Labs Accomplishments 2002

Sandia National Laboratories

Sandia LabNews

Special Issue February 2002

Sandia researcher Jeff Danneels was one of many Sandia experts who answered the nation's call to help assure the safety and security of the nation's critical infrastructures in the wake of the Sept. 11, 2001, terrorist attack on the US. Jeff's work helps municipalities assess the vulnerability of their water supplies. Inside, read about some of the notable accomplishments over the past year of Jeff and his 7,600 Sandia colleagues.

(Photo by Randy Montoya)

To all Sandians:

Each year we at Sandia National Laboratories take great pride in cataloguing significant accomplishments achieved during the past year by the men and women who make up this great laboratory. The past year, 2001, was extraordinary for the diversity and richness of the achievements and for the one day, September 11, that so deeply affected and changed our laboratory and our nation.

Sandia's staff have rapidly shifted gears to turn up the rate of progress in our national security work, suddenly rendered even more important by the instantaneous change in the free world's security situation that occurred that day. All across the Labs, individuals and teams have all made heroic efforts to extend our technology contributions to both better protect our troops and to help win the war against terrorism. The deep patriotism that inspires all of our laboratory's work took on monumental importance in the days following the terrorist attacks, and we are today operating at an unprecedented intensity in increasing the rate of development and deployment of our unique technologies.

C. PAUL ROBINSON

While the many hardware products we have delivered to the Afghanistan front give us special pride that we are fulfilling our highest goal **"to become the Laboratory that the nation turns to first for technology solutions to the problems that threaten peace and freedom,"** I am delighted with the richness of the many accomplishments, large and small, that we report this year. Sandia has achieved pioneering accomplishments in so many important areas of science and technology, from new software tools that revolutionize the design process, to software systems that vastly improve our financial management; and from creation of classified networks within Sandia to creation of the world's most powerful network that is now furthering the work of all of the NNSA labs. I invite you to judge for yourself: Have this year's accomplishments been the best ever in rendering *exceptional service to our nation?*

C. Paul Robinson
President and Director
Sandia National Laboratories

A Note to Readers

Shortly after the beginning of each calendar year the *Lab News* sums up Sandia National Laboratories' principal achievements during the previous fiscal year. This issue of Labs Accomplishments continues that tradition.

All Sandia divisions — from both the technical and administrative sides of the house — were invited to identify some of their key accomplishments from the period of Oct. 1, 2000, through Sept. 30, 2001. Submissions selected by the VPs' offices are presented on the following pages.

In reading through the accomplishments, you'll notice some numbers in parentheses at the end of each entry. Those represent the Sandia center (or centers) in which most of the work on a particular accomplishment was done. Also, you'll note that many of the technical accomplishments include a key contact name and e-mail address.

The work is presented here by category. We've found over time that this organizational approach is helpful, but it is important to recognize that such categorization, particularly in a multiprogram, multidisciplinary laboratory such as Sandia, is to some extent arbitrary. Much of the work listed in the category "Nuclear Weapons," for example, could very appropriately have been listed under "Computing," "Engineering Science," or any one of a number of other categories. And the converse is certainly true. Indeed, much of the work done across all the Labs' technical divisions supports Sandia's fundamental mission-related nuclear weapons work.

Nuclear weapons

The B83 Systems Engineering group has c**ompleted development of Alt 355 for the B83 Modern Strategic Bomb.** Alt 355 is a near-term field retrofit kit that incorporates design modifications to the present B83-0/1 Gas Transfer System (GTS) hardware. It is the first Alt to complete the stringent Phase 6.X process. Also, a series of field tests were conducted, in conjunction with Alt 355, using two B83 Transportation Environmental Sampling Units (TESU). Both TESU test units were equipped with a data acquisition system and used to collect vibration and shock data during a variety of transportation scenarios. The data were used to compare Stockpile-to-Target Sequence specified levels for these environments. The Stockpile-To-Target-Sequence specified environments were shown to govern and remain unchanged. (2200, 8400, 8700) Thomas Gaffney, tmgaffn@sandia.gov

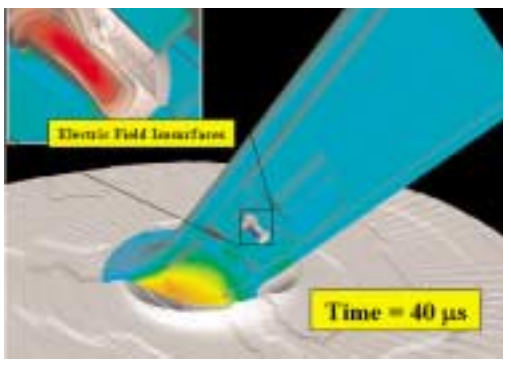
TRANSPORTATION Environment Sampling Units loaded on B-2A Rotary Launcher Assembly.

Lead zirconate-lead titanate (PZT) is a key ceramic used in the production of Neutron Generator power supplies. With the loss of all external suppliers, **we developed an in-house production-scale process to supply PZT.** Process development spanned the chemical synthesis of the PZT through powder fabrication processes resulting in a fired ceramic. Numerous technical and ES&H hurdles were overcome to scale-up the process from the laboratory size to 10 kg production quantities. MC3422 voltage bars made from the production-scale processes have met the stringent War Reserve specifications. (14100, 1800, 2500, 9200) Steve Lockwood, sjlockw@sandiagov

A simulation-based engineering approach that integrates research, numerical simulations, code validation experiments, wind tunnel data, and flight test data was used to quantify B61 spin rate losses due to vortex-fin interaction and to define optimal fin cant angle for B61-3,4,10 ALT354. TAOS spin rate predictions, confirmed in flight tests, showed that **the new fin cant angle produces improved spin rates** when used in conjunction with the existing spin motor. (2100, 9100, 15400) Carl Peterson, cwpeter@sandia.gov

B61 spin-rate test.

In support of the FY01 Acclerated Strategic Computing Initiative Normal Environment Level 1 Milestone, the ALEGRA code development team successfully completed **calculation of contact fuze electromechanical operation** during target impact at termination of flight for a W76 Reentry Body. This calculation showcased the Adaptive Mesh Refinement (AMR) and Arbitrary Lagrangian-Eulerian (ALE) capabilities of the ALEGRA code. (9200) Edward Boucheron, eabouch@sandia.gov



ALEGRA calculation of pressures and electric fields produced during RB impact and operation of contact fuze.

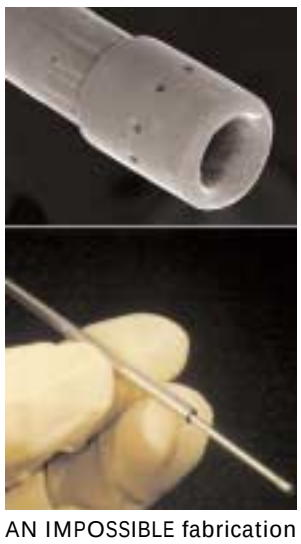
Code Management System (CMS) delivery provides **a significant security enhancement to weapon code operations** in Europe. The CMS project has completed a four-year full-scale engineering effort with its first full system delivery to its DoD customers. This system enables the recoding of nuclear weapons in a fully encrypted manner and greatly simplifies use and logistics issues for personnel. The complete system consists of 17 NNSA-qualified products, and several commercial computers. (1700, 2100, 2500, 2900, 5900, 6500, 12300, 14100) Doug Clark, jdclark@sandia.gov

We created **a highly detailed finite element model of the W76/Mk4 Reentry Body** (over 3 million degrees of freedom) using the ASCI code SALINAS. Model improvements have been made using data from validation experiments. Additional experiments provided insight into variability in dynamic response of these components. We have found that as-built differences in weapon components have a significant impact on dynamic response. The variability data enable statistical tests of model validation and may also affect derivation of component environmental requirements used for design certification. (9100, 2100) David Clauss dbclaus@sandia.gov

HIGH-FIDELITY dynamics model of MC2912.

