-day period that included the historic Dust Bowl of the 1930s.



LANL research gained insight into Southwest climatological periods called megadroughts.

Solar Secrets Revealed

In 2011, LANL scientists had two papers published in *Science* magazine that reported the first oxygen and nitrogen isotopic measurements of the Sun, demonstrating that these elements are very different from the same ones on Earth. These results H U M H O R S I W R S U R U M V R I \$ 6 \$ V I H Q M V P L M R Q I M H I L W spaceflight to return from beyond the Moon).

The capsule on the spacecraft contained a special instrument (built by a team at LANL) to enhance the flow of solar wind onto a small target to make the oxygen and nitrogen measurements possible. The targets of this Solar Wind Concentrator survived W H I S D F H F U I W F U D M K X S R Q U H Q M I I D C G H Y H Q M D O I H Q H G M H I solar secrets.

Fighting Global Influenza

A compact, self-contained, automated system for surveillance and screening of potential pandemic strains of influenza and other deadly infectious diseases is a step closer to reality, thanks to an agreement between LANL, the UCLA School of Public Health, and HighRes Biosolutions of Boston.

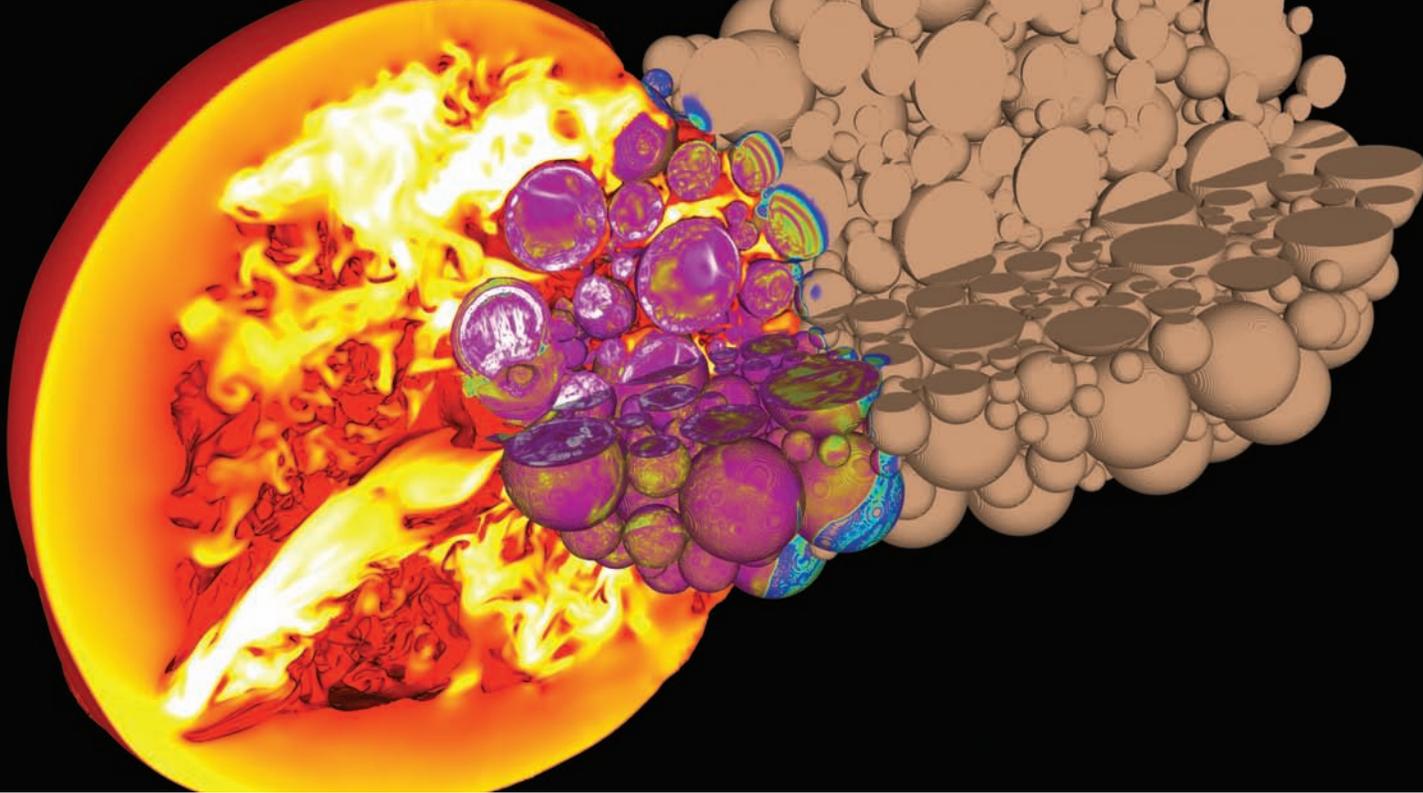


Work with quantum dots could lead to highly efficient solar cells.

Under the agreement, researchers from LANL and UCLA will test and certify the High-Throughput Laboratory Network, which is a prototype Global Bio Lab. The compact, modular laboratory can reliably process thousands of specimens of infectious agents to help public health officials respond quickly to a global health crisis. This technology can bring crucial disease-fighting tools to medical providers in remote locations that lack the resources to provide reliable public-health surveillance services during an emergency, such as a global pandemic.

Witnessing an Elusive Hydronium Ion

