



Sandia LabNews
February • 2008

Labs

Accomplishments

2008



Sandia National Laboratories



Night launch of a Defense Support Program satellite (DSP-23). See page 4.

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Gary Froehlich (5345) examines a test object mounted inside an anechoic chamber. The chamber is part of Sandia's Facility for Antenna and RCS Measurement (FARM) where measurements of antenna characteristics and radar cross sections of materials, shapes, and devices are performed. FARM, which underwent a yearlong renovation and upgrade, contributes to programs for a variety of Sandia, DOE, military, and government agency customers.

Cover photograph by Randy Montoya

This year's *Labs Accomplishments* publication recognizes some of Sandia's best work during 2007, as submitted by center offices and selected by the division offices. Each citation is followed by the center numbers of centers that contributed most directly to the effort described.

An acronym after each accomplishment indicates which of Sandia's strategic management units (SMUs) or strategic management groups (SMGs) the work most directly supported. The SMG/SMU acronyms are:

NW: Nuclear Weapons SMG & SMU
 ITS: Integrated Technologies & Systems SMG
 LT: Laboratory Transformation SMG
 DS&A: Defense Systems & Assessments SMU
 ER&N: Energy, Resources, & Nonproliferation SMU
 HS&D: Homeland Security & Defense SMU
 ST&E: Science, Technology, & Engineering SMU
 IES: Integrated Enabling Services SMU

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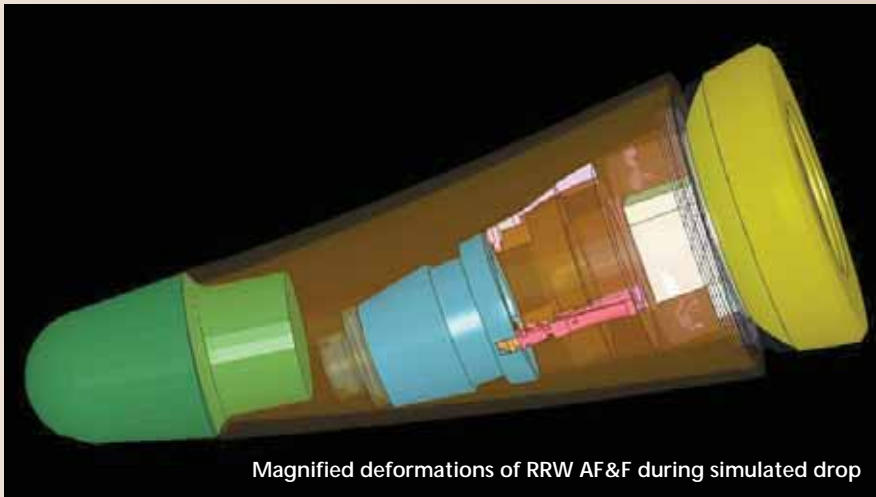
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Nuclear weapons engineering

The California Reliable Replacement Warhead (RRW) team was selected to go forward with the RRW-1 Phase 2/2A program in March 2007, ending an 18-month New Mexico/California **competitive design study**. The team completed the requirements review stage of a rigorous phase gate process, stood up major component product realization teams, developed subsystems and components requirements, and made progress with the designs. Computer modeling and simulation have aided the RRW program. (8200, 8700, 8900, 1300, 1500, 1600) NW



Magnified deformations of RRW AF&F during simulated drop

The Code Management System (CMS) for Use Control is being implemented at the Pantex plant to support the B61, B83, W80, and W84 weapon systems. A concept of operations was completed in February (NNSA Level II Milestone), software and training products were provided in July, and documentation in support of the Nuclear Explosive Safety Study (NESS) was provided in September (NNSA Level II Milestone). Implementation of the CMS is scheduled for FY08. (2100, 2900, 5600, 8200, 12300) NW

Following completion of a four-year Sandia-led spin rocket motor development program, **B&W Pantex is retrofitting new motors** into B61-7/11s (onsite) and producing field conversion kits for the B61-3/4s. The new spin rocket has significantly higher torque output and resolves potential age-related issues of the old motors. Concurrently, B&W Pantex began replacement of the aging B61-11 secondary. The effort was an intensive multi-agency program that also included replacement and refurbishment of some Sandia structural components. (1500, 1800, 2100, 2500, 2600, 2900, 5300, 10200, 12300) NW



B-2 drop test involving B61 spin rocket motor

The QASPR (Qualification Alternatives to SPR III) experimental team developed a key **capability to match radiation transients** at the Sandia Ion Beam Laboratory (IBL) and the Sandia Pulsed Reactor (SPR III), demonstrating damage relationships between facilities. The QASPR goal is to qualify the transient response of electronic systems for short-pulsed fast-neutron environments without testing at a fast-burst reactor. The methodology consists of high-fidelity computational models (initially validated at SPR III), combined with testing at alternative experimental facilities such as the IBL. Testing at multiple facilities requires that the radiation damage relationship between facilities be understood. (6700, 1300, 1100) NW

Partnering with the production agencies, the W76-1/Mk4A Arming, Fuzing, and Firing Product Realization Team **delivered to NNSA the first production units** on schedule. Development costs for the arming and fuzing subsystem were 30 percent of a similar effort for the W88. The design includes use of commercial electronics, new battery technology, custom micro-electronic circuits, and small-volume capacitors. It also includes surety devices for enhanced nuclear detonation safety and is hardened to strategic radiation levels for hostile encounters. (2100, 200, 1300, 1500, 1600, 1700, 1800, 2500, 2600, 2800, 2900, 5300, 10200, 12300) NW



W76-1 AF&F First Production Units

The W76-1 and the W80 SS-21 programs, high-visibility activities for NNSA and key elements for W76-1 production and W80 disassembly & inspection, were led by Centers 2100 and 8200, respectively. Surety Assessment Center 12300 generated weapon response data for the **assembly and disassembly operations** of the W76-1 and W80 by teaming with Los Alamos and Lawrence Livermore national labs as well as Sandia organizations. This data enabled

Pantex to complete hazard analysis reports that were reviewed by several complex-wide teams before final authorizations were granted. (2100, 8200, 2500, 12300) NW

Sandia invented and proof-tested a **new blast-mitigation gel**. The solid water-based gel has the advantages of liquid water yet is dimensionally stable and easily manufactured and deployed. The gel absorbs the energy from an explosion, reducing both the blast overpressure and dispersion of aerosols generated in the blast. These blast mitigation gels complement existing Sandia technologies and could become part of the toolbox for addressing explosive storage, transportation, and security issues. (5400, 6400, 8200, 8700, 12300) HS&D

The Engineering Sciences Center's technical expertise, simulation capabilities, and experimental facilities was a critical partner in the **W76-1/Mk4A Life Extension Program**. For the first time ever, a balanced approach of advanced analytical simulations, complex physical experiments, and uncertainty-quantification calculations was used to produce a system qualification evidence package. These efforts spanned the range of mechanical and thermal insults for normal (e.g., vibration), abnormal (e.g., fire), and hostile (e.g., shock) environments. (1500, 2100) NW



W76-1/Mk4A Life Extension Program qualification experiment

Sandia continues to provide timely **technical analysis to the nation's leadership**. Under a joint Sandia-STRATCOM memorandum of understanding, projects included an analysis of terrain effects on radar fuzing, mission planning analyses for bombers, consultation on nuclear command and control, advanced weapons effects studies, investigation of weather issues for reentry vehicles, and support of several STRATCOM advisory group panels. Working with NNSA and DoD, Sandia provided input for the 2007 Presidential Nuclear Weapons Stockpile Memorandum as well as an RRW strategy outline that was adopted by the Nuclear Weapons Council. (200, 500) NW

What happens if a 10,000-pound 45-year-old nuclear bomb is in a severe truck accident? It remains safe. That was the conclusion of a 2007 study supporting an NNSA Office of Secure Transportation **safety basis authorization to transport the B53**. The work by the Los Alamos National Laboratory-Sandia team, led by Surety Assessment Center 12300, involved the evaluation of weapon responses for 20,000 accident scenarios. Over-the-road operations were completed without incident four months after authorization. (2100, 6400, 1500, 12300) NW

Security & Use Control Assessment Dept. 12334 **migrated the Virtual Deliberate Unauthorized Use Assessment Facility (VDAF)** to the Weapons Integration Facility. The migration involved taking advantage of improved computing capabilities and eliminating a 16-node computer cluster needed to drive the previous facility's projectors. The new facility is an example of Sandia partnering with private industry in the application of virtual tools to assist both the weapon design and assessment communities. VDAF is managed by Weapon Use Control Systems Dept. 2126. (2100, 12300) NW

Methodologies were developed for Quantified Margin and Uncertainty (QMU) analyses for Cycle 12 Annual Assessment. Guidance was provided for **data- and model-based analyses for selected weapon components**. The results were reported in the Annual Assessment Reports. System engineers, consulting with component, surveillance, and computational analysts and assessment engineers, conducted the analyses and interpreted the results. The analyses identified high- and low-margin performance variables, some trends in performance, and some data-improvement opportunities. (1200, 1400, 1500, 2100, 2500, 2600, 2700, 2900, 8200, 12300) NW

Weapons security

Communications Systems Dept. 6452 delivered a **vehicle-mounted wireless Tactical Network (TacNet)** to NNSA's Office of Secure Transportation. TacNet, a mobile ad hoc communications network, provides personnel who are on the move with low-cost secure access to critical data without satellite links or fixed infrastructure. TacNet employs a line-of-sight mesh radio network, which is self-forming, self-healing, and multi-hopping. The radio network essentially becomes a privately owned, custom Internet with the ability to self-form on a second-to-second basis. (6400, 6300, Wind River, Arcrom, Motorola) NW



TacNet provides critical data to authorized personnel without satellite links or fixed infrastructure

Sandia developed the Pre-Installation Test and Check Out (PITCO) concept and created an operational laboratory at Sandia to replicate and **test proposed security systems before installation** at a site. Sandia designed and developed testers to replicate inputs from the actual sensors and entry-control devices and to stress the system to define operational limits. After testing, the hardware can be broken down, transported to Kings Bay Naval Base, and installed using the same configuration, saving time and money and creating higher confidence levels. (6400) HS&D

A Sandia-led team that included Pantex, NNSA, and Air Force personnel was able to quickly and definitively demonstrate that a set of warheads, where chain of custody requirements could not be verified, had not been compromised. The team's readiness to rapidly deploy to a DoD location was made possible by prior studies establishing baseline gas signatures for all weapon types as a function of age. Comparison of this baseline-to-field results provided compelling **evidence that no tampering or mishandling of the weapons occurred**. (8200, 1800, 2900, B&W Pantex, NNSA) NW