The US Navy W76-0/Mk4 Joint Test Assembly (JTA) redesign achieved First Production Unit status last August, following a successful development flight test in February 2000. The redesign replaced sunset technology components in the existing 20-year-old JTA, which is used to test the continued conformance of a denuclearized version of the War Reserve (WR) warhead. The new JTA collects significantly more state-of-health and critical performance data from onboard the Reentry Body (RB), as part of the core surveillance program. (1700, 2100, 2500, 2900, 8400, 9100, 12300) Bill Tedeschi, wjtedes@sandia.gov

A seemingly impossible fabrication task often leads to enhanced creativity. The Advanced Systems Group 2254, located at Livermore, Calif., expressed the need for a small tube-assembly consisting of very intricate components. A team from center 14100 met the following challenges: **Design and fabricate a tube within a tube** (thin wall-thickness); create features of very high aspect ratios (diameter versus length); manufacture micro-size grooves and angled holes (alignment / assembly); assemble components to provide a high-pressure seal (assembly/welding). Lothar Biegs, lfbieg@sandia.gov



AN IMPOSSIBLE fabrication task? Not at Sandia.

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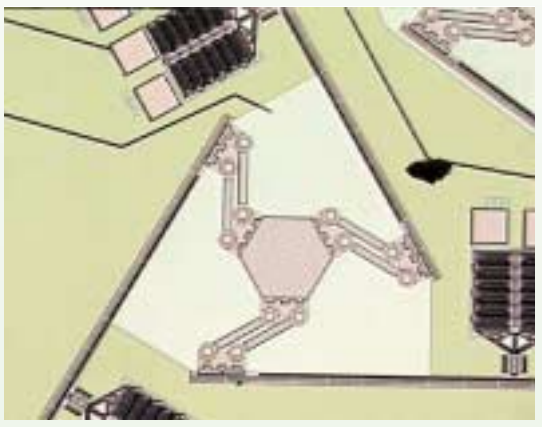
Electronics, robotics, and pulsed power

In December 2000, NASA launched the Sandia-developed Laser Dynamic Range Imager (LDRI) on the Space Shuttle Endeavor to assess the structural dynamics of the International Space Station (ISS). The 3-D LDRI images measured vibration of the ISS during thruster firing for validation of the ISS operational model and expected lifetime. **Sandia achieved major innovations in 3-D imaging technology to meet NASA flight requirements,** including a 5-lb weight and sub-centimeter resolution from a 30m standoff distance. NASA is considering the LDRI technology for future missions requirements in rendezvous and docking and proximity operations. (2600) Colin Smithpeter, csmithp@sandia.gov

The Sandia-developed robotic Weigh and Leak-Check System passed a final DOE review, moved a W80 pit in a laboratory at Pantex, and became fully operational for handling nuclear weapons pits. This event marked **the first time a pit had ever been lifted by something other than human hands.** Use of the automated system all but eliminates human exposure to radiation. Sandia designed, developed, installed, integrated, and tested the robotic system, including safety features necessary to operate safely and reliably. (15200) William Drotning, Drotning@sandia.gov

We completed engineering and modifications, shipped, and installed **one of the world's largest robot systems** for Lockheed Martin Aeronautics Company (LMAC) in Marietta, Ga., to implement robotic coating technology for the F-22 fighter weapon system. The Large Aircraft Robotic Painting System for F-22s was converted at Sandia for coating applications in hazardous environments and installed at LMAC. We also developed and tested advanced software algorithms that dramatically improved the motion performance of this 9-axis, 27-foot-tall, 35-ton robot. (15200) William Drotning, drotning@sandia.gov



MEMS XYZ translation only spatial positioner in SUMMiT-V™.

MEMS devices that "pop-out" of the fabrication plane and can be controlled to move along any arbitrary, three-dimensional path in space will enable a host of new products and technologies — particularly in electronic imaging and telecommunication systems. A variety of **microscopic parallel kinematic mechanisms have been designed and built using the SUMMiT-V™ process.** They take up 1-3mm^2 of chip area and can produce different types of motion, including XYZ translation, piston-tip-tilt, or spherical. Motion is controlled by three linear stepper motors (2-micron minimum step). (14100, 1700) Bernie Jokiel bjokie@sandia.gov

The Defense Ammunition Center has funded Sandia for two **robotic disassembly systems based on technologies developed under the DOE/DoD Memorandum of Understanding** program. The first system, which disassembles a projectile containing 36 mines, will be part of a new Munitions Demilitarization Cryofracture Facility under construction at the McAlester Army Ammunition Plant. The second system will disassemble 8-inch Rocket-Assisted Projectiles at the Blue Grass Army Depot. These systems will remove people from potentially fatal hazards that occur annually in a worldwide industry. Walter Wapman, wwapman@sandia.gov

The Z-Beamlet Laser (ZBL), one of the largest pulsed lasers in the world, is Sandia's most recent enhancement of the Z Machine, the most powerful electrical device on earth. ZBL provides scientists from around the world with **a state-of-the-art diagnostic tool to take X-ray pictures of matter under extreme conditions** of temperature and density. The $12.875 million project to construct ZBL was a multiyear collaborative effort between Sandia and Lawrence Livermore National Laboratory. (1600) John Porter, jlporte@sandia.gov

A **new Gamma Irradiation Facility (GIF), Bldg. 6586, opened in FY01.** Following separate pre-operational reviews by both Sandia and DOE, approximately 80,000 curies of Co-60 were safely transferred into an 80,400-gallon water tank at the facility in late January 2001. In March, DOE authorized the facility to begin operations. Subsequently, a variety of radiation-hardness testing has been performed on nuclear weapons components and on circuits for the International Space Station, space communication satellites, and military avionics. (6400) Donald T. Berry dtberry@sandia.gov

A Defense Threat Reduction Agency-funded project to investigate the use of high performance computing to design radiation-hardened DoD systems was successfully concluded. **A prototype web-based tool that a satellite designer could use to perform high-fidelity 3-D radiation transport analysis** was demonstrated. The tool showed how teraflop-class software and hardware could be used to decrease costly over-conservatism in design for nuclear survivability. (15300, 9200, 6400) Len Lorence, ljloren@sandia.gov

Nuclear weapons

(Continued from preceding page)

Sandia surveillance departments were key participants in the **NNSA Strategic Review of the Surveillance Program** (the 150-day study) and major contributors to the final report. This study will guide the future NNSA Surveillance program whose goals are to ensure that no defects in the stockpile go undetected, to uncover precursors of aging early to allow adequate time to implement corrective action, and to address other vital stockpile isses. The study and its recommendations have been accepted by DOE, and an implementation strategy has been developed. (2900) Bill Norris, wlnorri@sandia.gov

The B61-4 Type 3E Trainer is a system that the US Air Force will use to practice loading and handling operations. **The Warhead Simulator Package** is a key component of the Trainer, which simulates the electrical functionality of a real War Reserve weapon. The new trainer provides a significant improvement by allowing DoD personnel to realistically practice performing lock/unlock and prelaunch arming/safing operations without exposing a real nuclear weapon to vulnerabilities. The First Production Unit of the Trainer has been delivered. (2100, 2300) James Harrison, jamharr@sandia.gov

The B61-4 Type 3E training system.