Thanks to a unique capability found at the Los Alamos Neutron Science Center (LANSCE), LANL researchers were able to witness for the first time the critical role that an elusive molecule plays in certain biological reactions. Prior to this research, no one had ever directly witnessed the role of the hydronium ion (a water molecule bound to an additional hydrogen ion) in macro- P R O F X O U I F D M O W W W H F D M O W F P H K D Q L P V R I H Q P H M I Y K H I research could aid in the treatment of peptic ulcers or acid reflux disease in humans, or allow for more efficient conversion of woody waste into transportation fuels.



Scientists are using this three-dimensional Cielo supercomputer simulation, which shows a megaton nuclear energy source exploding on the surface of the Itokawa asteroid, to address ways to prevent objects in space from colliding with Earth.

Successful Collaborations Enhance Transfer of LANL Technologies

In 2011, LANL continued to enhance essential relationships with major universities and key corporate partners, such as Chevron, Boeing, Procter & Gamble (P&G), and Westinghouse.

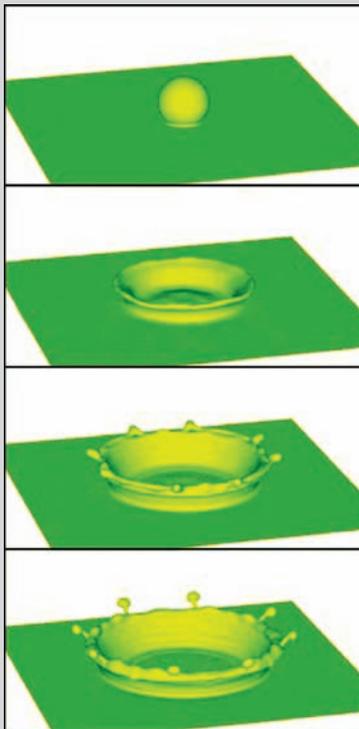
Under a Cooperative Research and Development Agreement (CRADA), LANL and P&G have collaborated for two decades, incorporating computational technologies developed for national security into cutting-edge tools for advanced manufacturing. For example, Los Alamos researchers and P&G engineers enlisted computer codes developed to model the flow, transport, and interaction of fluids and particles to help design a more efficient diaper manufacturing process.

Further collaboration led to the creation of a comprehensive modeling system, called Reliability Technology, that has saved P&G billions of dollars by reducing interruptions to production lines, and resulted in P&G's building new manufacturing capacity in the United States.

These specialized computer codes are now available to U.S. industry as part of President Obama's American Recovery and Reinvestment Act of 2009 to help make American companies more competitive and create new jobs.