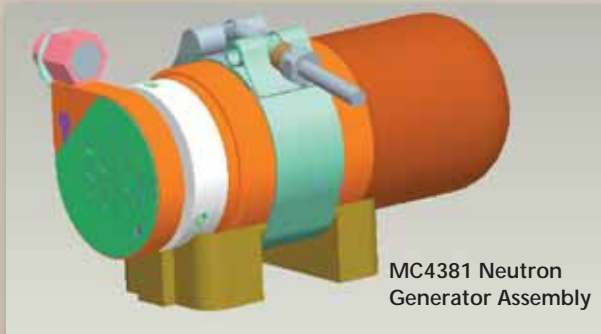
Military Liaison Dept. 2913 teamed with NNSA's Office of Secure Transportation, Los Alamos National Lab, and Sandia organizations to **close out in July 2007 a 40-plus-year stockpile lifetime for the B53**. The B53's life included a return from retirement to active status in the 1990s, followed by a decade of retired status with DoD. Disposition of B53 trainers was completed at the Naval School of Explosive Ordnance Disposal (NAVSCOLEOD) at Eglin Air Force Base in November 2007. Military Liaison continues to provide disposition instructions for remaining ancillary equipment. (2900, NNSA, OST, LANL, 2100, 12300) NW



Developing the B53 tie-down transportation configuration

Product realization

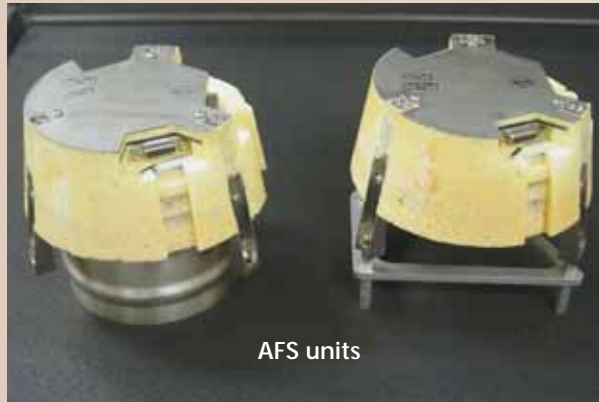
The MC4381 neutron generator was fabricated and qualified for the W78 Program to **replace legacy MC3051A/B neutron generators**. The project team overcame technical, schedule, and budget challenges while developing a product that meets demanding environmental requirements. In addition to inspiring customer confidence in Sandia's ability to deliver on time and on budget, this effort also



MC4381 Neutron Generator Assembly

enabled replacement of a neutron generator with potential aging concerns. The first production units were delivered to bonded stores in April 2007. (2700, 2400, 2100, 12300, 1500, 1300, 2500) NW

In FY07 the Concurrent Design and Manufacturing (CDM) Program submitted a total of **14,117 Mark Quality (MQ) parts**, including War Reserve parts for the stockpile, Process Prove-In (PPI) units used in component qualification, and MQ trainers. The parts (by deliverable area) included 467 capacitors, 2,125 explosive materials/subsystems, 1,279 frequency devices, 6,455 magnetics, 2,392 microelectronics, 2 parachutes, 624 power sources, 50 special components, and 722 switch tubes. (2500, 1700, 2700) NW



AFS units

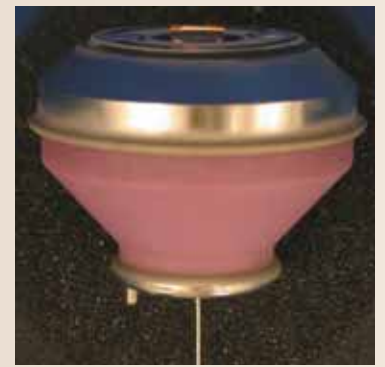
The W76-1/Mk4A Arming Fuzing Subsystem (AFS) met all product qualification requirements and the **first production unit was delivered** on schedule, below cost, and with outstanding performance and quality. The effort was the result of years of work by dozens of people at both Sandia and the Kansas City Plant. The AFS team received an NNSA Defense Programs Award of Excellence. In addition, the team was recognized by the US Navy for meeting and exceeding cost targets. (5300, 2100, 1700, Kansas City Plant, many others) NW

The B&W Pantex plant needed new **assembly fixtures and tooling for the W76-1 Life Extension Program**. Due to the complex geometry and demanding precision requirements, Pantex was not able to produce the tools and selected Sandia to fabricate the hardware. The Sandia machine shop had sufficient manufacturing capacity, high-precision machining capabilities, and the quality, safety, and security processes in place to fabricate and assemble the classified tooling. All work was completed on schedule and significantly under budget. (2400, 2100, 12300) NW

Centers 2500 and 2700 developed and implemented a set of integrated procedures documenting their approach to supplier quality management. These procedures were reviewed and **released as mandatory DSW (Directed Stockpile Work) procedures**. The procedures define the system used to select and approve suppliers, ensure product readiness, and prepare for acceptance; address non-conformances and corrective actions; and address supplier quality documentation requirements. A Supplier Quality Council was created to provide oversight, and a Supplier Performance Tracking System (SPTS) was established to collect supplier data and help create performance metrics. (2500, 2700) NW

The MC4300 Neutron Tube Product Realization Team **completed all Process Prove-In (PPI) activities for the MC4300 neutron tube** — which is half the volume of the

MC4277 neutron tube now in production. The tube features a simplified design, 54 percent fewer parts, and 46 percent fewer process steps than the MC4277, and its performance exceeds requirements. The MC4300 will be used in five systems and replaces the legacy MC3368 and MC3854 neutron tubes fabricated at the Pinellas Plant. With the completion of PPI, all processes were successfully transferred to the manufacturing floor at Sandia. (2700, 1500, 12300, 1300, 1800, 2100, 8200) NW



MC4300 neutron tube

Remote sensing

Working with NNSA and the US Air Force, a joint Sandia/Los Alamos team developed and launched several satellite payloads supporting the nation's capability to monitor nuclear explosions from space. Included this year were the launches of the final Defense Support Program (DSP-23) payload and two payloads on GPS IIR satellites, and the delivery of three payloads for GPS IIF. These programs have involved hundreds of Sandians since their inception more than three decades ago and further expand the global detection network serving the nations present and future defense needs. (5700, 5500, 5300, 2600, 1700) DS&A



Night launch of a Defense Support Program satellite (DSP-23)

Two new **satellite ground data processing systems** were delivered to the Air Force and began operations this year. The Radiation Detection Capability Data Processor receives sensor data from the constellation of Defense Support Program satellites. The Ground Nuclear Detonation Detection System Terminal is a mobile system that receives sensor data from GPS satellites. Both systems use the latest computer, algorithm, and software technology to generate nuclear detonation reports in near real-time. These systems were developed and delivered on time and within budget. (5700, 5500, 2600) DS&A

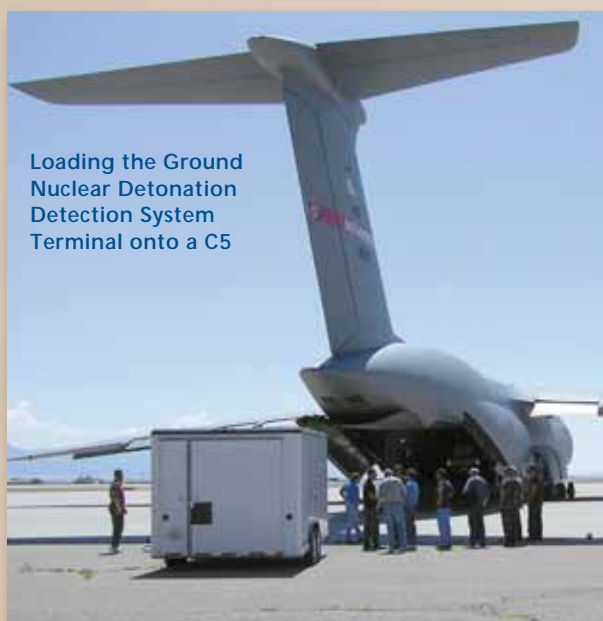
Sandia has taken **delivery of the first flight mechanisms** — a filter wheel and secondary mirror actuator — for a space telescope project in the Advanced Systems program area. This represents the first deliverable in an 18-month production effort between Sandia and Moog Inc. The filter wheel mechanisms are installed within the optics path and provide rotary actuation to insert optical filters into the path. The secondary mirror actuator is designed to linearly actuate a mirror for precision focal adjustments. (2600, 5500, 5700) DS&A

The Joint Chiefs of Staff has mandated that the Selective Availability Anti-Spoofing Module (SAASM) be used in all military Global Positioning System (GPS) applications. Sandia has developed a single-chip version of the key data processor (KDP), the government-owned portion of SAASM that provides **next-generation cryptography and enhanced security**. The KDP-III hard macro cell is available in the IBM 130 nm Trusted Foundry process for integration into single-chip SAASMs. The secure, dual-processor KDP-III system can host a variety of encrypted application software packages and thus could benefit a number of security applications. (1700, 2600, 5600, 12300) DS&A

