LOS ALAMOS NATIONAL LABORATORY

CURRENTS

November/December 2009

2008

DPA

DISTINGUISHED PERFORMANCE AWARDS

Los Alamos
NATIONAL LABORATORY
EST. 1943

2008 Distinguished Performance Award winners selected

Five individuals, eight small teams, and 11 large teams are recipients of 2008 Distinguished Performance Awards. The annual awards recognize individuals and small and large teams for job performance above and beyond what normally is expected.

Individuals or small teams who receive Distinguished Performance Awards have made an outstanding and unique contribution that had a positive impact on the Laboratory's programmatic efforts or status in the scientific community, required unusual creativity or dedication of the individual or team, and resulted from a level of performance substantially beyond what normally would be expected.

Large team award recipients
- performed scientific, engineering, technical, administrative, and/or management activities at a level far above normal job assignments;
- completed a project that brought distinction to the Laboratory by resolving a problem that has broad impact and/or resulted in the Lab becoming the recognized expert in the field;
- worked on a project that involved original and innovative thinking, approaches, and results; and
- exhibited (by each member of the team) an exemplary level of skill, teamwork, and dedication well beyond normal expectations that resulted in the successful completion of the project.

Receptions are held for all the award winners.

John Bent, HPC-5

John Bent of System Integration developed a checkpoint file system for parallel applications—a parallel log-structured file system, or PLFS.

Parallel applications running across thousands of processors protect themselves from component failures by checkpointing: saving their state to persistent storage. Many applications, however, save this state into a shared single file, with writes that are small and not aligned with file system boundaries, resulting in poor performance from the underlying file system.

PLFS interposes a layer between the applications and the underlying parallel file system and remaps an application's write access pattern into one that is optimized for the underlying file system. The checkpoint time is reduced by up to several orders of magnitude, even on the largest supercomputers.

PLFS has been deployed and tested on the Roadrunner supercomputer and is expected to revolutionize file system provisioning. It already is generating substantial interest beyond Los Alamos. A paper about PLFS is one of three finalists for the best paper of ISC 2009, the leading international supercomputing conference.

Darrin Byler, MST-8

Darrin Byler of Structure/Property Relations made significant contributions to two high-impact programs during the first six months of 2008.

For the LDRD-Directed Research project "Dynamics of the onset of Damage in Metals under Shock Loading," Byler independently designed and processed a unique set of samples for shock dynamics studies at the Trident laser facility—the "Ugly Duckling" shot series. He also prepared depleted urania insulator pellets for the first U.S. irradiation test of mixed-oxide fuel bearing minor actinides of both neptunium and americium. The insulator pellets were shipped to the Advanced Test Reactor at Idaho National Laboratory. Byler had sole responsibility for each of these accomplishments.

In completing these deliverables, Byler demonstrated the productivity and unique capabilities of the Integrated Material Preparation facility at a critical time for expanding its mission with the Office of Nuclear Energy. His work included insights and studies that will become the foundation of the synthesis of many multicomponent ceramic oxide fuels for transmutation applications.

Charles T. Kelsey IV, LANSCE-LC

Charles Kelsey of the Lujan Center (LANSCE-LC), resolved fundamental safety concerns about prompt radiation in the event of a beam spill accident at the Los Alamos Neutron Science Center (LANSCE) linear accelerator.

Kelsey researched maximum anticipated beam spill consequences and actual beam spill events at accelerators in the United States, Canada, and Europe, noting in particular when a beam spill caused an accelerator to shut down because of equipment failure. Thoughtfully considering the results, he conceived that beam spill consequence was more accurately defined by probability and total spilled energy than by time and beam current—the previously mandated accident parameters.

He concluded, and successfully defended, that 30 megajoules (not 3,600 megajoules) defined the maximum credible energy that existing accelerating structures at LANSCE could absorb before they failed and terminated a beam spill. Kelsey's work produced a realistic, cost-effective, and safe redefinition of the LANSCE beam spill design-basis accident and enabled this year's restart of the LANSCE linear accelerator under a new operating license.