One of several active projects under the Chevron CRADA, LANL and Chevron codeveloped

Tech Transfer



This simulation of a droplet of liquid falling into a pool of liquid was modeled using LANL's Computational Fluid Dynamics Library, also used by Procter & Gamble to simulate a manufacturing process.

and a downhole wireless communication technology used to collect real-time information from very deep oil and gas wells, and from drilling operations for new wells. The patented system delivers continuous electro-chemical monitoring and analysis. The collected data will improve well yields, saving producers millions of dollars per well. In addition, this data will aid oil-recovery efforts, which should increase domestic oil production and enhance U.S. energy security.

Commercialized in 2010, the INFIComm technology was licensed to Chevron, which sublicensed it to the start-up Inficom, Inc., (initially funded by Chevron). The first commercial units began to ship in fall 2011.

Technology Transfer Excellence

LANL received two 2011 Federal Laboratory Consortium awards for excellence in technology transfer, in recognition of successfully advancing technologies from the laboratory to the marketplace.

The Laboratory was recognized for Satellite & RP P XQIFMRCV DUDGIFRP P XQIFMRCV system prototype for use on miniature satellites, and for Genie Pro (Genetic Imagery Exploitation), a general-purpose, interactive, adaptive software tool for automatically labeling regions and finding objects (areas of interest) in image data.

Business and Operations

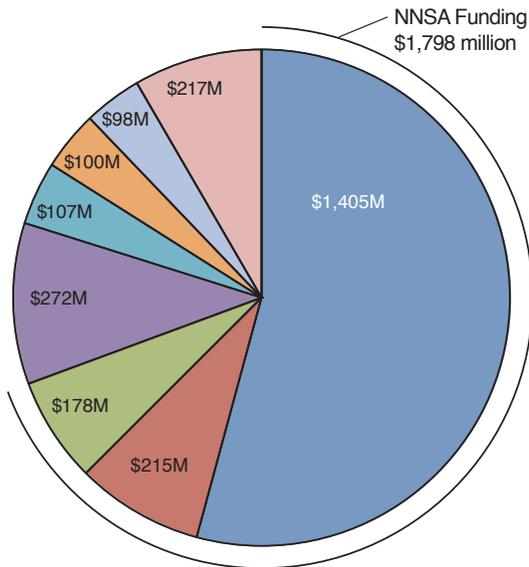
LANL operations and business systems ensure the safe, secure, and efficient performance of our mission.

Managing Operational Costs

LANL in 2011 established a Laboratory Integrated Stewardship Council to take concrete steps in preparation for leaner budgets in coming years. Members of the council have been scrutinizing Lab operating costs in order to meet current budget expectations without compromising safety, security, or mission.

LANL FY11 Budget

The total Laboratory budget for FY11 was a record \$2.6 billion.



- NNSA Weapons Program
- NNSA Nonproliferation
- NNSA Safeguards and Security
- DOE Environmental Management
- DOE Energy and Other Programs
- DOE Office of Science
- Work for Others
- Work for Others (National Security)



LANL's Emergency Operations Center was instrumental in maintaining Lab operations during the Las Conchas Fire.

Cyber Security Recognized

LANL is partnering with government agencies to improve incident response and detection capabilities that support national security efforts. LANL incident responders were deployed to and assisted with significant intrusions at three different laboratories. The team was recognized for its achievements with a 2011 U.S. National Cybersecurity Innovation Award.

Programmatic Work at Record Levels

While permanent staff numbers remained constant, the Laboratory executed \$184 million more in programmatic work (compared with FY10) and \$484 million more than FY09. LANL performed more than \$2.6 billion in work for the first time in its history, and completed more than \$900 million in procurements. LANL exceeded its goals for placing contracts with disadvantaged small businesses, Northern New Mexico businesses, and small businesses. LANL also saved more than \$33 million by using the Management Center.