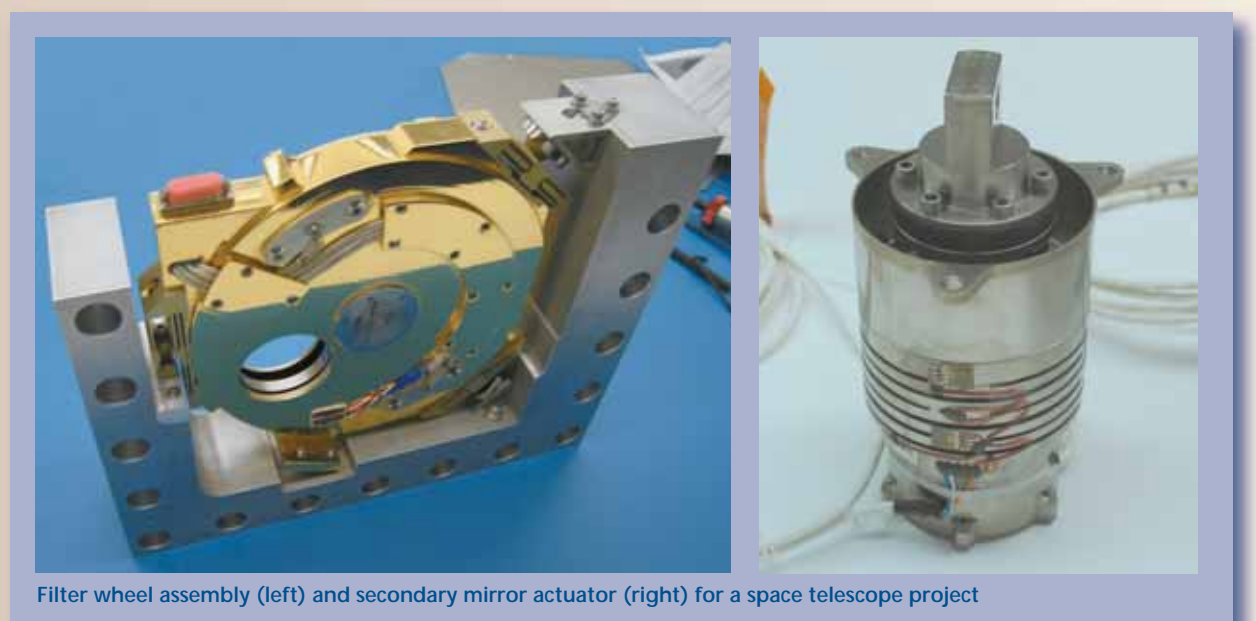


KDP-III Hard Cell

In December 2006 a Sandia team partnered with the New York Air National Guard (NYANG) to perform a number of successful tests using a Twin Otter aircraft. The tests clearly demonstrated the ability of Sandia's miniSAR (mini synthetic aperture radar) to **detect buried crevasses in Antarctica** that make landing on the snow and ice difficult. In FY08 Sandia plans preproduction miniSAR testing on an LC130 aircraft scheduled to deploy by mid-October 2008. (5300) DS&A



Loading the Ground Nuclear Detonation Detection System Terminal onto a C5



Filter wheel assembly (left) and secondary mirror actuator (right) for a space telescope project

Military programs

Sandia's modeling and simulation capabilities are helping to address improvised explosive device (IED) threats to the US military. Sandia has successfully provided on-site support and reach-back capability to JIEDDO (Joint Improvised Explosive Device Defeat Office) in situational modeling and simulation using the Umbra simulation framework. JIEDDO's Counter IED Operations Integration Center has requested an increase based on the successful exploratory efforts that occurred the first quarter of FY08. This close engagement allowed Sandia to better understand JIEDDO missions and demands and link them to other Sandia capabilities. (6300) DS&A



Modeling and simulation capabilities are helping address improvised explosive device (IED) threats to US soldiers. (Photo by Randy Montoya)

Sandia fielded its Joint STARS synthetic aperture radar (SAR) **automatic target recognition (ATR) system** at the successful Bold Quest advanced concept technology demonstration at Nellis Air Force Base in Nevada. Bold Quest showcased several technologies that promise significant enhancements to existing warfighter combat identification capabilities. Sandia's SAR ATR enables real-time, all-weather, day/night detection and identification of noncooperative enemy targets from radar signatures, greatly improving the speed and accuracy of target prosecution. Sandia's Joint STARS SAR ATR was developed under Air Force sponsorship. (5400) DS&A



Bold Quest team members assemble in front of the Joint STARS T-3 aircraft. Sandians Brian Bray, John Richards, Mindi Koudelka, and Wallace Bow (all 5433) appear at the lower right.

Sandia's **Space Mission Program (SMP)** successfully completed a number of hardware, software, and contracted deliverables to multiple external customers and facilities. During FY07 SMP shipped almost twenty tons of deliverable computer hardware and over one million lines of software. SMP engages a broad cross-section of the laboratory. (1500, 1800, 2400, 2600, 4800, 5300, 5500, 5700, 5900, 9300) DS&A

Sandia coordinated **nine launches from the Kauai Test Facility**. A first-ever multiple simultaneous engagement involving two ballistic missile targets was successfully conducted on Nov. 6, 2007, in support of the Navy's AEGIS Ballistic Missile Defense System. The targets simulated rogue missiles and were successfully intercepted by the Navy's Standard Missile-3 Interceptor. (5400, 2600) DS&A



Dual ballistic missile target launch out of Kauai Test Facility

Energy



The Joint BioEnergy Institute, a partnership of six institutions including Sandia, will open in Emeryville, Calif., in spring 2008.

Sandia teamed with five other institutions to establish the Joint BioEnergy Institute (JBEI), funded by the DOE Office of Science Bioenergy Research Centers program. This \$135 million, five-year program is focused on addressing the systems **biology challenges of producing cellulosic ethanol biofuels**. JBEI is led by Lawrence Berkeley National Laboratory and includes Sandia, UC Berkeley, UC Davis, Lawrence Livermore National Laboratory, and the Carnegie Institute. (8300, 8700, 1700) ER&N



JBEI building in Emeryville, Calif., near Lawrence Berkeley National Laboratory

Research at Sandia extending back two decades played a dominant role in an engine-design milestone — the first **all-computationally designed diesel engine** by Cummins Inc. Through the application of advanced laser-based optical diagnostics, researchers at Sandia's Combustion Research Facility led the development of the diesel-combustion science base that provided, for the first time, a firm scientific understanding of the complex combustion processes in a diesel, as well as guidance and validation data for the development of the computational tools. (8300) ER&N

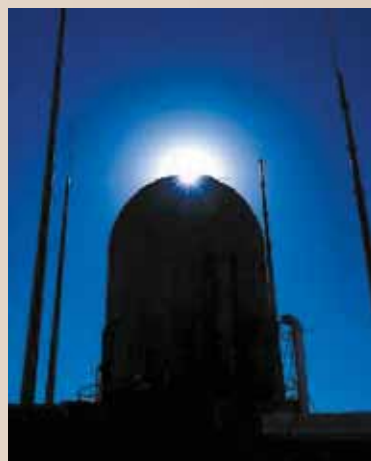
A new radioactive materials shipping cask design required drop tests for certification, with a twist: Highly-enriched uranium is in the package during the tests. To meet this challenge, a multi-organizational team addressed security, criticality, radiation-protection, and industrial-hygiene requirements and prepared detailed test and security plans. DOE cooperation was essential and enabled the successful completion of a high-profile sequence of nine drop tests with all work being completed in less than five weeks. (6700, 1300, 1500, 1800, 2100, 2400, 4100, 10200, 10300, 10800) ER&N



Radioactive material shipping cask ready for drop

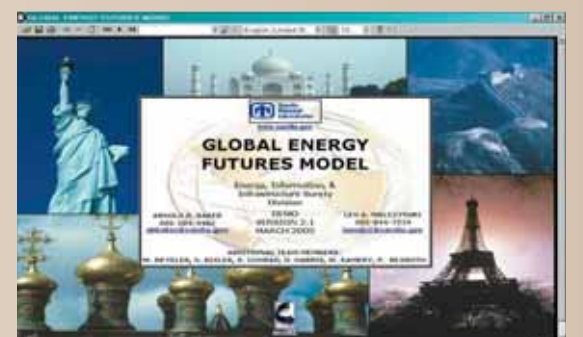
A hydrogen economy will require new methods of hydrogen generation; nuclear is an attractive option. Sandia has developed a first-of-a-kind computer simulation tool, MELCOR-H2, to dynamically **simulate a fully coupled nuclear reactor/hydrogen-generation plant**.

This desktop system allows users to vary parameters to maximize hydrogen and electrical production while enhancing nuclear and hydrogen plant safety. Validation and verification studies on key models, including transient sulfur-iodine thermochemistry models, demonstrate that MELCOR-H2 matches available experimental data to within 5 percent. (6700, 6300) ER&N



Nuclear is an option for hydrogen generation. (Photo by Randy Montoya)

Future world oil demand and carbon emissions gaps are enormous, and the trade-offs are complex. At the request of the Club of Prague, **global energy-economic-environmental scenarios to 2050** were developed using Sandia's



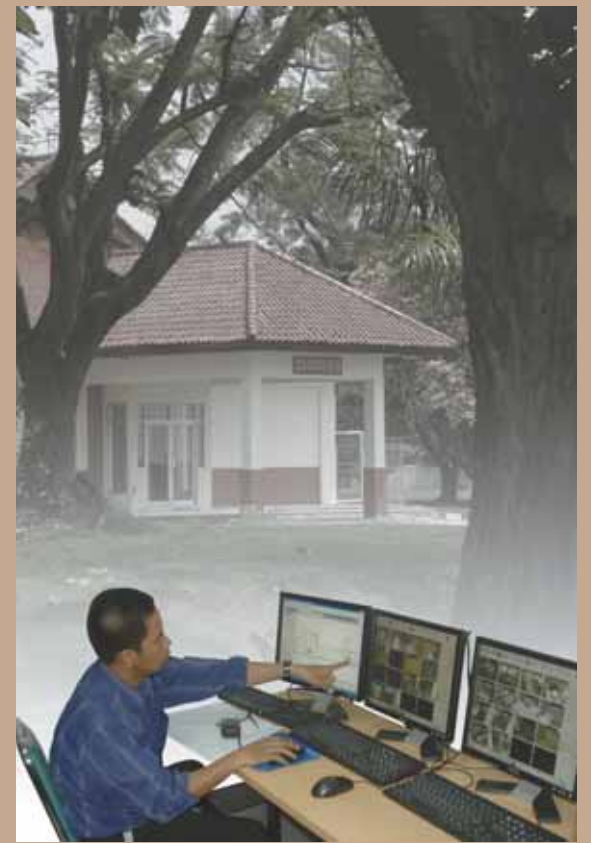
Global Energy Futures Model screen

Global Energy Futures Model. These scenarios were well received, framed the Club's discussions on new ways of thinking about global energy-economic-environmental problems, and were published in a conference report: *Energy: Empowering the Individual and the Community*. (320, 6300) ER&N, ITS

Global security



Sandia helped provide equipment and procedures for detecting radioactive material in containers bound for the US from several foreign ports.