Jennifer Lillard, MST-6

Jennifer Lillard of Materials Technology-Metallurgy spearheaded the adoption of a new methodology for assessing the lifetimes of canned subassemblies (CSAs). Her new CSA Lifetime Model will be used for the Enhanced Surveillance Program to predict lifetimes for the active Laboratory stockpile.

Previous attempts at assessing lifetimes used statistical curve fitting to trend surveillance data, but the form of the fit had no scientific foundation. Lillard chose not to stick to conventional methods and instead worked to find the scientific mechanism that would explain observed material aging phenomena.

She pulled together a cross-discipline team to study the underlying material issues responsible for aging in CSAs and developed a material-degradation model supported by published literature and experimental data collected at Los Alamos and validated against surveillance data. Ultimately, her work has provided the National Nuclear Security Administration and the Department of Defense with the information they need for making long-term strategic decisions for the nation's nuclear weapon deterrent.

William Ward, AET-6

Bill Ward of Applied Engineering Technology-6 has dramatically improved the Los Alamos thermoacoustics code DeltaEC, which is essential to Los Alamos' thermoacoustics research and development and is freely shared with academic and corporate users worldwide.

DetlaEC has been vastly improved. It can simulate many more physical processes and has a higher-quality user interface, which Ward changed from a command-line interface to a fully graphical user interface. The software package can now display tables and plots of multiple types of data to provide better understanding of physical processes.

DeltaEC is an important tool for the Laboratory's thermoacoustics team in Condensed Matter and Magnet Science and Tritium Science and Engineering. That team has used it in studies for DOE's Office of Science and in collaborations with corporate and academic partners. Six of the world's largest corporations use DeltaEC for some of their advanced-product research and development.

Ward's efforts enhance the Laboratory's reputation in the global physical-acoustics community and facilitate continuing research and development in thermoacoustic alternative energy on six continents.

Bullring 607 VTR Team

Front row: Raymond Joggerst, Kirk Rector
Back row: Michael Whitehead, Stephen Joyce, Brian MacDonald

The Bullring project for forensic microscopy on classified materials samples began in 2003 with a modest investment from its government sponsor and established itself in a small security-hardened space in Technical Area 3. The program's success, measured in increased mission scope, personnel, and equipment, expanded the program until the original space was no longer adequate. Relocation to a larger vault-type room (VTR) became necessary in 2008.

The Bullring Team identified an appropriate new space—Room 607 in TA-3's Building 2322—but the space had to be converted into a VTR. In addition, because of Bullring's importance to the customer, the team had to complete the move without delaying or altering programmatic milestones.

The project team was able to clean out legacy equipment, move the analysis instrumentation, certify the space for classified operations as a VTR, and accredit a new Secret/National Security Information computing network in just three months, accomplishing it all while completing project deliverables and helping to ensure new fiscal year 2009 and fiscal year 2010 funding.

DIVA Team

Left to right: Douglas Wokoun, Stephen Schultz

This two-man team developed, tested, and rolled out the new software approval and tracking system for foreign nationals coming to work at the Laboratory. The automated system—Database for International Visits and Assignments (DIVA)—replaces the paper "982 process."

The Department of Energy permits Los Alamos to conduct its own foreign nationals reviews and approvals, but the unwieldy paper-based 982 process did not provide DOE with an efficient method of auditing those approvals. DOE's concern about that weakness ultimately might have led to the Laboratory's losing the right to conduct internal approvals. Furthermore, the 982 process was extremely burdensome within the Laboratory, and increasing security requirements were making it more and more complex.

This team's DIVA system is a comprehensive, secure, Web-based application that automates almost every aspect of the foreign nationals approval process and balances the demands of security, usability, and availability of information for individuals with a need to know. It is a time and cost saver that meets all of DOE's audit needs.