Structural Upgrades to Nuclear Facility

LANL aggressively and effectively implemented structural upgrades to its Plutonium Facility in order to address newly identified seismic vulnerabilities. The Laboratory also continuously improved the overall safety posture of the facility through materials consolidation, repackaging, and other facility-related upgrades. Parent organization resources assisted with development of structural improvements, review of engineering design calculations, and preparation of the capacity calculations of the existing structure for the seismic analysis.

Improved Safety Results

As a sign of increasing safety in the workplace, LANL statistics in FY11 showed a decrease in total recordable cases by 6% and days-away cases by 44% (compared with FY10).



Workers took direct-push samples to characterize the contents of Material Disposal Area B prior to excavation.

The Environment

LANL is dedicated to protecting the environment and managing environmental impacts.

Completion of Cleanup Projects

LANL completed \$212 million in American Recovery and Reinvestment Act-funded environmental cleanup projects, including demolition of 175,000 square feet of Cold War-era former labs and office buildings. The Laboratory also completed excavation of its Manhattan Project-era waste disposal site. This work provided nearly 450 jobs, removed contamination from the environment, stimulated the regional economy, and cleaned up Laboratory land for eventual reuse.

Waste Shipment Record

For the third consecutive year, LANL set a record for shipping containing plutonium and other elements used in nuclear New Mexico. LANL completed 171 shipments in FY11, compared with 158 in 2010, and 132 in 2009. Each shipment brings LANL closer to closing Area G, its last remaining active waste disposal area.

Increase in Energy Efficiency

A massive project to make LANL buildings more energy efficient made considerable progress in 2011. The project involves swapping out old fluorescent light bulbs and installing smarter addition to the 2,300 new fixtures and automation of heating save LANL more than \$1.2 million per year while decreasing environmental impacts.

More Effective Water Management

In 2011, LANL strengthened its groundwater monitoring network of more than 230 wells, and took immediate actions aimed at slowing the flow of ash runoff after the Las Conchas Fire. Monitoring continues to show that Rio Grande water is cleaner downstream of the Laboratory than upstream. In addition, upgrades continued at a facility that treats up to 120,000 gallons of water per day for reuse to cool LANL supercomputers. Once completed, the project will save enough water to serve 4,000 homes each year.



The high-priority initiative to ship waste from LANL's Area G has accelerated off-site waste shipments.

Facilities

The Laboratory is committed to providing the very best facilities and infrastructure to support science and research.



The new Radiological Laboratory and Utility Office Building is now occupied.

Improved Project Management

In 2011, the Laboratory improved the performance of its capital projects by creating the Principal Associate Directorate for Capital Projects, and executed \$276 million in line-item projects. The new organization brings an improved and focused institutional rigor and standardization in project management to all capital projects. Line-item projects included demolishing the 317,000-square-foot former Laboratory Administration Building,



Old buildings are demolished to make way for modern facilities.

demolishing 175,000 square feet of Cold War-era laboratories with American Recovery and Reinvestment Act funding, and targeting infrastructure investments within the approved Long-Range Development Plan for the Laboratory.

CMRR Savings

In the latest phase of the Chemistry and Metallurgy Research Replacement project (CMRR), LANL completed and began occupying the new Radiological Laboratory and Utility Office Building. In addition, LANL initiatives have produced a costing strategy that is planned to save more than \$400 million. Resources provided by the LANS parent organizations are helping LANL collaborate with project managers at the Y-12 and safety reviews, as well as in such areas procurement, engineering, construction, and risk reduction.

Reducing the Laboratory Footprint

The Laboratory continued with its footprint reduction strategy to reduce its structural footprint, modernize its infrastructure, and provide LANL workers with safe, energy-efficient facilities. Between 2010 and 2014, LANL anticipates having removed nearly 1 million square feet.



LANL employees volunteered to fill sandbags that were placed around Santa Clara Pueblo buildings to protect them from post-fire flooding.

Community Involvement

Together with LANS, LANL continues to contribute time, talent, and money to help improve the quality of life for our neighbors.