The Weapons New Hire Orientation Program was developed to provide a basis for early career development in the presence of increased hiring. The program gives new technical hires in the weapons program **an unclassified basis of knowledge in Sandia's capabilities and missions**, engineering processes, emerging technologies, basics of the DoD/DOE relationship, and national security strategy. (2900) John Shaw, jdshaw@sandia.gov

Sandia's largest construction project, MESA (Microsystems Engineering and Sciences Applications), continues to move at a fast pace, completing preliminary design in FY01. Six reviews led the way for projected approval of the $400 million-plus baseline, authority to proceed to final design, and subproject construction in FY02. **The MESA complex is the heart of Sandia's investment** in microsystems research, development, and prototyping activities. (1900, 10003, 10505, 10800) Karen Higgins, klhiggi@sandia.gov

Sandia has developed **its first custom microprocessor architecture, the Sandia Secure Processor**. With emphasis on surety, the design is proceeding with the goal to apply mathematically provable methods for verifying flawless, secure operation. Synthesis of the current model has yielded a 50MHz design with 40,000 logic elements that is presently undergoing extensive testing. The processor is planned for fabrication in a rad-hard technology at Sandia's Microelectronics Development Laboratory. (2100, 1700, 5900) Greg Wickstrom, glwicks@sandia.gov

Work was completed to qualify the **B61-11 bomb as meeting all requirements, resulting in its acceptance as a "standard stockpile item"** for the nuclear deterrent force. In recognizing the efforts of the B61-11 certification team, CINCSTRAT cited the weapon's many advantages over the retired B53-1 bomb. Also, alterations (ALTs) have been made to enhance the safety and security of B61 bombs at field locations. B61 ALT335/339/354 Production Milestones were achieved this year with the shipment of kits to support all B61s deployed outside of the US. (2100, 2600, 2300, 1800, 9100) James Harrison, jamharr@sandia.gov

ARTIST'S RENDERING of MESA project.

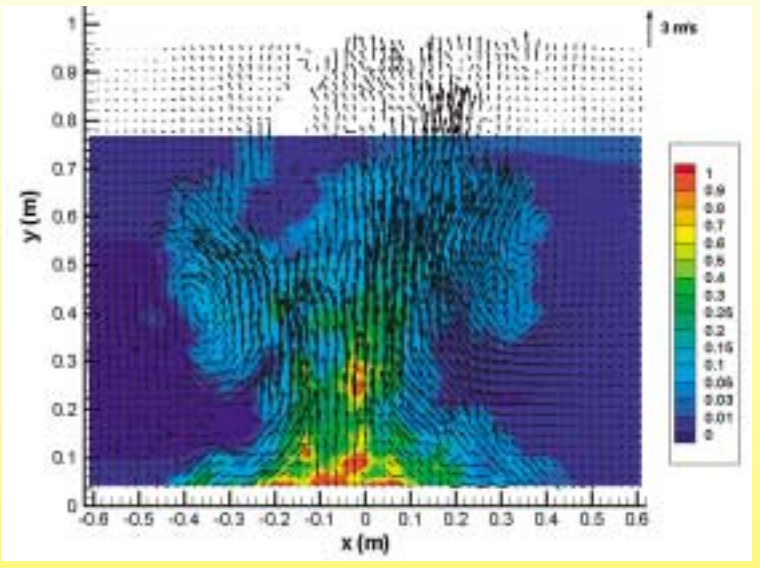
The EV-C (Escort Vehicle, Class C) development team established signed requirements with NNSA's Office of Transportation Safeguards. The development team competitively selected a manufacturer to work with Honeywell and delivered a working testbed vehicle. The team also **completed initial communications system integration and testing**, prototyped installation of all hardware and cables, and contracted for a pre-production unit to be delivered last December — all while reducing the overall end-to-end development cycle time by one-third. (5800) Jake Deuel, jkdeuel@sandia.gov

Emerging microsystem technologies are being explored to improve the nuclear weapon stockpile by enhancing existing systems and enabling new system architectures. **Sandia successfully built the first of a series of product vehicles** that will focus the maturation of war reserve-quality microsystem technologies and engineering methods. We demonstrated common hermetic packaging for mechanical, electrical, and optical microcomponents, precison alignment of optics and a SUMMiT‘ micromachine, die attach, wirebonding, multi-level electrical interconnects, and process integration of the above. (1700, 2300, 2600, 2900, 9100, 12300, 14000, 15300) Frank Peter, fjpeter@sandia.gov

(Continued on next page)

Engineering science, manufacturing and production

Laboratory-quality diagnostics, namely particle image velocimetry and planar laser induced fluorescence, were transitioned to a field-test facility and applied to obtain velocity and species concentration validation-quality data. **We made measurements in turbulent one-meter-diameter helium plumes** and methane and hydrogen fires. These unique data have been analyzed and applied for validation of an unsteady numerical simulation using the Large Eddy Simulation technique. These data continue to provide validation of transport models in the ASCI fire code, FUEGO, and to guide development of new models. (9100, 8300)



Overlay of helium velocity from particle image velocimetry and helium concentration from planar laser induced fluorescence (color contours from 100% helium to 100% air).

The Sierra reusable software framework, which provides the physics-independent and computer-dependent portions of several new ASCI analysis codes, passed two major milestones. The first milestone required developing an extensive list of technical capabilities and releasing Sierra to the ASCI sites. A formal review certified successful completion of this milestone, **calling Sierra "a unique simulation capability of unprecedented breadth and sophistication."** The second milestone occurred when Sandia released the first Sierra-based code, the Calore thermal analysis code. (8700, 8900, 9100, 9200, 9300, 9500) John Zepper, jdzeppe@sandia.gov

Sandia's Microelectronics Development Lab (MDL) delivered its first War Reserve (WR), Diamond Stamped Integrated Circuit (IC). WR represents the extreme level of quality needed for ICs used in nuclear weapons and other critical applications. This **demonstrates the ability of the MDL to be a backup production source for WR components.** Produced under the umbrella of the Manufacture Development Engineering program, the IC incorporates tens of thousands of submicron transistors on a single chip. Timothy Mirabal, mirabatj@sandia.gov

To meet significant increases in production delivery requirements in FY02, Center 14100 has used **Lean Manufacturing methodologies** on all three of the Neutron Generator Active Ceramics production lines. In rod production, where Lean has been fully deployed, we have cut cycle time by over 50 percent, labor costs are down 20-30 percent, and our manufacturing yield has increased from 94 percent to 96 percent. (14100, 12300) Steve Lockwood, sjlockw@sandia.gov

The Sandia Production Program, which is made up of Neutron Generator Production and the Concurrent Design and Manufacturing Program (CDM), achieved **100 percent delivery to negotiated schedule and DOE product acceptance on first time submittals for all products.** This is the first time in the Program's history this has been achieved. During the past year, The CDM Program was awarded a Defense Programs award of excellence. (1700, 2500, 2600,14000, 14100, 14400, 10200, 2900) John Sayre, jasayre@sandia.gov