National Ignition Facility Advance Team

The National Ignition Facility (NIF) at Lawrence Livermore National Laboratory will be used to create, for the first time, thermonuclear fusion in the laboratory and to conduct high-energy-density physics experiments for stockpile stewardship.

Los Alamos' contributions to NIF already have included theoretical target design, diagnostic development, and the invention of new experimental methods. This team is now mastering how NIF works to enable Los Alamos scientists to use the facility in the future.

George Kyrala and John Kline, lead scientists for commissioning and basic physics experiments at NIF, have defined laser, target, and diagnostic specifications and created procedures for fielding these experiments. Douglas Wilson, lead designer of campaigns that will test the effect of deuterium and tritium fuels on ignition capsule performance, simulated these future experiments, determined the physics issues, and then resolved those issues in the design of the experiment.

This team's NIF work ensures that Los Alamos will play a critical role in the National Ignition Campaign.

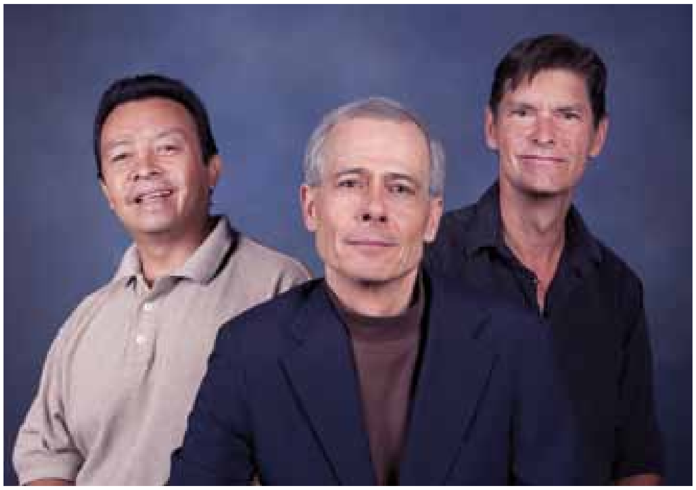
Left to right: George Kyrala, John L. Kline.
Not pictured is Doug Wilson.

NMSBA Energy Analysis Team

Representing the Laboratory's New Mexico Small Business Assistance program, this team assisted a small manufacturing plant in Santa Teresa, New Mexico. The company, Ffhoenix Cuivre, manufactures bare, tin-plated, and insulated conductors for automobiles, consumer appliances, telecommunications, and industrial and medical equipment.

Frequent power interruptions and high power rates were preventing Ffhoenix Cuivre from meeting production deadlines and maintaining competitive pricing. To help, team members used the Laboratory's advanced technical capabilities in energy infrastructure modeling to analyze the plant's major equipment, power demand, and daily power-use patterns. They identified process modifications and equipment retrofits that resulted in immediate energy cost savings of $5,000 a month. When all recommendations have been enacted, the company potentially will save $40,000 a month in electricity costs and up to $60,000 a year in maintenance costs.

The team's work helped not just the one business but also four others in the same area. Such success exemplifies how Laboratory technologies can assist local communities.



Left to right: Marvin Salazar, Gasper L. Toole, Andy McCown.
Not pictured is John Flores.

Neutron Pinhole Aperture Development Team for NIF

Clockwise from top left: Robert D. Day, Gary Grin, Felix Garcia, Mark Wilke, Carl Wilde, Valerie Fatherley

This team designed and fabricated a diagnostic for the National Ignition Facility (NIF) at Lawrence Livermore, where researchers hope to achieve fusion. The team's neutron pinhole aperture will capture an image of the neutron-emitting spot in the center of the ignition capsule after implosion.

Neutron pinholes were used at the Nevada Test Site, but NIF requires a more precise one with 23 very small apertures: 8 inches long. Team members developed new machining and fabrication techniques to create the tiny holes—each made of two grooves aligned to form a conical tunnel through tungsten-encased gold.

After obtaining supplies, practicing on dummy materials, and evaluating tool accuracies, the team had only enough time to manufacture one pinhole. There was no room for error. The resulting product has been tested successfully at the Omega Laser Facility in Rochester, New York, and is ready to do its job at NIF: document the first laboratory-created fusion.