Investing in the Community

The \$3 million annual LANS investment in education, economic development, and charitable giving in Northern New Mexico continues to generate outstanding, mutually beneficial results. LANS employees have increased charitable giving by 270% since 2006. During the 2012 Employee Giving Campaign, conducted in FY11, we broke previous records by raising more than \$1.8 million for eligible nonprofit organizations in the region through United Way. LANS is proportionally matching that total with an additional \$1 million.

Results-Driven Investment in Education

The LANS investments in educational programs at New Mexico Highlands University, Northern New Mexico College, and Santa Fe Community College led to employment opportunities for more than 80 graduates. Graduates from the University of New Mexico-Los Alamos are planned for 2012. The Los Alamos 11 college scholarships worth \$400,000 to 72 regional students.

Investing in Small Business Success

Our Northern New Mexico Connect economic development programs continued to invest in promising startup companies and activities that help local businesses reach the next level of success. Since 2006, 166 companies have received assistance that resulted in the creation or retention of 240 jobs, \$6.8 million in additional salaries, and \$8.2 million of new funding outside of the initial LANS investment. LANS also supports the New Mexico Small Business Assistance Program, which in 2011 enabled LANL staff to help 150 New Mexico small businesses meet their technical challenges.

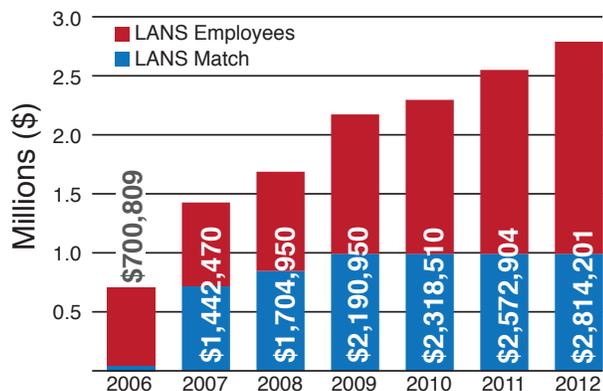
Helping our Neighbors

In February 2011, about 32,000 New Mexicans lost natural gas service in the midst of a deep freeze. Many were Laboratory employees and their families living in the Española Valley and as far north as Taos. LANL provided the help of a highly skilled group of Laboratory employees along with vehicles and equipment and paid them full wages during the emergency. LANL also provided technical expertise in the crisis in response to a request from State officials.



Every holiday season, LANL employees donate and distribute gifts to families in need throughout Northern New Mexico.

Employee Giving Campaign



Outstanding Employees

We recognize the creativity, innovation, and unwavering dedication of our employees and are committed to the development of our future workforce.

E.O. Lawrence Award

LANL scientists David Chavez and Mark Chadwick were two of the nine winners of the 2011 Ernest Orlando Lawrence Award. This honor is given to those who have made outstanding contributions in research and development that support DOE and its missions.



David Chavez

Chavez won in the area of Atomic, Molecular, and Chemical Sciences for his discovery of new chemical synthetic schemes used to advance development of fundamentally novel, highly energetic, environmentally friendly (high-nitrogen) molecular materials important to national security missions. Chadwick won in the area of National Security and Nonproliferation, and was honored for innovative scientific contributions to advance our understanding of fission product yields and other key nuclear reactions resulting in the resolution of a longstanding problem in national security.



Mark Chadwick

Fellows Appointments

LANL continues to show its breadth of expertise across scientific disciplines through the appointments of fellows. Typically, fellows are the highest level of recognition afforded to members of key scientific societies or associations. Seven LANL scientists earned the distinction as Fellow of the American Association for the Advancement of Science for advancing science applications that are deemed scientifically or socially distinguished. Eight scientists were named Fellows of the American Physical Society. LANL staff were also named Fellows of the Institute of Physics, the American Statistical Association, the American Geophysical Union, and the Materials Research Society.