Nuclear weapons

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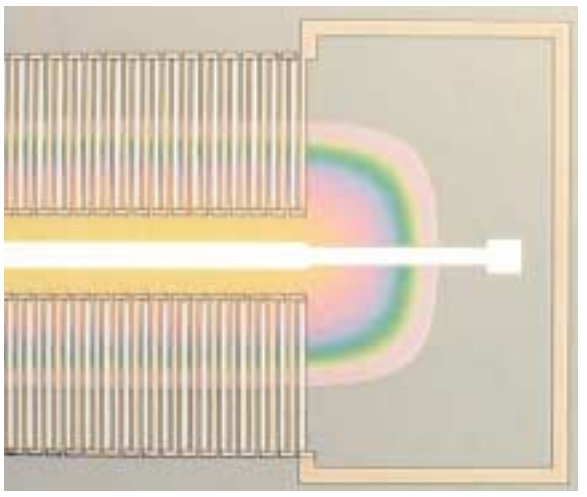
At the successful conclusion of a three-year testing and evaluation program a Major Assembly Release (MAR) authorized on Jan. 24, 2001, **the unconditional use of the Alt 342 W87 Life Extension Program (LEP) warhead** by the Air Force. The Nuclear Weapons Council has accepted the W87 LEP as a standard stockpile item. (8200) C. Martin Hinckley, cmhinck@sandia.gov.

LIGA metallic and polymeric microstructures were prototyped for first use as critical components in a positive valve indicator (PVI) in preparation for inaugural flight testing next year. The key element of the PVI is an actuator-microbridge-isolator assembly that indicates positive valve functioning via a loss of electrical continuity. This assembly was packaged into a precision-machined housing and successfully tested. The prototyping was accomplished by the LIGA microsystems team, and the design, packaging, and testing of the assembly were done by the CA weapon intern team. (8700) Craig Henderson, cchende@sandia.gov

Sandia has initiated a $100 million program to **restore its Directed Stockpile Work test capabilities** and to field qualification, weapon development, and model validation capabilities for the 21st century. NNSA/NA-11 approved the Justification of Mission Need in July and commissioned the development of the Conceptual Design Report that lays the foundation for the facility design efforts. The Test Capabilities Revitalization project team is well on its way to providing revitalized test facilities with leading-edge capabilities. (9100, 10800, 2100, 2200) Mike Valley, mtvalle@sandia.gov

Weaponeers should spend time innovating technology, not reviewing hundreds of nontechnical requirements and figuring out what to do next. Weapon Requirement Integration Dept. 9821 has partnered with Labs weapons experts to **synthesize requirements and create short simple processes** for new and refurbished weapons. The department also is leading a weapons complex-wide team to modernize Engineering Procedures into Technical Business Practices and add Infrastructure Business Practices for interface implementation details. (9800, 2100, 2200, 2300, 2600, 2900, 8400, 12300) Mark Dickinson, mddicki@sandia.gov

The DOE Weapons Complex standards

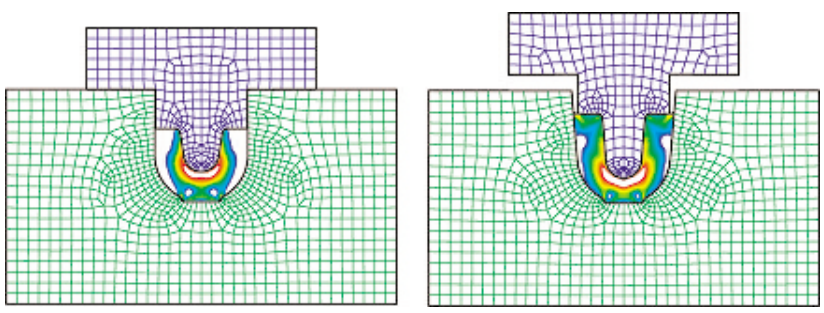


PHOTOMICROGRAPH of a fabricated thin-film multijunction thermal converter standard.

laboratories will benefit from improved accuracy — exceeding one part in a million — in ac voltage calibrations, as well as reduced calibration expenses, thanks to **microfabricated thin-film multijunction thermal converter standards** designed by the Primary Standards Laboratory and fabricated in the Compound Semiconductor Research Laboratory. Vacuum sealing by the MDL using non-evaporable getters welded to the package lid increases the sensitivity an order of magnitude beyond conventional thermal converters. (2500, 1700) Thomas Wunsch, tfwunsc@sandia.gov

Model Based Reliability An alysis (MBRA) uses a combination of simulation and reliability methods to provide both **qualitative and quantitative insights into reliability** for both existing weapons and new development hardware. In support of enhanced surveillance activities, the MBRA process was applied to the electrical system of the W80 warhead taking advantage of the CPlant™ distributed computer platform. The capabilities provided by MBRA can be applied to surveillance activities including design margin analysis, specification limits, lifetime predictions, and anomaly investigation. (12300) Tom Brown, tdbrown@sandia.gov

In January 2001 **Sandia responded to a US Air Force "Dull Sword,"** a low-level incident involving a nuclear weapon. The incident occurred when uncharacterized electrical energy surged through a Minuteman III missile weapon system in its silo. Sandians immediately responded with engineering support from several organizations. Deploying on site, the Sandians assisted in the evaluation and disposition of the warheads. There was no apparent damage to the warheads, and they have been safely transferred to DOE/NNSA custody awaiting further disassembly and inspection. Sandia continues to guide the warhead inspection effort. (2100, 2900, 12300) David Olson, drolson@sandia.gov



Tritium gas reservoirs are fabricated from stainless steel forgings, billets formed by a repeated heating, deforming, and quenching process. Analysts and materials scientists from the Materials & Engineering Sciences Center (8700) with CA Weapons Engineering Center (8200) design engineers developed a manufacturing process computer model that enabled them to optimize forging properties for a specific reservoir application. The team worked with product engineers at Honeywell FM&T and used the model to design tooling and process parameters for a forging to be produced at a commercial supplier. In illustration above, original (left) and redesigned forging models are depicted. The redesigned forging strength is more uniform. (8200, 8700) Mike Hardwick, mfhardw@sandia.gov

Since adopting **Lockheed Martin's Lean/Six Sigma project management approach**, Neutron Generator Production Center 14400 has seen: a 50 percent reduction in MC4277 neutron tube frame defects; a 66 percent reduction in piece part and fixture packaging time; a 33 percent reduction in neutron tube exhaust cycle time; and reduction in work in process and cycle times due to implementation of "pull." An operational goal of producing 80 neutron tubes per month for three consecutive months was achieved in October through December of 2001. Center 14400 intends to implement Lean/Six Sigma into all aspects of neutron generator operations and business practices. (14400) Ruben Muniz, rbmuniz@sandia.gov

Emerging threats

ARMY CHEMICAL ORDNANCE expert carries bomblet at end of "hot stick" toward Explosive Destruction System.