PetaVision Team

Clockwise from top left: Craig Rasmussen, Garrett Kenyon, Charles Ferenbaugh, Sriram Swaminarayan

PetaVision is a functional model of the visual cortex that enables petascale simulation of mammalian vision. The PetaVision Team implemented its massively parallel simulation on the Roadrunner supercomputer and, in the process, set a world speed record for scientific computation—1.144 petaflops.

The team created a completely new methodology for neural computation. Members defined a set of computational primitives for integrate-and-fire neurons, then developed a novel software architecture to emulate cortical columns in hardware. The resulting billion-neuron simulation was run in Poughkeepsie, New York, where Roadrunner was still being tested by IBM. The simulation was the first of its kind in the world and the first scientific calculation to break the petaflop barrier.

Widely reported in the media, the PetaVision Team's success has had tremendous impact on the emerging field of synthetic cognition and nonconventional high-performance computing in general. It allows Los Alamos to lead in the important new area of large-scale neural computing, which has enormous potential for programmatic growth.

SNM Attractiveness for Next-Generation Nuclear Power Team

This team produced a groundbreaking study on the potential proliferation threat of special nuclear material (SNM) in advanced civilian nuclear fuel cycles.

Although many advanced fuel cycles are being studied around the world—some even have been implemented—confusion over what constitutes weapons-usable material has undermined decisions about which materials are safe to use or produce with these systems. This team clarified the issue by evaluating the nuclear material present in and produced by various advanced fuel cycles, providing reliable information about the impact different cycles will have on nonproliferation concerns.

Team members also had to find a way to communicate their results to a world audience when the underlying data were highly classified. By working closely with Classification, the team created clear, unclassified papers and presented them at international conferences and to major players in international fuel cycle decision making.

By promoting national and worldwide understanding of proliferation resistance in nuclear fuel cycles, this team has made a major contribution to national security.

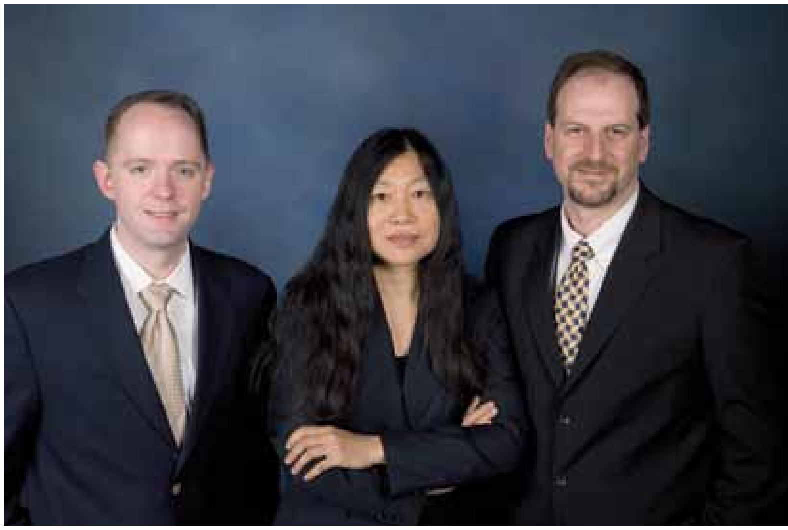
Clockwise from top left: Gordon Jarvinen, Richard Wallace, Bill Johnson, John Ireland, Diana Hollis, Chuck Bathke

VPIC Team

Members of the VPIC team redesigned the three-dimensional electromagnetic plasma simulation code VPIC to run on the Roadrunner supercomputer, taking full advantage of the computer's unique IBM Cell chip to achieve unprecedented performance. The finished code was used for large-scale integrated calculations during the Roadrunner acceptance tests in June 2008.