Research Institute of Veterinary Science, Bogor, Indonesia

Members of the International Borders Monitoring Department's Second Line of Defense Program were instrumental in providing equipment and procedures for **detecting radioactive material in containers bound for the US** from ports at Southampton, United Kingdom; Port Qasim, Pakistan; and Honduras. This work supports the DOE/DHS cooperative Secure Freight Initiative and fulfills the requirements of the Security and Accountability for Every Port Act of 2006 by providing data to officials at the Customs and Border Protection's National Targeting Center in Reston, Va. (6700) ER&N, HS&D

Sandia Radiological Assistance Program (RAP) personnel conducted the first-ever joint NNSA/ROSATOM (Russian

Federal Atomic Energy Agency) **radiological emergency response field training** in St. Petersburg, Russia. The week-long training covered various emergency response topics, including radiation detection, detection equipment, and real-world responses to terrorism situations. Two mini-exercises were held to test responses to the dispersion of radioactive material. The culminating event was a day-long exercise that incorporated notification and alert procedures, mission planning, response deployment, field operations, and event resolution. (2900) NW

At the request of NNSA's Office of Nonproliferation Policy and the Department of State's Bureau of International Security and Nonproliferation/Office of Cooperative

Threat Reduction, Sandia's International Biological Threat Reduction program completed a project to **secure dangerous pathogens** at the Research Institute of Veterinary Science in Bogor, Indonesia. This project marks the US government's first biosecurity project in Indonesia, a critical US partner in the global war on terrorism. (6700) ER&N

In September 2007 Sandia hosted the DOE Cyber Security Summit. Attendees included leaders from DOE, NNSA, and the national labs. Dialogue focused on cyber security as a critical challenge facing our nation and **protecting institutions from cyber attack**. Six follow-on teams have since been formed to address complex topics related to cyber security. (1, 5000, 12100) DS&A

Members of a US-Russian team survey a suspicious package for radiation during field training in St. Petersburg, Russia.



Homeland security



Trucks lined up to pass through secondary inspection. Backups would be reduced with the installation of Advanced Spectroscopic Portals.

The DHS's Domestic Nuclear Detection Office (DNDO) has contracted with three vendors to develop **next-generation radiation detection equipment**, referred to as Advanced Spectroscopic Portals (ASP). Sandia played a pivotal role in helping evaluate the new ASPs in field operations at the New York Container Terminal (NYCT). The Labs led a multi-laboratory team that operated and collected performance data from the ASPs. The ASP systems had previously been evaluated at the Nevada Test Site (NTS), but the NYCT effort added stream-of-commerce data to supplement the NTS tests. (8200, 8100, 5900, 8100, 6400, Kansas City Plant, 4300, 10300, 5000, 5600) HS&D

Shielding effectiveness measurements in excess of 90 decibels (dB) were made for the US State Department using Sandia's recently approved system for attenuation measurements up to 110 dB. Uncertainty of the measured values was less than 0.3 dB at frequencies near 900 MHz. The measurements were made on candidate sleeve materials for the forthcoming State Department ID Card, which will enable **streamlined US border crossings**. When kept in its sleeve, the ID card will be immune to interrogation by unauthorized parties. (2500) HS&D

The High School Homeland Security Program **enhances critical thinking skills among high school students** using homeland security and emergency response as teaching elements. It has been or is being implemented in high schools in California, Arizona, Colorado, and New Mexico. The program includes instruction in homeland security and emergency response, case studies, and a half-day exercise. A senior DoD official said the program should be in the curriculum of every high school in the country. (300) ITS, HS&D



Students work to solve a complex homeland security problem.

Remote Target Engagement System (RTES)



On Oct. 1, 2007, the **first Remote Target Engagement System (RTES)** — designed, developed, and installed by Sandia to enhance security at a US Air Force location — went operational. The system was certified for design safety by the Non-Nuclear Munitions Safety Board (Air Force) and tested to verify functional and safety implementation by AFOTEC (Air Force Operational Test and Evaluation Center) Detachment 2. Operation from a hardened control center removes Air Force operators from harm's way. RTES has been continuously operated 24/7/365 since initial installation in April 2006. (6400) DS&A

In partnership with the Federal Emergency Management Agency (FEMA), Sandia is developing the secure architecture and standards for an alert and warning system that will provide a robust, multifaceted path to ensure **effective public communications during a federal, state, or local emer-**

gency. Known as the Integrated Public Alert and Warning System (IPAWS), the program deployed a pilot on Aug. 1, 2007, in the midst of the hurricane season and is initially supporting states and local jurisdictions in the Gulf Coast region. (1700, 5600, 6300, 6400, 8100, 8500, 8900, 9500) HS&D

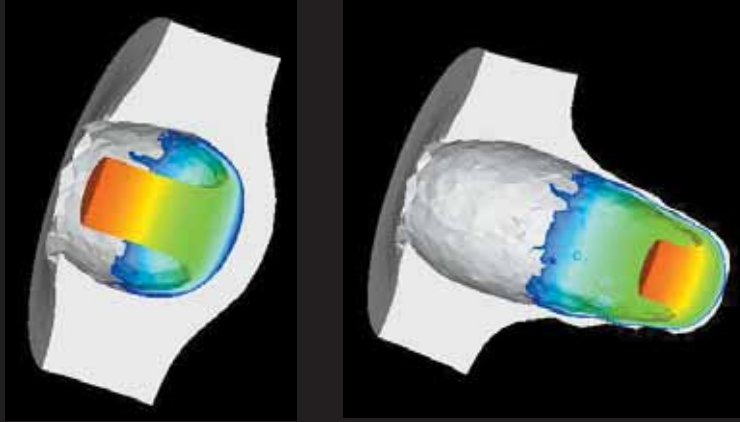
Participants in the September 2007 Golden Guardian exercise



In September a Lawrence Livermore National Lab/Sandia team conducted a Golden Guardian preparatory exercise in Anaheim, Calif., the **first functional exercise of the DHS-sponsored TELL (Training, Exercise, and Lessons Learned) system**. Based in the Anaheim Emergency Operations Center, TELL presented a simulated catastrophic incident to an incident management team operating in a remote mobile incident command post. Ground truth and exercise injects were provided by Sandia's WMDDAC (Weapons of Mass Destruction Decision Analysis Center) and Lawrence Livermore's ACATS (Advanced Conflict and Tactical Simulation) software. (8100, 8900) HS&D

Computing & information sciences

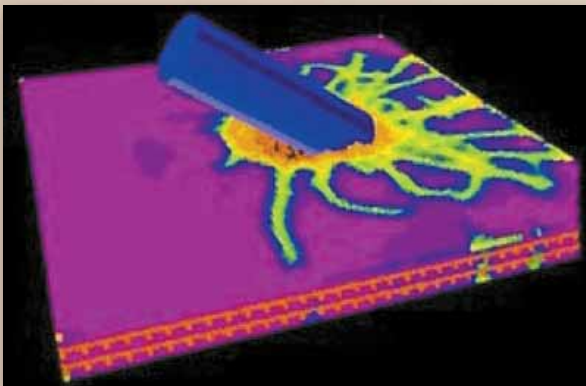
Capabilities were added to the Advanced Simulation and Computing SIERRA mechanics code that greatly enhance the ability to predict mechanical response for nuclear weapon applications. These capabilities include new elements for extremely large deformations, explicit dynamics algorithms that provide up to two orders of magnitude speed-up in computation time, and improved reentry pressure and acoustics modeling capabilities. These capabilities represent the next step in computational prediction of margins and uncertainties. They were applied to analyses performed for the W76-1 qualification and component design. (1500) NW



Simulations on the SIERRA mechanics code

As part of the Advanced Simulation and Computing Algorithms Milestone, Sandia demonstrated **vertical integration of Trilinos algorithms** with the Charon semiconductor device modeling code. Algorithms ranging from preconditioned iterative solvers through nonlinear solvers, transient solvers, and optimization were integrated in a modular yet high-performance manner, yielding up to ten-fold reductions in solution time while providing more accurate results. The algorithms are available to the Qualification Alternatives to SPR Program to optimize modeling parameters, and they are being used to explore the sensitivity of transistor device models to input parameters. (1400) NW, ST&E, DS&A

Peridynamics theory, shown to be consistent with molecular dynamics, is enabling **predictive simulation of failure** in highly heterogeneous materials and shows promise for coupling atomistics to continuum scales. Peridynamics approaches are being used to investigate damage and



Peridynamics-based simulation of a projectile impact, showing failure, crack initiation, and propagation in the target material

delaminations in composites for future Boeing aircraft structures. A recently developed peridynamics-based stress tensor that is consistent with classical continuum mechanics enables coupling to finite-element methods. (1400) NW, ST&E, DS&A

A cross-discipline team of researchers in the data mining, visualization, data analysis, and information security areas designed and built the **Data Analysis and Visualization Laboratory** in Sandia's Distributed Information Systems Laboratory (DISL). The lab includes three high-resolution projectors for group analysis and visualization of data related to national security problems. The room includes lab space for working on group projects, several high-end computer workstations for open use, and facilities suitable for meetings and presentations to VIPs. (8100, 8900) HS&D, DS&A

The Data Analysis and Visualization Lab is well-suited for developing and presenting complex analyses across numerous disciplines, including geographic information system-based analysis.



Life is multidimensional, but many of the nation's calculations and simulations are done using two-dimensional mathematical data structures called matrices. The Tensor Toolbox for MATLAB is enabling the **use of multidimensional data structures**, called tensors, for solving problems in domains such as data analysis, image and signals processing, psychometrics, and chemometrics. On a laptop, the software can easily do numerical computations on problems of size 10,000 x 10,000 x 10,000 with more than a half million nonzero entries. More information at <http://csmr.ca.sandia.gov/~tgkolda/TensorToolbox/>. (1400, 8900) HS&D, DS&A

The Design Analysis Kit for Optimization and Terascale Applications (DAKOTA) suite of systems analysis tools works with simulations to address assessment and design questions. Developed with Lockheed Martin, DAKOTA has been deployed within DOE to facilitate **risk-informed national security decisions**. DAKOTA 4.0 enables predictive simulations and performs decision making for stockpile stewardship. While DAKOTA applications can be proprietary, the software itself is not. Free downloads are available, allowing the emergence of DAKOTA as a de facto standard for systems analysis. (1400, 330) ER&N, ITS

OVIS-2, a tool for intelligent, scalable real-time monitoring of large computational clusters, has been developed and deployed for prerelease testing on Sandia's Thunderbird and Talon clusters. It is being used for post-processing



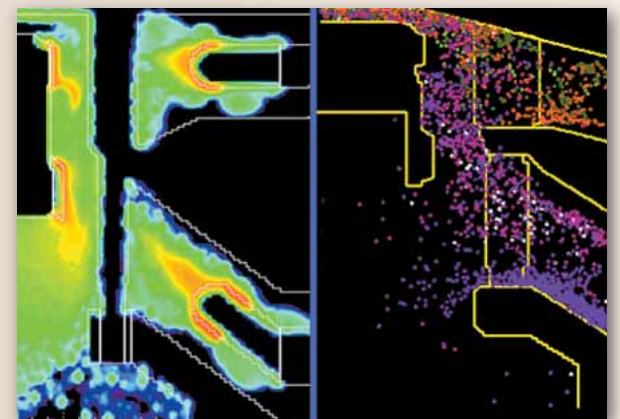
Portion of the OVIS-2 three-dimensional interface. Components with outlier behavior are indicated by color and distance projected out from the racks.