Sarin-filled bomblets discarded long ago were discovered in October 2000 at Rocky Mountain Arsenal near Denver. Sarin, a deadly nerve agent, posed a threat to nearby communities. **The US Army responded with a rapid deployment of the Sandia-developed Explosive Destruction System** (EDS), promptly moving an EDS unit from England where it was undergoing engineering development tests. During two campaigns at the arsenal, ten bomblets were opened explosively inside the EDS containment system, and the Sarin agent was chemically neutralized without incident. (8100, 15300, 8700) Al McDonald, amcdona@sandia.gov

Of the 26,000 people killed or maimed by landmines each year, 8,000 are children. Landmine detection using chemical sensing methods (e.g., dogs and electronic sensing technologies) is challenged by the ultra-low levels of explosive vapors emitted by buried devices. Sandia has combined laboratory testing and numerical simulation of the transport of chemical signatures emitted from landmines to **determine optimal conditions for locating buried landmines.** Sponsors have included the DARPA Dog Nose Program, the US Army, and the Geneva International Center for Humanitarian Demining. (6100, 2500) James Phelan, jmphela@sandia.gov

The successful launch of Target Test Vehicle 2 from Kauai Test Facility on Jan. 25, 2001, marked a major event in an effort aimed at presentation of **development test targets for Navy Theater Wide Missile Defense.** This launch of an Orbital Sciences rocket system involved the Navy, Army, Air Force, and their respective support contractors in addition to Sandia rocket and range personnel. An interceptor missile was launched from an Aegis cruiser to observe the target in a deliberate near-miss scenario. (15400) Richard Hay, rghay@sandia.gov

The Sandia Short-pulse Laser Group achieved revolutionary physics breakthroughs in understanding propagation of high-intensity femtosecond lasers. **The exceptional utility of femtosecond optical pulses originates from their short duration and wide coherent spectral bandwidth,** creating unique measurement opportunities in both the frequency and time domains. Experiments and modeling (sponsored in part by by LDRD funds) identified new enabling strategies for advanced directed-energy, communication, and remote-sensing technologies. High levels of interest are indicated by recent briefings to Vice President Cheney and Secretary of Defense Rumsfeld. (15300) Guillermo Loubriel, gmloubr@sandia.gov

SANDIA successfully tested a prototype vehicle portal that detects trace amounts of common explosives.

Detecting explosives in vehicles is a major concern at airports, military bases, government facilities, and border crossings. Department 5848 has developed and **successfully tested a prototype vehicle portal that detects trace amounts of common explosives.** The system uses Sandia-patented sample collection and preconcentrator technology. The Technical Support Working Group and DOE Office of Safeguards and Security funded this research. (5800) John Parmeter, jeparme@sandia.gov

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LANDMINE DETECTION DOG and handler demonstrate traditional land mine detection methods.

Launch of Target Test Vehicle-2 from Sandia's Kauai Test Facility, part of a Navy Theater-Wide Missile Defense system program.

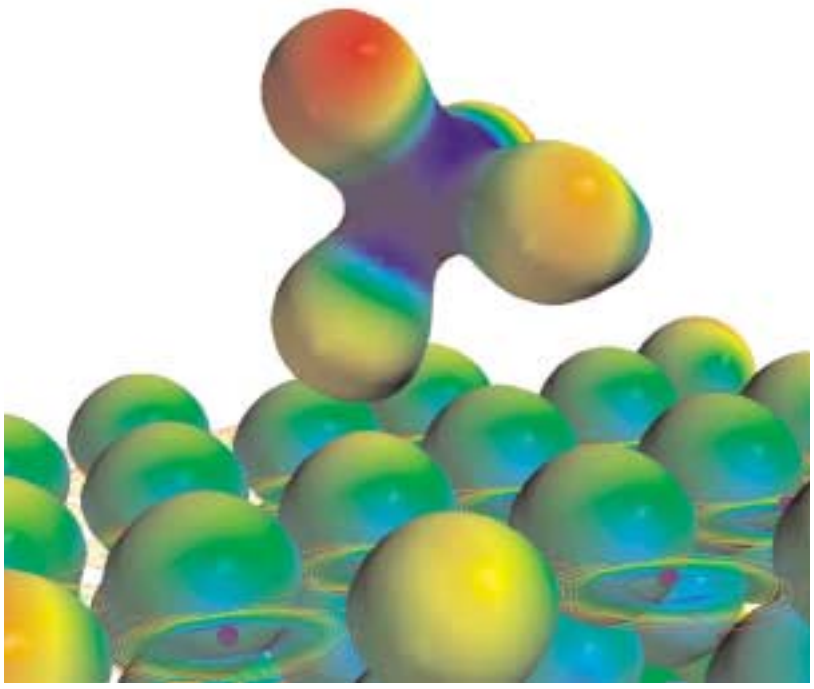
Energy and critical infrastructures

We have developed **state-of-the-art battery safety tests to evaluate batteries** destined for space (aboard NASA's Space Shuttle) and terrestrial applications (electric vehicles and hybrid electric vehicles). We have tested batteries from US and Japanese manufacturers at the request of NASA and DOE, measuring parameters of importance for the cells, and the response of cells to physical and electrical abuse. We have provided information that will help ensure that safe, reliable cells are used in these large-scale applications. (2500, 1800) Daniel Doughty, dhdough@sandia.gov

Sandia, in cooperation with the American Water Works Association Research Foundation and the Environmental Protection Agency (EPA), developed **a security risk assessment methodology for assessing the surety of water utilities.** This water infrastructure assessment tool has been employed to evaluate security and mitigate risks at several large municipal water utilities. EPA Administrator Christie Whitman highlighted and applauded Sandia's efforts in a nationally televised speech. Sandia was invited to testify about the program before two congressional committees. (5800, 6100, 6500), Jeffrey Danneels, jjdanne@sandia.gov

Complying with new Environmental Protection Agency arsenic drinking water standard of 10 ppb could cost affected rural water customers an additional $100 per month. Sandia is developing less costly alternatives through the application of nanotechnology. **Fundamental insights gained through molecular and surface complexation modeling** are guiding the design and synthesis of optimal Specific Anion Nanoengineered Sorbents, which outperform alternatives by at least a factor of six in real application conditions. (6100) Henry Westrich, hrwestr@sandia.gov

A Risk-Informed Proliferation Analysis methodology has been developed for quantifying the proliferation resistance of nuclear fuel cycles. The methodology uses **the tools of probability risk assessment to identify proliferation pathways** for various definitions of proliferators. The tool is being used to compare the proliferation risk of advanced nuclear fuel cycles with today's once-through nuclear fuel cycle. (6400, 5300) Gary Rochau, gerocha@sandia.gov



SIMULATION of arsenate anion sorption on metal oxide surface. Fundamental insights gained through such molecular and surface complexation modeling could help alleviate the high cost of meeting new arsenic standards.