Early Career Award

Los Alamos researcher Evgenya Simakov was named by President Obama as a recipient of the Presidential Early Career Award for Scientists and Engineers. Simakov was one of 94 scientists within 16 federal agencies nationwide to receive the honor. Simakov is pioneering the development of specially designed structures for high-energy particle



Evgenya Simakov

accelerators that mitigate undesirable byproducts of high-energy particle acceleration.

Outstanding NM Woman

The New Mexico Commission on the Status of Women selected Los Alamos National Laboratory research statistician Christine Anderson-Cook as one of 20 women to receive the 26th Annual Mexico Women in April 2011. Anderson-Cook was recognized for her technical leadership in statistics, extensive professional service at the national level, and mentorship of nearly 70 students. She currently leads the Complex System Health Assessment project in the Department of Defense and DOE Joint Munitions Program.



Christine Anderson-Cook

Emergency Operations Team

NNSA Defense Programs recently recognized the LANL Emergency Operations Team with its Defense Programs Employee of the Quarter Award. The award was given for the outstanding performance of the Emergency Operations Center during the Las Conchas Fire. The award recognizes those who go beyond the call of duty in

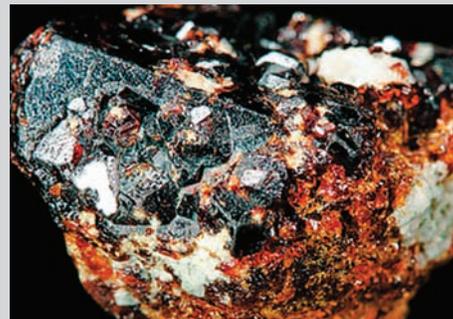
LANL won three prestigious R&D 100 Awards, which honor the top 100 proven technological advances of the past year, as judged by *R&D Magazine*.



NanoCluster Beacons are collections of silver atoms maneuvered to illuminate when bound to specific nucleic acids, such as the DNA of particular pathogens. Inexpensive, easy to use, and reversible, NanoCluster Beacons are superior molecular probes for detecting specific targets, human oncogene (cancer) sequences, and molecular disease sequences (such as sickle cell anemia).



Trapped Annular Pressure Shrinking Spacer (TAPSS) is a spacer fluid developed in collaboration with Chevron Energy Technology Company, Baker Hughes Services Company, and Lucite International Limited. The fluid can help prevent catastrophes in offshore oil-well drilling. TAPSS shrinks when heated and can be used to offset thermal expansion from the other fluids.



Thorium Is Now Green (Th-ING) introduces a straightforward, cost-effective, and safe method to produce thorium, an element that is capable of producing more energy than both uranium and coal at significantly lower quantities. This element is only slightly radioactive, and it is safe enough that it will never lead to a nuclear meltdown when used in a nuclear reactor. Until now, thorium could only be produced in hazardous settings at very high prices.

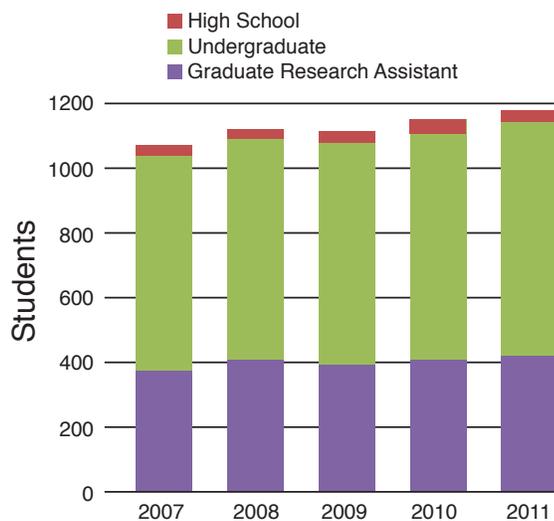
Preparing Our Future Workforce

In 2011, LANL attracted 1,179 student interns in both technical and nontechnical fields, giving them the opportunity to conduct important and exciting research in a wide range of disciplines. In addition, a record 452 postdoctoral students worked at LANL in 2011. Student interns and postdoctoral students contribute