analysis of Red Storm system data. OVIS uses a unique statistical approach to characterize behaviors of cluster components and detect abnormalities and outliers that could be indicative of impending failures. Advances in OVIS-2 include a three-dimensional visual display, enhanced statistical capabilities, and a distributed clustered database back end for scalability and fault tolerance. (8900, 8300) NW

Ed Thomas (12227) and Tim Draelos (5635) have developed a method for authenticating concealed and statistically varying multidimensional data. Their approach provides a way to **measure the statistical similarity of data objects** in their concealed states. The calculated Euclidean distance metric of the concealed data is identical to the Euclidean distance metric between the data objects prior to the transformation used for their concealment. This technology can be used for authentication when the information itself is private in nature, such as for biometric authentication applications. (12200, 5600) DS&A

Engineering sciences

Enhanced **three-dimensional electromagnetics and plasma computational capabilities** were developed and applied to several important physics applications. The tools advanced our understanding of magnetically insulated flow of electrical power and electrode plasma formation in the Z machine (where current will exceed 26 million amperes), enabled assessment of multiple system-generated electromagnetic pulse effects for a WR1-like configuration (combining electromagnetic and radiation transport tools), and assessed performance of a phased-array antenna, accounting for its large but finite size and the presence of defective array elements. (1600, 1300) NW, ST&E



Calculated electron density in electrode plasma formation (left) and electron transport (right) in Z

Infrastructure protection

As directed by the White House Homeland Security Council, the National Infrastructure Simulation and Analysis Center (NISAC), a DHS program co-led by Sandia and Los Alamos National Lab, completed a two-year examination of **potential impacts of pandemic influenza on the nation's population, critical infrastructures, and economy**. The results suggest absenteeism, mortality, infrastructure service impacts, and demand shocks could cause adjustments to the structure of the nation's economy. However, preparedness and the type, timing, and duration of intervention strategies can provide some level of containment. (6300, LANL) HS&D



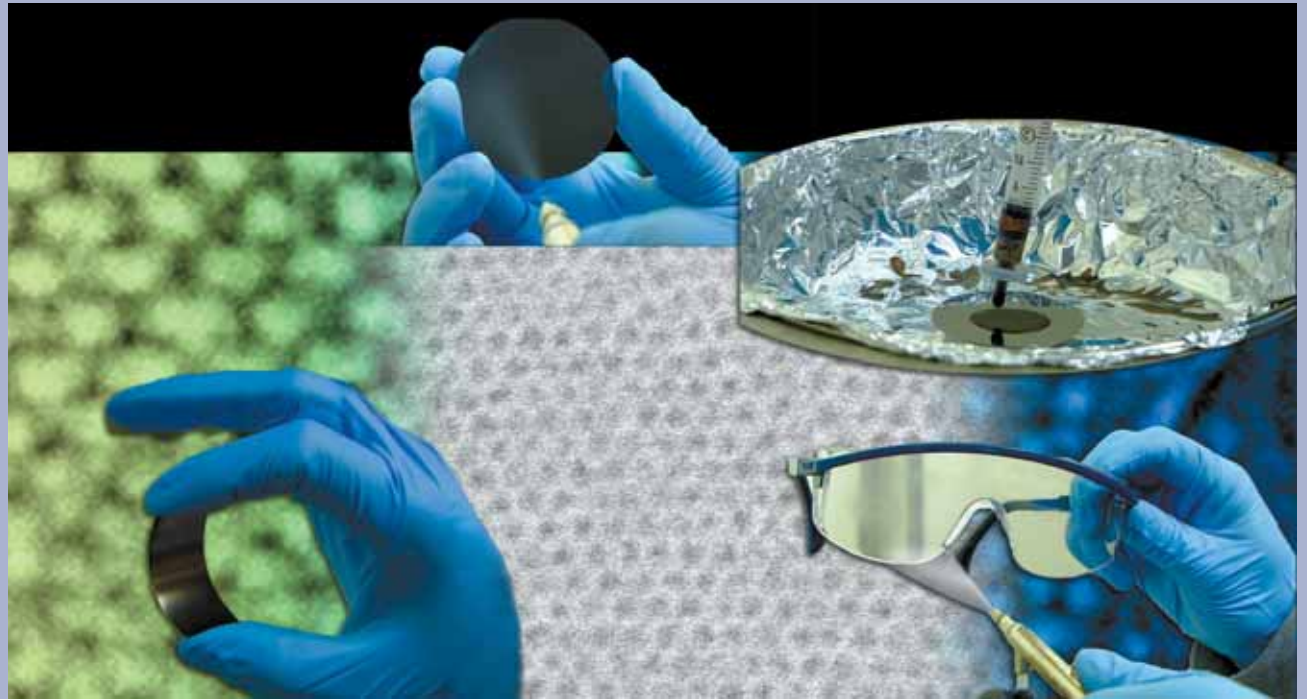
NISAC examined potential national impacts of an influenza pandemic.

The Virtual Control Systems Environment (VCSE) is a tool being developed under the National Supervisory Command and Data Acquisition Test-Bed program. VCSE is a scalable environment for **simulating cyber effects and evaluating security mitigation options** for control systems of infrastructures such as electricity, oil, and gas. VCSE allows asset owners and operators to conduct system-level effects analyses on control system failures and understand how they propagate into local operations. From a government perspective, policy makers can more easily understand how these effects cascade and affect other infrastructures. (5600, 6300) ER&N, DS&A

Materials

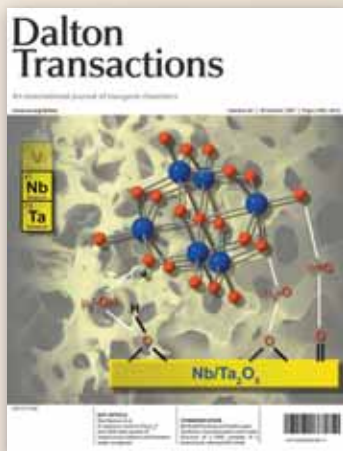
A new simple self-assembly coating process was developed to **functionalize nanoparticles and organize them into ordered arrays**. The resulting films exhibit unusual functionality not previously observed in conventional processes, needed for anti-reflection coatings on sensor windows for military aircraft and unmanned aerial vehicles. This innovative self-assembly process offers significant advantages including reduced costs, increased manufacturing flexibility, improved logistics, and a tailored material response. This technical innovation, made possible through a Sandia/Lockheed Martin partnership, was recognized with a 2007 R&D 100 Award. (1800, 0330) ST&E

A simple, economical nanotechnology coating process enables the development of nanoparticle thin films with unique optical, electrical, and magnetic properties unattainable by conventional processes.



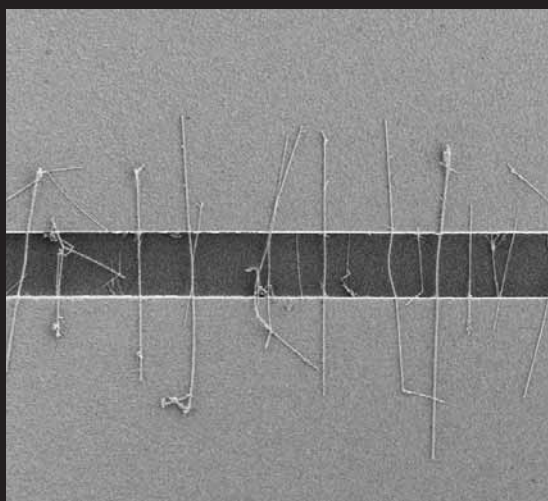
Unexpected differences discovered between niobium and tantalum may lead to **new electronic and photocatalytic materials** as reported in an Oct. 28 *Dalton Transactions* cover article. Sandia researchers developed a “soft chemistry” route to niobium/tantalum oxide compounds.

The alternative “volcano” method involves melting oxides at high temperatures. The “soft” method involves chemical finesse rather than brute force and offers new forms of these oxides including nanoparticles, coatings, and unprecedented compositions. Tantalum oxides are used in medical implants, hypoallergenic surgical tools, cell phone capacitors, and ceramics for encapsulating nuclear waste. (6300) ER&N, ST&E



Dalton Transactions cover article describing a novel aqueous route to niobium/tantalum oxide compounds

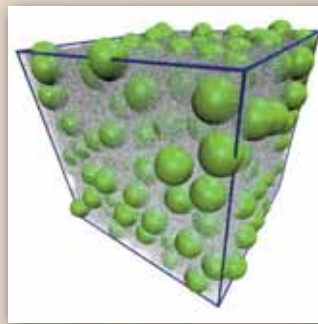
Nanomaterials such as carbon nanotubes and semiconductor nanowires may possess unusual but useful properties in response to microwave radiation. Sandia researchers, collaborating with Penn State, made the first measurements of the fundamental high-frequency **electrical conductance in arrays of carbon nanotubes and silicon nanowires** across the same microwave spectrum used in telecommunications and radar. They showed that the nanomaterials' frequency-dependent conductance behaves very differently from conventional macroscopic materials. This work was supported by a Nanometer-to-Micrometer LDRD-funded project and by the Readiness in Technical Base and Facilities program. (1100, 1800) ST&E



Electron microscope image of an array of doped silicon nanowires assembled across the 3 μm -wide gap between the gold electrodes of a microwave waveguide used to measure their high-frequency electrical conductance

A Sandia team has **carried out multimillion atom simulations of the shear rheology of nanoparticle suspensions** to predict how the chemical interactions that occur

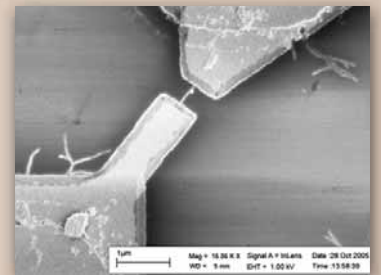
among nanoparticles affect the behavior of nanoparticle fluids during manufacturing. The team improved by more than 100 times the speed of the molecular dynamics code LAMMPS for nanoparticles in an explicit solvent. This work was supported by the National Institute for Nano Engineering (NINE) and by a cooperative research and development agreement with a five-company consortium to develop production-level computations for nanoparticle flow processing. (1100, 1400, 1500) ST&E



Sample simulation cell for nanoparticles in an explicit solvent.

Sandia and University of Wisconsin researchers demonstrated that the **sensitivity of carbon nanotubes to light** is increased dramatically when they are coated with dye molecules.