As a new capability, VPIC is recognized as a "best in class," in both the size of problems it can run and its overall speed and efficiency. VPIC simulations on Roadrunner will allow researchers to address fundamental, longstanding plasma physics issues important to the weapons program. The code's success in the past year already has led to numerous users, newly recruited staff, national awards, coverage in numerous publications, and new programmatic responsibilities.

VPIC already is profoundly affecting high-energy-density physics and plasma physics, fields of great importance to the scientific mission at Los Alamos and to the worldwide scientific enterprise.



Left to right: Kevin Bowers, Lin Yin, Brian Albright
Not pictured is Ben Bergen.

Due to the sizes of the large teams, photos and names of the team members will not be shown here. Please visit http://www.lanl.gov/news/currents/2009/oct/performers.shtml for photos and full listings of the team members.

Free-Electron Laser Injector Thermal Test Team

The Free-electron Laser (FEL) Injector Thermal Test Team achieved groundbreaking performance for a radio-frequency (RF) electron injector in a normal-conducting, radio-frequency (NCRF) accelerator: world records in both continuous average power delivery and continuous accelerating gradient. That milestone is absolutely essential for building a weapons-class free-electron laser.

Interest in a weapons-class FEL was the driver for the project's sponsor, the United States Navy. Experts had considered the necessary performance unattainable, but the Navy felt the potential payoff was worth the funding risk. This team rewarded that trust by pushing the limits in accelerator physics, high-power thermal management, RF engineering, control software, and vacuum technology. The result was a high-gradient injector operating at 100 percent duty factor (ratio of the duration of time when a system is actually operating to the total time for a complete cycle of the system), whereas only 25 percent had been achieved before, with a design capable only of lower beam quality.

This team has made Los Alamos the "go-to" laboratory for high-power FEL technology and positioned the Laboratory's NCRF injector as the primary candidate injector for the Navy's high-power FEL program.

Full Toss Experimental Support Team

Full Toss, a Lawrence Livermore experiment, was executed at the Nevada Test Site in October 2008. Data analysis after the event demonstrated that Los Alamos predictions were correct and that the experiment was a success.

That success was possible because of a unique component manufactured at Los Alamos with the support of this team. Moreover, the component was validated in a unique local experiment that was conceived and executed in only a few months, using novel diagnostic equipment developed solely for the validation experiment.

Full Toss has placed specific national intelligence analysis on a firm technical foundation. The successful results will have ramifications within the intelligence community for the foreseeable future, potentially impacting national policy toward the Comprehensive Test Ban Treaty and national intelligence analyses concerning nuclear proliferation and nuclear terrorism.

HiWAIS Blue Devil Team

This team developed a high-resolution, wide-area imaging system (HiWAIS), integrated it with the Laboratory's airborne AngelFire technology, and successfully demonstrated it in the Blue Devil exercise over Ft. Meade, Maryland, in August 2008. Blue Devil was organized to demonstrate sensor interoperability, interagency collaboration, and data fusion and dissemination in relation to real-time, wide-area, persistent surveillance.

In less than three months, the team developed HiWAIS and integrated this advanced system with a full-motion video system and ground-based signals intelligence (SIGINT) sensors provided by two different government agencies. The resulting surveillance capability, demonstrated live during Blue Devil, dramatically changed the concept of what is possible in terms of fusing information and data between multiple sensors and institutions in real time.

HiWAIS technology is another significant step forward in the warfighter support arena and most likely will be deployed into a theater [of operations] soon. As a programmatic outcome, an extensive development program with the Office of Naval Research and a separate program of record are now moving forward.

LANSCE H^+ Cockcroft-Walton Accelerating Column Rebuild Team

The Laboratory uses the LANSCE particle accelerator to irradiate targets in the Isotope Production Facility (IPF), and those targets are used to produce unique radioactive isotopes for medical imaging and oceanography. The Laboratory's isotope science programs are an important part of a national and international effort to cooperatively produce these costly medical isotopes efficiently.