Federal authorities used **decontamination formulation developed at Sandia to help rid Capitol Hill buildings of anthrax.** Members of the Chemical and Catalysis Technologies Department helped license this decontamination foam to two companies. This year, the team helped develop this licensed product to address the national security need for an anthrax decontaminant. This department was consulted for the foam's possible uses, and consequently helped develop a stronger formula (for more robust threats like anthrax contamination). (6200)

RAMPART — the Risk Assessment Method-Property Analysis and Ranking Tool — represents **a new type of computer application for the screening-level assessment of risk to federal buildings.** RAMPART was developed for the General Services Administration. Users enter basic data and RAMPART evaluates and allocates the risk arising from earthquake, tornado, flood, winter storm, hurricane, crime, and terrorism. The consequences considered are death, injury, loss of mission capability, loss of property, loss of contents, loss of use of property, and first-responder risk. Results are presented graphically. (6800, 5800) Regina Hunter, rlhunte@sandia.gov

Sandia researchers have developed **a novel method for producing catalyzed complex hydrides to store hydrogen.** The starting materials are simply aluminum and sodium hydride powders. When mixed with a titanium catalyst precursor, the resulting material forms a sintered powder that is capable of storing a record 4 percent to 5 percent hydrogen by weight. Hydrogen gas can be desorbed (at 1 atmosphere) in less than 1 hour at 125° C. This work represents a major breakthrough in the search for a light-weight, low-temperature, and low-pressure means of storing hydrogen for fuel cell automobile applications. (8700, 8300) Karl Gross, kjgross@sandia.gov

Scientists at the Combustion Research Facility and the University of Nevada have made **the first measurements of the direction in which molecules rotate after a collision.** These measurements are of

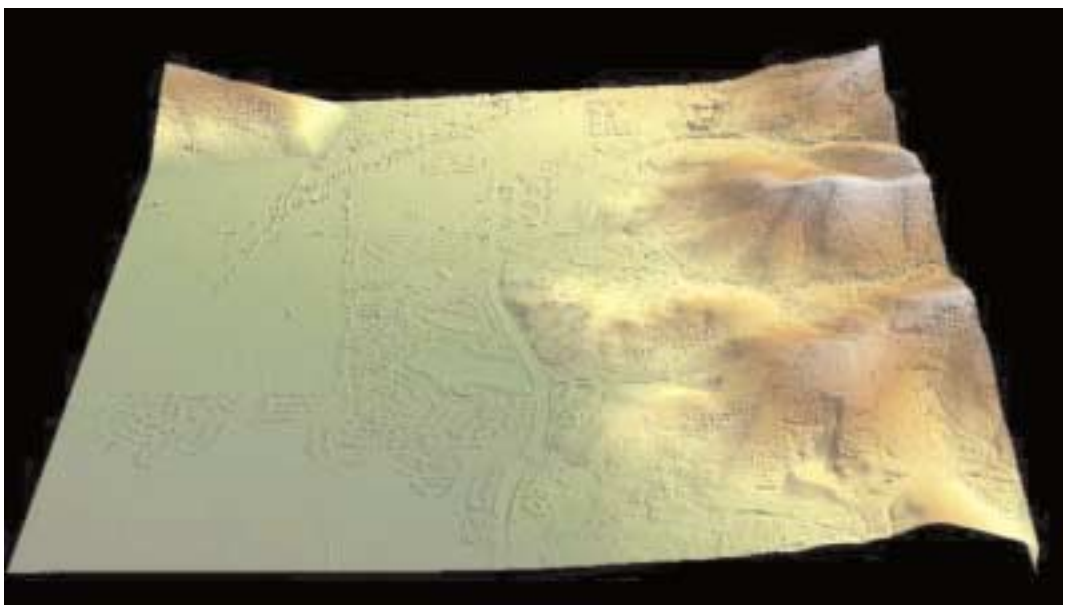
(Continued on page 8)

Emerging threats

(Continued from preceding page)

The Sandia targets team continued to provide **successful target objects for the Ground-Based Midcourse Segment of the Ballistic Missile Defense System.** A Sandia target reentry vehicle was successfully intercepted over the Pacific Ocean on July 14, 2001. In addition to the reentry vehicle, the target object suite included a new balloon decoy designed and developed by the Sandia team. All Sandia-provided objects and support equipment performed as expected. All data from the target reentry vehicle was retrieved and provided the required insights into the performance of the missile defense system elements participating in the test. (2300, 2600, 15400) Eric Reece, ewreece@sandia.gov

Sandia produced radar maps with unprecedented fidelity for the site of the 2002 Winter Olympics in Park City, Utah; Washington D.C.; Fort Bragg, N.C.; and South Korea. These 3-dimensional maps are generated in real time by an interferometric synthetic aperture radar on a DHC-7 turboprop airplane as part of a program sponsored by the Joint Precision Strike Demonstration Project Office of the US Army. Customers for these maps include the DoD, Federal Emergency Management Agency, and law enforcement agencies. (2300, 5900) Brett Remund, blremun@sandia.gov

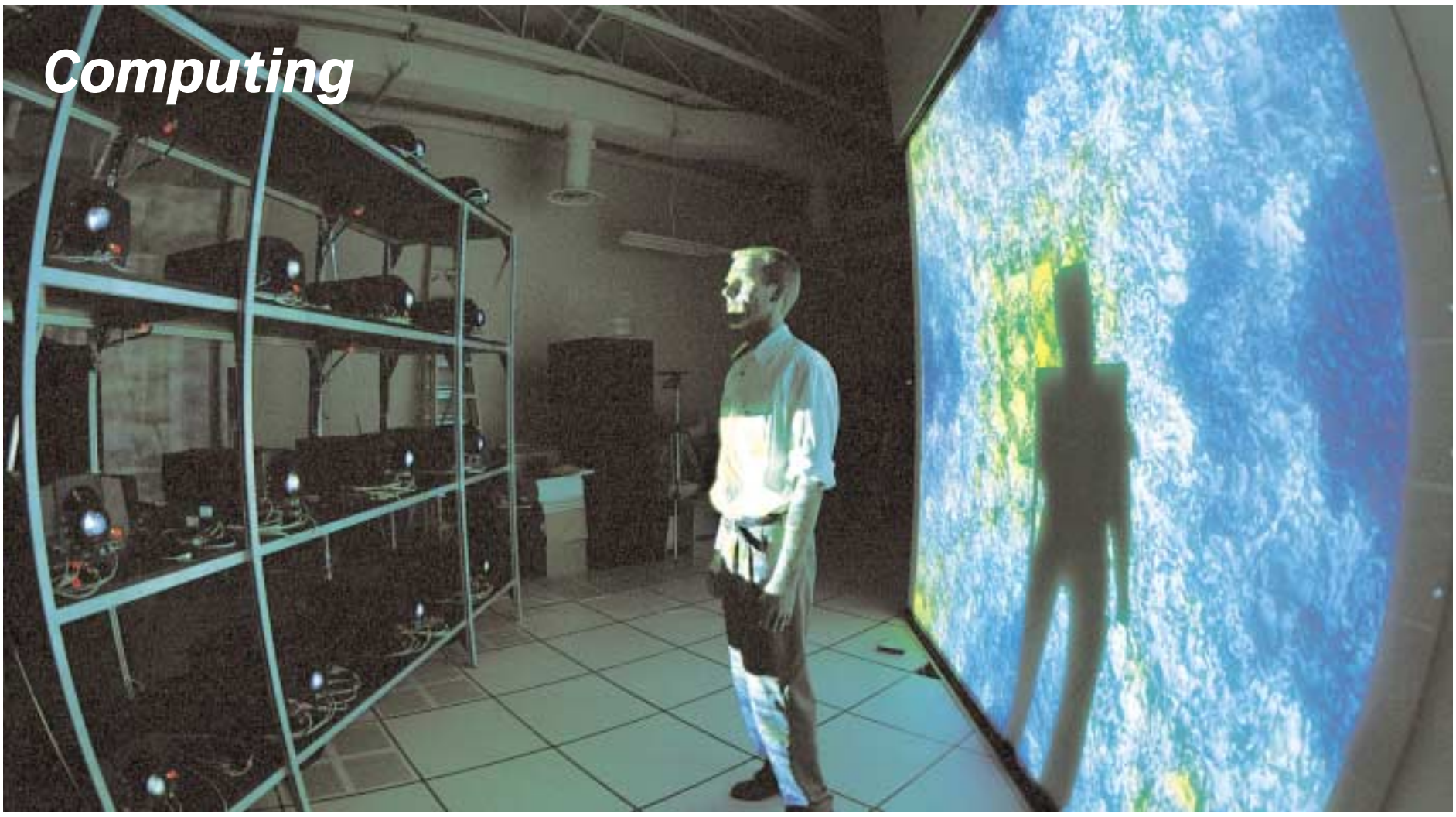


RADAR MAP of Park City, Utah, and environs — of unprecedented fidelity — produced by Sandia.