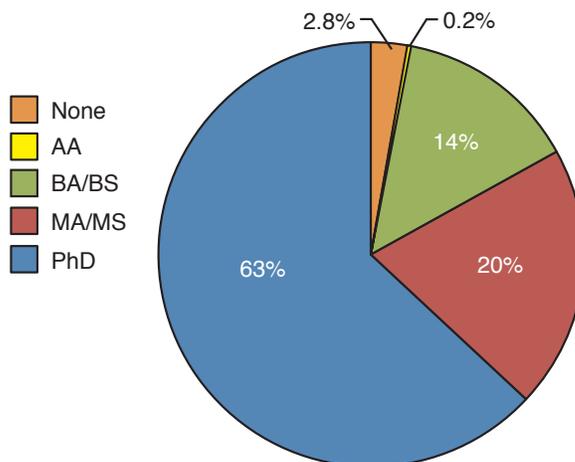
R&D hires and about 80% of non-management Ph.D. technical staff hires were former students or postdoctoral students at LANL.

Increasing Research Publications

LANL researchers generated 2,079 peer-reviewed publications in 2011, the highest number since the LANL contract transition to LANS in 2006. In addition, citations of LANL publications are the highest among DOE national laboratories.



Degrees Held by R&D Employees at LANL



Board of Governors

The LANS Board of Governors is composed of executive and advisory members from LANS partner organizations, together with key scientific, academic, national security, and business leaders serving as independent governors.

Executive Committee

Norman J. Pattiz

Chairman

Regent, University of California

Founder and Chairman Emeritus, Westwood One, Inc.

CEO, Courtside Entertainment

Craig M. Albert

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President, Bechtel Systems and Infrastructure, Inc.

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University of California

Chair of the Nominations and Compensation Committee

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Senior Vice President Emeritus, University of California

Chair of the Science and Technology Committee

Craig D. Weaver

Managing Director, Bechtel Management Company, Ltd.

Independent Governors

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Senior Fellow, Hoover Institution, Stanford University

Chair of the Mission Committee

Richard W. Mies

Admiral (Retired), U.S. Navy

Former Commander, U.S. Strategic Command

Chair of the Nuclear Weapons Complex Integration Committee

Nicholas G. Moore

Global Chair (Retired), PricewaterhouseCoopers

Chair of the Ethics and Audit Committee

Nick L. Salazar

State Representative, New Mexico Legislature



The LANS partners reinvested \$2 million of the LANS contract performance fee to upgrade the Weapons Neutron Research facility at LANSCE.

Advisory Members

Steven V.W. Beckwith

Vice President for Research and Graduate Studies,
University of California

John P. Howantiz

General Manager of Nuclear Security and Allied Governments,
Bechtel National, Inc.

Bruce D. Varner

Regent, University of California

Partner, Varner & Brandt LLP

David M. Walker

President, Bechtel National, Inc.

Chair of the Business and Operations Committee

Board of Governors Committees

The Board executes its oversight responsibilities through seven committees that help review the direction of the Laboratory, conduct evaluations, provide resources, measure performance, and provide advice on positioning for future trends and challenges. These committees are as follows:

- Business and Operations
- Ethics and Audit
- Mission
- Nominations and Compensation
- Nuclear Weapons Complex Integration
- Safeguards and Security
- Science and Technology



Regional businesses received more than \$57,000 in grants from the Las Conchas Fire Recovery Challenge Fund.

Board of Governors Accomplishments

LANS provides leadership enabling effective management of key mission, science and technology, fundamental operations, and business programs of the Laboratory to deliver outstanding results. Achievements in 2011 are highlighted below:

- After a rigorous, competitive, national search for a new Laboratory director, Dr. Charles McMillan was named director of LANL and president of LANS, effective June 1, 2011.
- Elizabeth Sellers, former manager of the DOE Idaho Operations Office and the Kansas City Site Office, was appointed as the deputy director of LANL, effective December 2011.
- The Board of Governors reinvested \$2 million of LANS contract performance fee to expand the Weapons Neutron Research capability at the Los Alamos Neutron Science Center. The design was completed and construction began on the 4,000-square-foot building that will house additional experimental capability, doubling the existing capacity.
- The Las Conchas Challenge Grant Fund, established with \$50,000 seed money from LANS, awarded checks to Northern New Mexico businesses that provided goods and services to first responders during the Las Conchas Fire.