In late 2007, proton beam delivery to the IPF began failing because of a problem in one aging accelerator component, the Cockcroft-Walton column. The Accelerator and Operations Technology Division assembled a team to rebuild the accelerating column, but the job was complicated by a lack of technical information: the original personnel with knowledge of the column were gone, and the equipment had not been dismantled or rebuilt in 17 years.

Using old photographs, drawings, and notes—and their own expertise—team members recovered the necessary information and completed the repairs to return the accelerator and IPF to operation. Both LANSCE and IPF had very successful 2008 runs.

Oak Phoenix Data Evaluation Team

In the event of a terrorist nuclear detonation, prompt assessment of post-detonation and radiochemical data would be used to determine the probable design of the weapon involved. Nuclear forensics information is a crucial link in the attribution process.

This Los Alamos team participated in Oak Phoenix, a 2008 nuclear forensics exercise involving multiple national labs, the Energy and Justice departments, and intelligence agencies. Such exercises always have depended on legacy tools, but this team demonstrated the applicability and technical capability of the Laboratory's primary Advanced Simulation and Computing program tools. Team members also developed new methodologies that enhance the Laboratory's ability to meet current and future national nuclear forensic requirements.

The results of the team's work provided definitive statements about placement of materials with higher confidence than previously achieved. Los Alamos was, in fact, the only national laboratory to correctly identify all of the potential device types, as well as the actual device geometry used to develop the exercise data.

Open Collaboration Enclave Team

In 2008, Director Michael Anastasio testified before Congress that Los Alamos would establish a system for maintaining better control over the access of foreign national employees to unclassified computer networks. This team was asked to complete the new system in time for the January 2009 Department of Energy audit.

Personnel from multiple divisions and several line organizations collaboratively designed, procured, integrated, and demonstrated an evolutionary system for network access management—the Open Collaboration Enclave (OCE)—and finished before the deadline. The new system moves more than 800 users and about 2,600 computers into a new network with completely new technology and provides user-authenticated, role-based access controls for networks, systems, databases, and Web assets.

The OCE provides protection of cyber resources and information commensurate with the Laboratory's national security mission while maintaining the valuable scientific contributions of foreign national employees. The design concepts will become a key feature in the re-engineering and modernizing of all future Laboratory networks and will be a model for all government cyber improvements.

Piñon Veil 2 Technical Incident Response Team

This team investigated the Piñon Veil 2 cyber event, a malicious computer hacking incident in the form of a "spear phishing" attack—forged e-mail messages sent to Laboratory computer users in an attempt to access critical portions of the Laboratory's information technology (IT) infrastructure. The hacker had little success but still posed a serious cyber threat.

Team members removed hacked machines from the Yellow Network and brought them in for forensic analysis, implemented short-term mitigations, and performed deep analysis on the malicious computer code injected by the adversary. After three months of work, they had checked several hundred computers, analyzed terabytes of network traffic and gigabytes of log files, sifted through thousands of computer files, reverse-engineered an analysis-resistant malicious code, and deduced the probable perpetrators of the attack.

This team's work spared the Laboratory the loss of sensitive data. Over time, its findings will result in significant improvements in the security and robustness of the Lab's IT infrastructure.

Second Line of Defense Team

This team is the technical underpinning of the National Nuclear Security Administration's Second Line of Defense program, whose goal is to help foreign governments stop illicit trafficking of nuclear materials and reduce the probability of such materials being fashioned into weapons of mass destruction or radiological dispersal devices.

Team members support the design, installation, and performance testing of more than 1,400 radiation detection systems (RDSs), exceeding 260 individual sites located in more than 30 countries. They also are on 24-hour call to evaluate RDS gamma and neutron alarm data from around the world. When true alarms occur, team members provide technical reach-back in real time and make recommendations that, in a worst-case scenario, would trigger a "wake the President" decision. Within the past year, the team has successfully adjudicated six major alarms without such dire consequences.

This team serves as a symbol of what Los Alamos stands for: exceptional technical know-how and willingness to go above and beyond the normal call of duty to support national needs.