Recent events have propelled hard and deeply buried target (HDBT) defeat to the forefront of national security challenges. Detailed functional characterization of subsurface structures is essential for effective attack, but is a formidable challenge. With funding from DARPA, Sandia has combined expertise in advanced sensors, geophysical modeling, and signal processing to develop a prototype integrated model that uses passive seismic, acoustic, and electromagnetic signals for HDBT characterization. The model combines site-specific geological information and sophisticated finite-difference modeling tools to predict machinery and other HDBT-specific signatures observable at the earth's surface. (6100, 15300) Marianne Walck, mcwalck@sandia.gov

The Selective Availability Anti-Spoofing Module provides the next-generation cryptography and enhanced security for the Precise Positioning Service used by all military GPS users. Sandia has delivered the NSA-approved secure Key Data Processor (KDP) design and operational software that implements the cryptographic and selective availability algorithms that provide the anti-spoofing module's capabilities, including support for black key and Over-The-Air-Rekey operations. **The module significantly advances military GPS capabilities** and security for the NAVSTAR Global Positioning System (GPS) Joint Program Office. (1700, 2300, 2600, 6500, 12300) Debby Jensen Kill, dljense@sandia.gov

Computing



VIEWS, the Visual Interactive Environment for Weapons Simulations, displays ultra-high-resolution results of high-performance computing simulations. (Photo by Randy Montoya)

The Accelerated Strategic Computing Intiative Visual Interactive Environment for Weapons Simulations (VIEWS) team designed and built the world's highest-performance scientific-visualization facility — the Bldg. 880 VIEWS Corridor. The facility has demonstrated **rendering performance and display resolution far beyond any commercially available graphics-display combination**. This capability is uniquely targeted toward visualization of terascale results of high-performance computing simulations supporting nuclear weapons engineering. Also, research into optimal meeting and review environments has resulted in an under-table projected display with high-resolution, high-brightness projectors, coupled to a high-end Sony HDTV camera to provide real-time motion image capture from a Zeiss Stemi microscope. (9200, 14100) Philip Heermann, pdheerm@sandia.gov

IDSL (Intrusion Detection System Laboratory) handles production network intrusion detection for the California site and provides a laboratory for intrusion detection and network countermeasures research. The IDSL team is credited with **capturing and identifying a number of Internet attacks** this year including the CodeRed worm. (8900) Barry Hess, hess@sandia.gov

Efficiently storing and moving hundreds of terabytes of information across networks through standard protocols remains a key challenge of the DOE/NNSA Accelerated Strategic Computing Initiative. This capability was the focus of demonstrations by more than a dozen collaborating businesses and government research laboratories at the Supercomputing 2001 annual meeting. The demonstration showed that the next generation network and storage technology would allow researchers at national laboratories to remotely share complex 3-D rendering of massively complex calculations that pertain to the maintenance of US nuclear weapons. (8900) Helen Chen, hycsw@sandia.gov

The Zoltan library of data services was released on the external web (http://www.cs.sandia.gov/Zoltan) in January, providing a model for Sandia's open-source software distribution. Zoltan provides data services for parallel, dynamic, adaptive applications services, including parallel repartitioning, distributed directories, unstructured communication, and memory management. **Zoltan's web-based release was a groundbreaking effort**, increasing Sandia's visibility to funding agencies and the greater scientific community. (9200, 1300, 11700) Karen Devine, kddevin@sandia.gov

(Continued on next page)

Materials, physics, and chemistry

Conjugated polymers have long been competitive materials for light-emitting diodes. Unfortunately, the polymer chains are inherently disordered and are not robust. Thus, before they find widespread use in opto-electronics, they must be prepared in ways that organize and stabilize the chains. We have solved that technical challenge by s**elf-assembling the organic monomers in a highly-ordered silica matrix and polymerizing them in place.** In fact, the polymers within this protective, hard scaffold exhibit unique optical properties not observed in the bulk material. (1100, 1800). Alan Burns, aburns@sandia.gov

We have improved the power output of our near-ultraviolet light-emitting diodes (LEDs) by a factor of 15. This dramatic improvement was accomplished in two different ways: first, by developments in the growth of the GaN nucleation layer that greatly reduced defect density; second, using a Sandia-invented low dislocation substrate technique — Cantilever Epitaxy. This is a significant step toward our **goal of improving the efficiency and cost of LEDs enough that they can replace existing lighting.** (1100, 6200) Robert Biefeld, rmbiefe@sandia.gov

Understanding how water molecules interact with solid surfaces will **answer many questions in environmental chemistry, biology, corrosion, and flow physics.** Recent theoretical work (published in *Science*) has shown that the first layer of water molecules on the metal ruthenium surface does not form the believed "ice-like" structure. Instead, some water molecules dissociate to spontaneously create an intricate layer consisting of molecules and fragments. This surprisingly complex structure is the template that determines how subsequent water layers are arranged and consequently controls the interfacial chemistry. (1100) Neal Shinn, ndshinn@sandia.gov

The Z accelerator was used to obtain the first isentropic compression equation-of-state (EOS) data to 2 Mbar on stockpile materials. This novel capability **enables critical validation of ASCI code simulations of weapon performance** and allows magnetic launching of precision flyer plates to velocities three times faster than conventional techniques. This technique has been used to obtain the first highly accurate EOS data on liquid deuterium to 700 kbar for evaluating quantum mechanical theories of hydrogen. (1600) Marcus Knudson, mdknuds@sandia.gov

Lightweight and high-strength alloys have great importance in the automotive and aerospace industries due to their strength both at low and high temperatures. **A breakthrough in the scientific understanding of technologically vital alloys** has been achieved. This new understanding of this important alloy could have great impact in the heat treatment of aluminum engine blocks and the optimization of the processing of half a billion pounds of aluminum each year. (8700) Bob Hwang, rqhwang@sandia.gov