- The Board completed five capability reviews and nine functional management reviews that spanned activities, including operations and business, manufacturing, fundamental science, and applied engineering. Outcomes from the reviews include
 - 25% and 58% reduction in total recordable cases and days away/restricted/transferred rates, respectively, for maintenance workers;
 - technology transfer from an affiliated site that enabled real-time P DQJHP HQRIUDGDMRQIP WMDVMH-Z \$1 / VD DMUDD LVSFVDD Area (MDA-B);
 - a major revision to the non-conformance reporting procedure;
 - management action to address staffing vulnerabilities in weapons quality assurance;
 - removal of the restriction on LANL Laboratory Directed Research and Development funds accumulation;
 - Development is effective;
 - validation of the readiness of LANL contractor assurance system for federal affirmation; and
 - validation of mission need for an active Biosafety Level 3 facility.
- Driven by the LANS commitment to match donations, Laboratory employees and LANS set a new record for giving to deserving nonprofits in Northern New Mexico, donating more than \$2.8 million to the annual employee giving campaign. In the same spirit, a LANS incentive fee investment of \$171,500 was essential in obtaining matching funds to purchase 3,000 student science kits for Northern New Mexico third-graders. The kits have helped increase science test scores by up to 39%.

About Los Alamos National Security, LLC

Los Alamos National Security, LLC (LANS) comprises four top 8 California, The Babcock & Wilcox Company, and URS Energy & Construction, Inc. Each organization has extensive experience in nuclear defense programs, scientific research and development, large-scale facilities management, applying science and technology to homeland security challenges, and safety and security.

The four parent organizations provide oversight of LANS performance through the Board of Governors, and functional managers of the parent organization provide reach-back

capabilities to corporate resources to provide best practices, processes, systems, and tools.

Capability reviews conducted by the Board of Governors in the areas of mission and science evaluate the quality, responsiveness, and future positioning of the programmatic and scientific work of the Laboratory. Functional management reviews are conducted to ensure that Laboratory management V VMP VDUHEDMGRQSDUHQWRJ DQ L DMRQ TEHMSUDFWHMDQGE industry standards. Continuous improvement is promoted by the Board by reviewing implementation of LANL management systems for adequacy, efficiency, and effectiveness.

LOS ALAMOS

National Security, LLC

Collaboration Key to Successful Fire Response

The largest fire in New Mexico history burned more than 156,000 acres south, west, and north of the Laboratory in 2011. The Las Conchas Fire forced LANL to close for six days, and 12,000 Los Alamos residents had to evacuate their homes.

Laboratory Director Charlie McMillan oversaw emergency responders who helped spare the community and the national treasure on the mesa. To them I say

The community of Los Alamos, as well as the Laboratory, survived Las Conchas because of thoughtful planning, excellence under stress, and the spirit of collaboration between the National Nuclear Security Administration (headquarters as well as the Los Alamos Site Office), LANL, Los Alamos County, the State of New Mexico, and federal emergency responders.

said Norman Pattiz, chairman of the LANS Board of Governors.



Only an acre of LANL property burned during the Las Conchas Fire, owing in part to Lab preparations since the Cerro Grande blaze of 2000. Sadly, the nearby communities of Cochiti, Jemez, and Santa Clara suffered major damage. LANL and a consortium of major subcontractors, including EnergySolutions and Frank's Supply Company, helped Santa Clara Pueblo in the aftermath of flooding caused by Las Conchas.



www.lanl.gov
www.lansllc.com

Los Alamos National Laboratory, an affirmative action and equal opportunity employer, is operated by Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396.

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