Thermos NTS Sub-Critical Experiment Analysis Team

Under science-based stockpile stewardship, Los Alamos requires physics experimentation, along with theoretical development, to improve the predictive capability of nuclear weapons codes.

This team was responsible for a series of dynamic plutonium experiments—the Thermos series—at the Nevada Test Site (NTS) in order to validate Advanced Simulation and Computing (ASC) codes. The team fielded the experiments in collaboration with National Security Technologies, which manages NTS, and Sandia National Laboratories. Members designed, engineered, and performed the experimental series and gathered data from a suite of diagnostics, including surface velocimetry, dynamic radiographic imaging, and soft-capture sample recovery for metallographic analysis.

Six months of data, source, and theoretical analysis; computational modeling; and extensive microscopic analysis followed the NTS work. The result was a 350-page report that validated ASC codes regarding damage and failure physics, including phase change.

The team's work supports the Laboratory's goal of, inside 10 years, making the representation of dynamic materials physics in computational models correct within a 1 percent error.

Presorted Standard
U.S. Postage Paid
Albuquerque, NM
Permit No. 532

Los Alamos NATIONAL LABORATORY EST. 1943

Or Current Resident

ULFNMR Physics and Engineering MagViz Team

In 2006, after authorities uncovered a terrorist plot to detonate liquid explosives aboard airliners, the Department of Homeland Security asked Los Alamos to find a way of deterring such plots through screening and detection. The Laboratory's Threat Reduction Office turned to the "SQUID team," which was developing Ultralow-Field Nuclear Magnetic Resonance (ULFNMR) using superconducting quantum interference devices, SQUIDs, for brain imaging. Could the same technology identify liquids at airline security checkpoints?

The team, which includes members from numerous divisions, launched an aggressive program to produce a demonstration product for use in airports. Creating the mobile system required new approaches to materials to get the needed signal-to-noise sensitivities, new construction technologies, and novel shielding and cooling designs to maximize signal fidelity and material throughput.

A prototype device, MagViz, was successfully demonstrated at the Albuquerque International Sunport in December 2008, where the team proved it could detect threat substances by chemical fingerprint. MagViz has worldwide implications for streamlining screening and reducing passenger stress and inconvenience.

W88 LANL Cell SS-21 Team

In July 2004, the W88 Cell Nuclear Explosive Package (NEP) disassembly and assembly operations at the Pantex Plant were halted because the Nuclear Explosive Safety Study (NESS) authorization basis expired. The resulting five-year interruption in work had a significant impact on stockpile stewardship activities concerning NEP component evaluation.

The Cell NESS Team, staffed from Los Alamos, B&W Pantex (operators of Pantex), and the National Nuclear Security Administration, was formed to develop the disassembly/inspection and assembly processes, tooling, and procedures, while applying the principles of NNSA's "Seamless Safety for the 21st Century" (SS-21) campaign.

The Los Alamos part of the enterprise—the W88 Cell SS-21 Team—helped to successfully obtain new authorization for the NEP disassembly and assembly activities. Members used new approaches and tooling, demonstrated them to the NESS Study Group, and delivered an excellent product that addresses potential configuration changes in the future.

The Los Alamos team was drawn from the Weapon Systems Engineering, Applied Physics, and Dynamic and Energetic Materials divisions.

CURRENTS is a monthly publication of the Communications Office, Los Alamos National Laboratory.

Editor, Jacqueline Paris-Chitanvis; Associate Editor, Steve Sandoval

Contributor: Eileen Patterson

Photographer: LeRoy N. Sanchez

Art Director: Allen Hopkins

E-mail: currents@lanl.gov; Web address: www.lanl.gov/news/currents

Los Alamos National Laboratory is operated by Los Alamos National Security, LLC for the Department of Energy's National Nuclear Security Administration

CURRENTS
P.O. Box 1663
Mail Stop C177
Los Alamos, NM
87545

LALP-09-0010

Printed on recycled paper.
Please recycle.