When exposed to light, these molecules change shape and induce a change in the electrical conductance of the nanotube. This discovery may allow for multicolor detection of low-intensity light at nanometer dimensions. It was highlighted in *Nature* in an article titled “Nanotubes see the light.” (8700) ST&E



Scanning electron micrograph of a carbon nanotube transistor. The nanotube is functionalized with a chromophore (dye) that undergoes a molecular transformation on exposure to ultraviolet light, which leads to a large shift in the characteristics of the transistor.

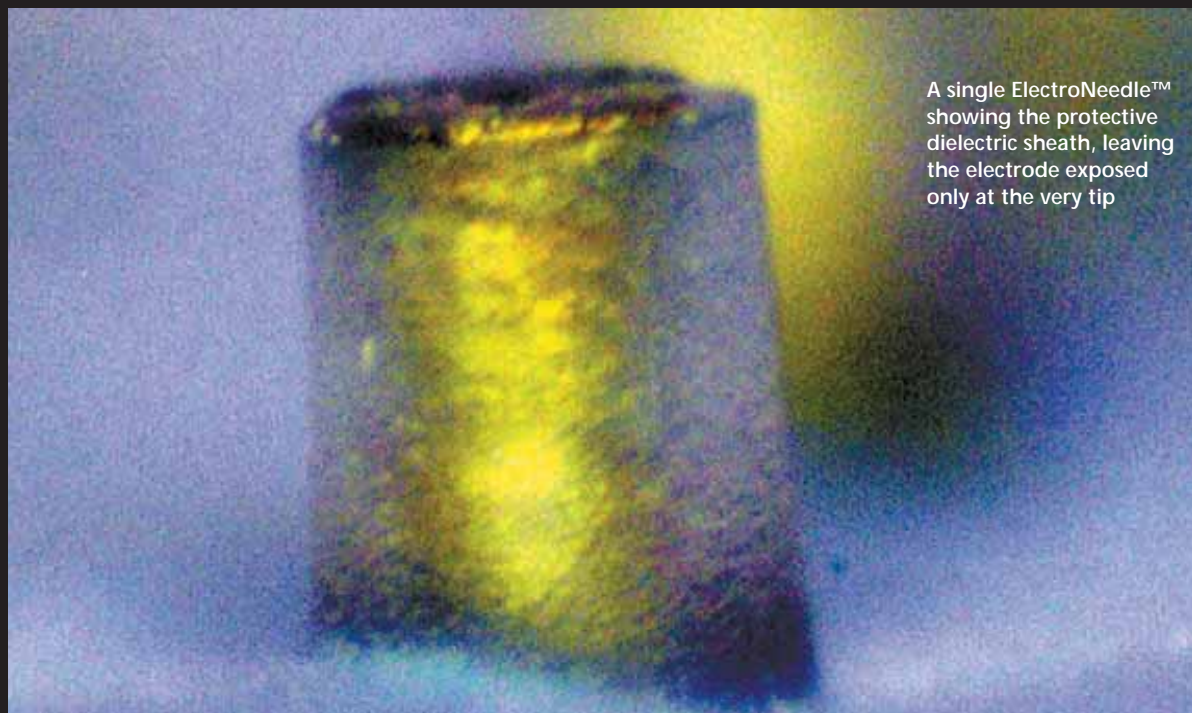
When two identical particles are exchanged, the wave function is unchanged if they are bosons but changes sign if they are fermions. The fractional quantum Hall effect (FQHE) is due to particles that are “anyons,” where the wave function changes phase by arbitrary amounts. These cases were long considered Abelian

(the order of exchange of multiple particles is irrelevant). Recently, however, a Sandia-led team obtained compelling evidence that **some types of FQHE particles are non-Abelian**. This profound result has important implications for quantum computing. (1100) ST&E, ER&N



Sandia physicist Wei Pan prepares a sample for cooling to millikelvin temperatures in a magnetic field of 140,000 Gauss, where non-Abelian properties of novel electron-based particles can be observed.

Microelectronics & microsystems



A single ElectroNeedle™ showing the protective dielectric sheath, leaving the electrode exposed only at the very tip

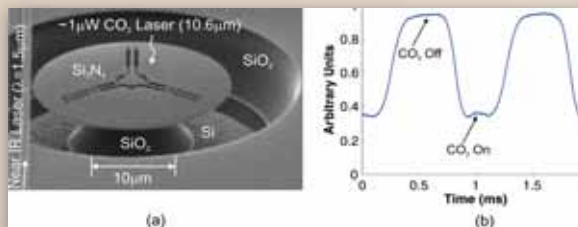
Extending semiconductor microfabrication technologies beyond integrated circuits has led to the development of arrays of micron-sized electrochemical sensors for use as minimally invasive diagnostic probes to sample a patient's blood or interstitial cellular fluid. By functionalizing the tips of these microneedles with antibodies, enzymes, and other biological receptors, electrochemical measurement techniques can be combined with well-defined immunoassay chemistry to detect a range of biologically important species, including carbohydrates, electrolytes, lipids, enzymes, toxins, proteins, viruses, and bacteria. This activity received a 2007 R&D 100 award. (1700) ST&E

The Quadrature Digital Waveform Synthesizer (QDWS) Application Specific Integrated Circuit (ASIC) supports a Center 1700/5300 partnership to miniaturize the transmit/receive (T/R) module in the MesaSAR synthetic aperture radar (SAR) system. The QDWS is a drop-in replacement for a XILINX Virtex II Field Programmable Gate Array in the MiniSAR, which reduces both the size and power of the T/R module. The QDWS ASIC was fabricated with first-pass success in IBM's 130nm Trusted Foundry and demonstrates Sandia's ability to provide commercial leading-edge integrated circuit solutions. (1700, 5300) ST&E



Packaged QDWS ASIC

Microphotonic thermal detectors could achieve uncooled sensitivity and noise performance in the long-wave infrared region approaching that of cooled photon detectors. The first microphotonic thermal detectors have been fabri-



Scanning electron micrograph of a representative silicon-nitride-based microphotonic thermal detector

cated in Sandia's MESA facility. The devices detect the change in optical resonance frequency of a suspended silicon-nitride microphotonic resonator on illumination with one watt of 10.6- μm radiation from a CO₂ laser. The silicon nitride resonator absorbs the infrared (IR) radiation, inducing a change in resonance via the thermo-optic effect and a resulting change in transmission of a near-IR laser interrogating the microphotonic resonator. (1700) ST&E

Pulsed power

The newly refurbished Z accelerator conducted two system demonstration shots in September, ending a 14-month shutdown where the old systems were dismantled, the tank structure extensively modified, and new pulsed power subsystems assembled and installed. This was the final phase of the 6-year, \$90 million (\$63 million capital investment) Z Refurbishment (ZR) project. Experimentalists will realize increased utilization via the capability to conduct more shots, with improved precision and pulse shape variability. Better reproducibility and data quality, as well as increased delivered current, should provide additional performance. (1600) NW, ST&E



Installation of Z's new center section



Z machine's center during the renovation process, its huge conduits being readied to focus an even more massive electrical current on a target

A series of ultra-high-velocity flyer plate impact experiments, designed to investigate the melting of diamond under large-amplitude shock-wave compression in support of the nation's inertial confinement fusion program, were performed on Sandia's Z machine. Through combined experimental and theoretical analysis, the onset and completion of melt were identified at pressures of 6.9 and 10.6 million atmospheres, respectively. As a bonus, compelling evidence was uncovered within the large solid-liquid coexistence region for the existence of a predicted diamond-liquid-bc8 triple point at 8.5 million atmospheres. (1600) NW, ST&E

Partnerships & alliances

Moving through the air in three dimensions, the Novint Falcon outperforms existing joysticks and mice, offering high-fidelity three-dimensional touch and a realistic experience that surpasses existing



The Novint Falcon

point-and-click technology. Novint's software is based largely on technology developed at Sandia. Novint is Sandia's first start-up licensee company to go public and is one of the first publicly traded companies in which Sandia holds an equity position. The Novint Falcon and Novint/Sandia 3D Touch Software won a 2007 R&D 100 Award for technological innovation. (1400) NW

The T-1A is a fiber optic, anti-tamper loop seal for securing high-value, high-risk assets. People lose confidence in mechanical seals as soon as they are



The T-1A fiber optic, anti-tamper loop seal on radioactive materials containers

applied because they are not monitored directly and continuously, but active seals like the T-1A, which automatically reports in several times a day, renew confidence in their security each time they report their status. Sandia and commercial partner Canberra Albuquerque combined a license agreement for the current T-1A sensor with a cooperative research and development agreement to jointly develop the next-generation sensor. (6700) ER&N

Letters between the US president and the prime minister of the United Kingdom in December 2006 initiated a series of enhanced collaborations that include work in key strategic areas required to meet national requirements, and for which the US/UK interaction is considered mutually beneficial. Major topical areas in which Sandia will play a significant role include radiation sciences, safety subsystems, gas transfer systems, and surveillance sensor development. (1100, 1700, 1800, 2100, 2600, 2800, 2900, 5300, 8200, 12300) NW

The Systems Integration Technical Support (SITS) group developed both a roadmap integrating some 20 NNSA plans and roadmaps and a standardized weapons stockpile concept for DoD and NNSA. SITS also supported development of NNSA's Readiness in Tech Base and Facilities Corporate Physical Infrastructure Plan and Weapon Program Baseline Guidance Handbook, as well as the NNSA Office of Transformation's development of strategic planning documents and processes such as the Preferred Alternative. During FY07 the number of SITS staff members has increased fourfold, commingling Sandia personnel with representatives from sites across the complex. (500, 200, 8200, 2100) NW



IT, networks, & facilities

Sandia's Facilities program completed several major projects in FY07, **adding much-needed space for mission work and improving the site infrastructure.** Projects included the Microsystems and Engineering Sciences Applications (MESA) complex, the Center for Integrated Nanotechnologies (CINT) Core Facility, the Test Capabilities Revitalization Phase 1 project, the Neutron Initiation Tech-



The new IPOC building outside the Kirtland Air Force Base Eubank Gate

nology building, and the Exterior Communications Infrastructure Modernization project. The Innovation Parkway Office Center (IPOC), a new off-site leased facility, provides unclassified space for the Badge Office and other groups while freeing up classified space on site. (4800, 10200) IES

Computing Support Services (CSS), a virtual organization serving more than 12,000 desktop computing customers and **resolving more than 135,000 trouble tickets each year,** achieved ISO 9001:2000 certification in March 2007. This involved developing a quality management system and undergoing several audits prior to certification. As a result, CSS has improved a number of its primary processes, instituted an internal method by which CSS employees can suggest process improvements, and improved how its five organizations (representing several centers) collaborate to support desktop computing. (9300, 9500, 8900) IES

The current technologies for building extremely large **network switching infrastructures for supercomputing environments** suffer from fundamental limitations. A Sandia team initiated a consortium of leading network vendors to demonstrate the effectiveness of dynamic routing for scalable switching infrastructures. They also demonstrated the efficiency of new lightweight protocols over standard Ethernet™ that compares well with more complex specialty hardware for cluster interconnects. These technologies will provide a high-speed Ethernet switching infrastructure that should scale to the thousands of ports required by future petascale computing environments. (9300, 8900)

Sandia's **Energy Management Program** continues to ensure that utility systems are reliable and efficient and energy management is institutionalized.

Energy intensity for regular buildings decreased 0.41 per cent from FY06 to FY07, and metering requirements for 99 percent of Sandia facilities were met five years ahead of schedule. Energy- and water-saving efforts, critical in preparation for the anticipated doubling of electricity costs in January 2009, resulted in a Federal Energy Management Program award for Bldg. 833's photovoltaic roof and US Green Building Council certification for four Sandia facilities. (4800) IES



Photovoltaic lights are among Sandia Energy Management Program improvements.

An Extended Enterprise was developed in FY07. Its premise is to retain an **IT resource base that can expand or contract** quickly to staff new and existing projects using off-site personnel. The benefits include maximizing the amount and types of work provided to customers while minimizing the costs of administering individual contracts. With Sandia Delegated Representative approval, the entire Laboratories can use these software engineering contracts. Other IT organizations are encouraged to use the Extended Enterprise to reduce costs and overhead Labs-wide. (9500) IES

ES&H & security

Sandia made significant progress in FY07 **removing its category 1 and 2 special nuclear material (SNM),** as seven of the ten identified SNM groups have been shipped off-site. The materials include Sandia Pulsed Reactor reactor plates, sodium experimental debris, calibration sources, and other material. The completed milestones included approvals for material packages, acceptance agreements, criticality safety analyses, procedural development, and quality assurance support to meet Sandia's integrated safety management and security requirements for shipment authorization. Remaining materials are being shipped in FY08. (1200, 1300, 4200, 10200, 4100) NW, ST&E



SPR plate being prepared for packaging



Sodium materials being shipped off-site



Shipping cask for sodium debris

DOE Headquarters requires Sandia to submit **ES&H/environment-related liability reports** for inclusion on DOE's FY07 financial statements. Sandia completed a comprehensive review of prior-year submissions across the entire site on legacy materials disposition and the long-term stewardship program. This effort required coordination among DOE/HQ, the Sandia Site Office, and several Sandia organizations. Sandia's submission was validated by KPMG auditors as part of their annual financial audit. IES

The Counterintelligence Awareness Program continues to **focus on the insider threat to Sandia.** Malicious outsiders can do only limited damage to a well-protected institution without the cooperation of a malicious insider. However, an insider assisted by a sophisticated foreign intelligence service can defeat even the best physical or cyber defense. Thus, deterring insiders is critical to effective



Inspectors recognized Sandia's security self-assessment program as "a model for the entire complex."

and cost-efficient security. Data collected during recent surveys shows a marked improvement in staff awareness of this issue. (301) ITS

To describe the **results of inspections of all of Sandia sites' physical security areas** this year, DOE Office of Independent Oversight inspectors used the phrase "phenomenal performance." Sandia's self-assessment program was recognized as "a model for the entire complex." Inspectors noted the consistent upward trend in protection program/posture effectiveness like this: "The general levels of security-related knowledge among the site population and the swift response to issues identified during this inspection also reflect management's support for the safeguards and security program and the recognition of that support by laboratory employees." (4200, 8500) NW

Supply chain

Sandia's Supply Chain Management Center had outstanding results in the **FY07 wall-to-wall physical inventory.** This inventory adhered to the industry standard find rate (98 percent), increased the accountable equipment threshold value (\$7,500), and removed items from inventoried status if the net book value (cost minus depreciation) equaled \$0 (18,197 fewer items). The cost savings and cost avoidance totaled almost \$1 million. Similar cost avoidances are expected annually. (10200) IES

The Supply Chain and Materials Management Council Project is a pioneering, inclusive communication and improvement process for **ensuring that supply chain services contribute to mission success.** It starts with supply chain data collection and analysis for a specific Sandia customer group. The information is discussed in a summit between supply chain experts (Procurement & Logistics) and customers. The successful inaugural event resulted in 13 center/division customer summits and many high-impact business process improvements resulting in cost savings. IES

Fleet Services received approval from NNSA on the Transportation Concept Initiative Implementation Project Plan in February 2007 and initiated a two-year pilot program facilitating **Sandia Fleet Services self management of the Sandia fleet.** The pilot has yielded success in meeting initiative goals of demonstrating effective and efficient stewardship of resources. Highlights include a 10 percent reduction of carts at Sandia/New Mexico and an increase in cart fleet utilization to 89 percent. (10200) IES



Michelle Fleming (3651) scans a laptop during a wall-to-wall inventory. Revised standards in FY07 resulted in a cost savings or avoidance of almost \$1 million.

(Photo by Randy Montoya)



Cart fleet utilization increased to 89 percent in FY07.

Human resources, finance, & legal

Sandia's Employee Caring Program (ECP) celebrated 50 years of giving to the United Way of Central New Mexico in 2007. **The campaign total was \$3,576,000 this year.** Since 1957 Sandians have donated more than \$15 million to help address community needs. More than 73 percent of Sandia employees participated.



ECP contributions supported United Way agencies such as St. Martin's Hospitality Center, where homeless New Mexicans can find conversation, meals, employment services, and other assistance. (Photo by Randy Montoya)

Sandia received excellent results in January 2007 for participation in the 2006 **Diversity Maturity Model (DMM)**, resulting in a score of 3.3 (on a 5-point scale, 0.2 above the 3.1 target), up from the 2.2 score earned in 2005. The results were similarly improved across Lockheed Martin, with all business units exceeding their targets. The 2006 DMM Assessment Response Team received a Team Employee Recognition Award for its approach to the Diversity Maturity Model. (3500, 200, 3000, 3600, 9200, 10200, 12100) IES

Sandia/California's Life Design Center Preventive Health Programs captured the **2007 California Fit Business Gold Award**. Sponsored by the California Task Force on Youth and Workplace Wellness, the award was created by California State Senator Tom Torlakson's office, with corporate and private sponsors. The Gold Award is the highest honor and is given to companies that demonstrate excellence and creativity in nutrition, fitness, and site culture. Staff from the Life Design Center Preventive Health Programs and Health, Benefits, & Employee Services received the award on Nov. 8, 2007. (8500) IES

Faced with escalating health care costs and declining care standards, Health, Benefits, and Employee Services (HBE) **contained costs while providing exceptional healthcare for employees.** HBE deploys a long-term cost control strat-

egy that includes prevention, consumerism, health-risk modifications, and disease management. A blend of on-site and off-site services encourages a workplace culture of individual responsibility. Sandia went tobacco-free in March 2007, for example, and HBE's smoking cessation program has helped employees quit smoking at success rates that are significantly higher than the national comparison rates. (3300) IES



Sandia's medical clinics are part of a blend of on-site and off-site health services provided to employees.

The Video Services and Infrastructure Computing organizations implemented **new video streaming functionality** such as interactivity, single sign-on, and full-resolution graphics. The Sandia Restricted Network was multicasted-enabled to reduce bandwidth consumption. Usability,

quality, reliability, and convenience of receiving live and on-demand communications at the desktop have improved, with more than 100,000 streams in FY07. An industry return-on-investment study showed that streaming returns almost \$4 in value for every \$1 invested. (3600, 9300) IES

The Microsoft Project/Oracle Integration Tool, added to the Oracle Project Modules, has demonstrated **favorable results during the FY08 budget call.** The tool allows users to import data from Microsoft Project directly into Oracle Projects. A Nuclear Weapons business analyst uploaded almost 700 financial tasks from a project plan in less than one minute, saving many hours of manual keying. An International Programs business analyst set up an FY08 work breakdown structure for 65 projects in about an hour; this effort usually requires three to four days of data entry.

DOE/NNSA issued final approval to Sandia for an **exemption from the Federal Travel Regulations (FTR)** that authorizes Sandia to use actual and reasonable costs instead of per diem allowances for travel expenses due to the demonstrated annual savings of approximately \$750,000 over the past five years. This approval allows Sandians to continue saving taxpayer dollars by using their judgment when making spending decisions while on travel. (10500) IES

Sandia completed full second-year implementation of OMB Circular A-123, Appendix A, and provided reasonable assurance to DOE and NNSA that an adequate **internal controls structure exists for financial reporting.** The final assurance statement was delivered before the scheduled milestone date. Teams consisted of a site assessment team, a laboratory cross-functional group of more than 60 managers of various levels, financial process owners, and testing teams of approximately 20 lab staff members. The A-123 implementation team received a Turquoise President's Quality Award in FY06. IES

The corporate tax function **aggressively pursued tax credits** based on tax questionnaires completed by program managers and financial analysts to reduce Sandia's tax obligation. Over the past 12 years, Sandia has averaged a corporate tax rate of 3.11 percent. In FY07, the rate was 2.82 percent, representing a savings of \$6.5 million over the historic average despite state and local tax increases in FY05, FY06, and FY07. (10500) IES

Management

Sandia successfully **implemented the Assure, Assess, and Improve Process (AAIP)**, which is the contractor assurance system (CAS) portion of the Integrated Laboratory Management System (ILMS). AAIP completes the implementation of the model contract at Sandia. Implementation of the model contract has resulted in improved management performance and effectiveness, including cost savings/avoidances of \$177 million since beginning the implementation of the Model Contract in FY04. (9700)

A system that integrates several processes and tools to provide one web-enabled location for actions required to **plan, authorize, track, and report (PLATR) nuclear weapons work** was developed by the Nuclear Weapons Strategic Management Unit. PLATR facilitates the planning and management of all FY08 and future work falling within the SMU. The PLATR team delivered the core planning capability in May 2007, with subsequent functionality delivered throughout the summer. (200, 9500) NW

The Ethics Office **gave 275 guidances and investigated 55 cases** while improving its case closure rate, facilitating 100 percent Labs-wide completion of annual ethics training, and sponsoring Lockheed Martin Corporation investigator training. Corporate Investigations completed 16 cases, conducted 48 preliminary inquiries, and assumed responsibility for the Workplace Violence Program. Working to help shape the ethics culture at the Labs, the Ethics and Business Conduct Center conducted strategic planning studies that included focus groups from technical and administrative staff and management. (12400)

Corporate Internal Audit teamed with two statistical modeling experts from Sandia's Threat Analysis Technologies department to pilot the application of **advanced statistical modeling processes and technologies in internal auditing.** Together they explored the use of text mining, clustering, and predictive modeling technologies. The results of this initial effort were presented in competition with other best-practice nominees at the DOE contractor internal audit directors meeting, where it placed second. Corporate Internal Audit will refine the techniques during FY08 internal audits. (12800, 5600) IES

An effective contractor assurance system provides confidence in Sandia's ability to manage its own work, including the identification of root causes of problems. Akin to medicine, a correct diagnosis is essential to the successful resolution of a problem. A collaborative effort led to recognition of the economic value of a **corporate root cause analysis program**, which is being established. A strong program results in less time and lower costs in correcting problems to the satisfaction of DOE. (12800, 4100, 4200, 9700) IES

WFO/CRADA Agreements Dept. 9732 and WFO Financial Management Dept. 10513 teamed with the Sandia Business School (SBS) to develop a **suite of SBS courses related to Work for Others (WFO).** Sandia's WFO program increased 86 percent in the past five years and is now a major element of Sandia's overall budget, resulting in the need for more formalized training for WFO project managers and business support personnel. Course content includes WFO policies, processes, and procedures for WFO proposals, agreements, and projects, including financial management requirements. (9700, 10500)

Other

For the last 15 years, Sandia has sponsored **detailed public opinion polls on national security issues** such as deterrence, nuclear weapon policy, terrorism, and energy security. The long-term nature of the program permits trend and causal analysis. Results suggest that there is substantial, long-standing support for US nuclear weapon policy, especially deterrence. The data also reveal some interesting trends, such as increasing support for nuclear energy. Results support long-term planning and are available on the ITS SMG website. (303) ITS

How can Sandia's diverse expertise be best harnessed to solve wicked problems? This issue was examined experimentally by **comparing the effectiveness of individual versus group electronic brainstorming.** Findings indicated that individuals produced significantly ($p < 0.05$) better ideas than the group. Thus, although group participation is often touted as providing synergistic benefit, these results suggest that individuals may perform better in isolation. The results could impact future electronic interactions within Sandia to find solutions to very difficult problems. (12300, 1400, 6700) ST&E



Sandia Site Office Manager Patty Wagner and Sandia President and Director Tom Hunter signed the FY08 Performance Evaluation Plan, which documents the criteria by which the site office appraises Sandia Corporation's performance in its management and operation of Sandia. Behind them are Labs Deputy Director John Stichman and SSO Deputy Manager Kim Davis. The annual PEP is a major part of an effective contractor assurance system that provides confidence in Sandia's ability to manage its own work. For FY07, Sandia's overall performance was rated "outstanding" in the NNSA's annual Performance Evaluation Report.



Public opinion polls show long-standing support for US nuclear weapon policy.

Human resources, finance, & legal

Sandia's Employee Caring Program (ECP) celebrated 50 years of giving to the United Way of Central New Mexico in 2007. **The campaign total was \$3,576,000 this year.** Since 1957 Sandians have donated more than \$15 million to help address community needs. More than 73 percent of Sandia employees participated.



ECP contributions supported United Way agencies such as St. Martin's Hospitality Center, where homeless New Mexicans can find conversation, meals, employment services, and other assistance. (Photo by Randy Montoya)

Sandia received excellent results in January 2007 for participation in the 2006 **Diversity Maturity Model (DMM)**, resulting in a score of 3.3 (on a 5-point scale, 0.2 above the 3.1 target), up from the 2.2 score earned in 2005. The results were similarly improved across Lockheed Martin, with all business units exceeding their targets. The 2006 DMM Assessment Response Team received a Team Employee Recognition Award for its approach to the Diversity Maturity Model. (3500, 200, 3000, 3600, 9200, 10200, 12100) IES

Sandia/California's Life Design Center Preventive Health Programs captured the **2007 California Fit Business Gold Award**. Sponsored by the California Task Force on Youth and Workplace Wellness, the award was created by California State Senator Tom Torlakson's office, with corporate and private sponsors. The Gold Award is the highest honor and is given to companies that demonstrate excellence and creativity in nutrition, fitness, and site culture. Staff from the Life Design Center Preventive Health Programs and Health, Benefits, & Employee Services received the award on Nov. 8, 2007. (8500) IES

Faced with escalating health care costs and declining care standards, Health, Benefits, and Employee Services (HBE) **contained costs while providing exceptional healthcare for employees.** HBE deploys a long-term cost control strat-

egy that includes prevention, consumerism, health-risk modifications, and disease management. A blend of on-site and off-site services encourages a workplace culture of individual responsibility. Sandia went tobacco-free in March 2007, for example, and HBE's smoking cessation program has helped employees quit smoking at success rates that are significantly higher than the national comparison rates. (3300) IES



Sandia's medical clinics are part of a blend of on-site and off-site health services provided to employees.

The Video Services and Infrastructure Computing organizations implemented **new video streaming functionality** such as interactivity, single sign-on, and full-resolution graphics. The Sandia Restricted Network was multicasted-enabled to reduce bandwidth consumption. Usability,

quality, reliability, and convenience of receiving live and on-demand communications at the desktop have improved, with more than 100,000 streams in FY07. An industry return-on-investment study showed that streaming returns almost \$4 in value for every \$1 invested. (3600, 9300) IES

The Microsoft Project/Oracle Integration Tool, added to the Oracle Project Modules, has demonstrated **favorable results during the FY08 budget call.** The tool allows users to import data from Microsoft Project directly into Oracle Projects. A Nuclear Weapons business analyst uploaded almost 700 financial tasks from a project plan in less than one minute, saving many hours of manual keying. An International Programs business analyst set up an FY08 work breakdown structure for 65 projects in about an hour; this effort usually requires three to four days of data entry.

DOE/NNSA issued final approval to Sandia for an **exemption from the Federal Travel Regulations (FTR)** that authorizes Sandia to use actual and reasonable costs instead of per diem allowances for travel expenses due to the demonstrated annual savings of approximately \$750,000 over the past five years. This approval allows Sandians to continue saving taxpayer dollars by using their judgment when making spending decisions while on travel. (10500) IES

Sandia completed full second-year implementation of OMB Circular A-123, Appendix A, and provided reasonable assurance to DOE and NNSA that an adequate **internal controls structure exists for financial reporting.** The final assurance statement was delivered before the scheduled milestone date. Teams consisted of a site assessment team, a laboratory cross-functional group of more than 60 managers of various levels, financial process owners, and testing teams of approximately 20 lab staff members. The A-123 implementation team received a Turquoise President's Quality Award in FY06. IES

The corporate tax function **aggressively pursued tax credits** based on tax questionnaires completed by program managers and financial analysts to reduce Sandia's tax obligation. Over the past 12 years, Sandia has averaged a corporate tax rate of 3.11 percent. In FY07, the rate was 2.82 percent, representing a savings of \$6.5 million over the historic average despite state and local tax increases in FY05, FY06, and FY07. (10500) IES

Management

Sandia successfully **implemented the Assure, Assess, and Improve Process (AAIP)**, which is the contractor assurance system (CAS) portion of the Integrated Laboratory Management System (ILMS). AAIP completes the implementation of the model contract at Sandia. Implementation of the model contract has resulted in improved management performance and effectiveness, including cost savings/avoidances of \$177 million since beginning the implementation of the Model Contract in FY04. (9700)

A system that integrates several processes and tools to provide one web-enabled location for actions required to **plan, authorize, track, and report (PLATR) nuclear weapons work** was developed by the Nuclear Weapons Strategic Management Unit. PLATR facilitates the planning and management of all FY08 and future work falling within the SMU. The PLATR team delivered the core planning capability in May 2007, with subsequent functionality delivered throughout the summer. (200, 9500) NW

The Ethics Office **gave 275 guidances and investigated 55 cases** while improving its case closure rate, facilitating 100 percent Labs-wide completion of annual ethics training, and sponsoring Lockheed Martin Corporation investigator training. Corporate Investigations completed 16 cases, conducted 48 preliminary inquiries, and assumed responsibility for the Workplace Violence Program. Working to help shape the ethics culture at the Labs, the Ethics and Business Conduct Center conducted strategic planning studies that included focus groups from technical and administrative staff and management. (12400)

Corporate Internal Audit teamed with two statistical modeling experts from Sandia's Threat Analysis Technologies department to pilot the application of **advanced statistical modeling processes and technologies in internal auditing.** Together they explored the use of text mining, clustering, and predictive modeling technologies. The results of this initial effort were presented in competition with other best-practice nominees at the DOE contractor internal audit directors meeting, where it placed second. Corporate Internal Audit will refine the techniques during FY08 internal audits. (12800, 5600) IES

An effective contractor assurance system provides confidence in Sandia's ability to manage its own work, including the identification of root causes of problems. Akin to medicine, a correct diagnosis is essential to the successful resolution of a problem. A collaborative effort led to recognition of the economic value of a **corporate root cause analysis program**, which is being established. A strong program results in less time and lower costs in correcting problems to the satisfaction of DOE. (12800, 4100, 4200, 9700) IES

WFO/CRADA Agreements Dept. 9732 and WFO Financial Management Dept. 10513 teamed with the Sandia Business School (SBS) to develop a **suite of SBS courses related to Work for Others (WFO).** Sandia's WFO program increased 86 percent in the past five years and is now a major element of Sandia's overall budget, resulting in the need for more formalized training for WFO project managers and business support personnel. Course content includes WFO policies, processes, and procedures for WFO proposals, agreements, and projects, including financial management requirements. (9700, 10500)

Other

For the last 15 years, Sandia has sponsored **detailed public opinion polls on national security issues** such as deterrence, nuclear weapon policy, terrorism, and energy security. The long-term nature of the program permits trend and causal analysis. Results suggest that there is substantial, long-standing support for US nuclear weapon policy, especially deterrence. The data also reveal some interesting trends, such as increasing support for nuclear energy. Results support long-term planning and are available on the ITS SMG website. (303) ITS

How can Sandia's diverse expertise be best harnessed to solve wicked problems? This issue was examined experimentally by **comparing the effectiveness of individual versus group electronic brainstorming.** Findings indicated that individuals produced significantly ($p < 0.05$) better ideas than the group. Thus, although group participation is often touted as providing synergistic benefit, these results suggest that individuals may perform better in isolation. The results could impact future electronic interactions within Sandia to find solutions to very difficult problems. (12300, 1400, 6700) ST&E

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