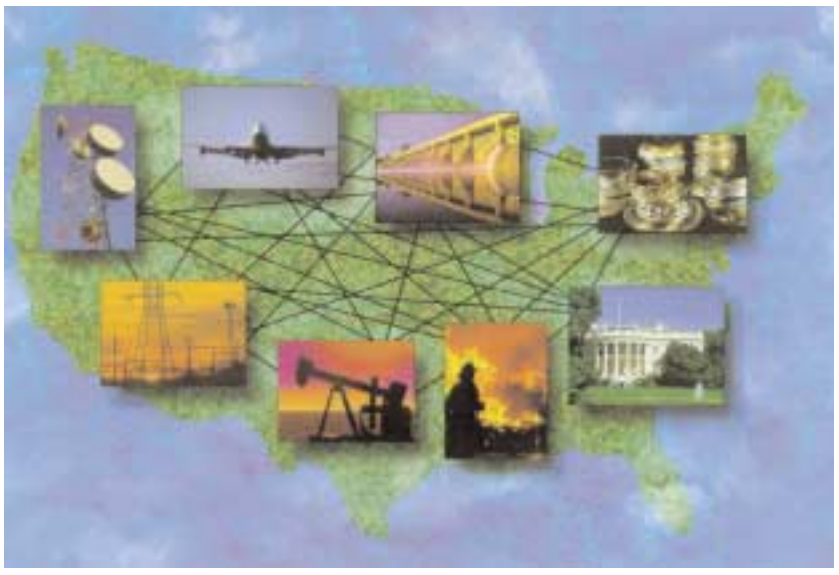
Development work demonstrated the viability of the active braze alloy "Nicoro+2%Ti" (62wt.%Cu-35Au-1Ni-2Ti) for use in a major subassembly of the MC4300 neutron tube. **The alloy exhibits good wetting of alumina ceramic surfaces and the ability to make strong, hermetic metal/ ceramic braze joints.** An evaluation build this year will use the alloy as baseline in the tube's header subsassembly. The Nicoro+2%Ti alloy was developed during FY98 as part of a Research Foundation (RF) brazing project, in cooperation with WESGO Metals, Inc. (1800, 14100, 14400, 2500) John Stephens, jjsteph@sandia.gov

The Aircraft Composite Inspection and Reference Standards Team produced an optimum set of composite reference standards to allow for accurate damage assessment and post-repair inspection of all composite aircraft structures. The team's work will **simplify the process of evaluating the severity of damage to composite aircraft structures** and more accurately determine the necessary repairs. The results of this effort were formally documented in industry-recognized Aerospace Recommended Practices and are being adopted into Boeing and Airbus maintenance manuals. Sandia's Airworthiness Assurance Center participated in this effort by leading an Inspection Task Group within the international Commercial Aircraft Composite Repair Committee. (6200) Dennis Roach, dproach@sandia.gov

Energy and critical infrastructure

(Continued from page 6)

basic scientific importance because a diatomic molecule struck by an atom recoils from the collision spinning, and that energy transfer process is fundamental to how gasses heat up, cool down, and come to equilibrium. **Experiments demonstrated the "preferred sense of rotation"** of NO molecules recoiling from collisions with argon atoms. Not only is there a preferred sense of rotation, but that sense depends on the rotational state of the diatomic molecule and the angle at which the molecule scatters. For example, at a scattering angle of 45 degrees, 80 percent of the molecules are spinning clockwise. At 60 degrees, they might prefer to spin counterclockwise. (8300) Dave Chandler, chand@sandia.gov



THE NEW NATIONAL Infrastructure Simulation and Analysis Center will analyze interdependencies of the nation's infrastructures.

A unique electronic "sniffer" has been developed that can provide **real-time in situ monitoring of volatile organic contaminants in air, soil, and water.** A small waterproof package houses an array of chemiresistors that can instantaneously detect a large variety of volatile organic compounds. The sensor can be deployed directly in underground wells or water resources, and data are transmitted to a computer for remote monitoring. This system could save millions of dollars at sites that currently rely on traditional manual sampling methods and off-site laboratory analysis. (6100, 1700) Cliff Ho, ckho@sandia.gov

UNIQUE "sniffer" monitors volatile organic compounds in real time.

Sandia, in partnership with Los Alamos National Laboratory, established the Congressionally-chartered **National Infrastructure Simulation and Analysis Center (NISAC).** NISAC will provide the most advanced modeling and simulation capabilities and expertise for the analysis of the nation's critical infrastructures, their interdependencies, vulnerabilities, and system complexities. This will lead to optimized mitigation strategies and reconstruction planning and real time crisis support and will allow the nation's leaders, policy makers, and infrastructure owners to proactively protect the infrastructures. (6500) Jennifer Nelson, jenelso@sandia.gov

Collaborative experiments of Sandia's Alternate Fuels Optical Engine Laboratory with Lawrence Livermore National Lab have shown that **isotope tracing with accelerator mass spectrometry (AMS) can help us understand how oxygenates affect soot formation in diesel engines.** The addition of oxygenates to diesel fuel can reduce particulate emissions, but the underlying reasons for the reductions are not understood. Dibutyl maleate, labeled at the carbonyl carbons, was burned in a modified 350-hp Caterpillar engine, soot was collected on filters, and the carbon-14 content of the soot measured by AMS. The almost complete lack of carbon-14 in the particulate matter suggests that the carbon-oxygen bond does not break during combustion. (8000) Bob Carling, rwcarli@sandia.gov

Sandia has worked with The Timken Company to develop a sensor to **optimize combustion and energy utilization in electric arc furnaces** by the real-time measurement of CO and CO_2 concentrations in off-gases. The tunable-laser-based prototype sensor has been successfully tested in field trials and is now installed for long-term tests in their Canton, Ohio, facility. Around-the-clock measurements are handled under remote control from the Combustion Research Facility. (8000)

The photovoltaic inverter test lab was expanded into the **Distributed Energy Technologies Laboratory** to address distributed generation issues of utilities, manufacturers, and end-users. Fossil and renewable energy generation and information technology are combined, with testing capability for electric grid-tied applications as well as Supervisory Control and Data Acquisition of remote generation. These capabilities have already resulted in a utility CRADA, and negotiations for a second with another utility. (6200) John Boyes, jdboyes@sandia.gov

MICROTURBINES like those at the right could be part of a distributed energy network.

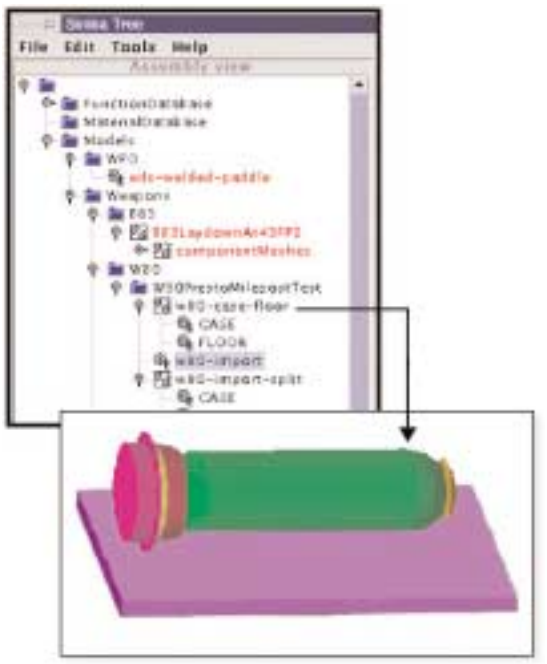
Computing

(Continued from preceding page)

Sandia's Cplant™ cluster now ranks 30th on the Top500 list of the world's most powerful computers and is the w**orld's largest and most productive self-made supercomputer.** Its four distinct modes of operation — open, development, restricted, and classified — enable university collaboration and advanced software testing, as well as unclassified and classified scientific computations. Each operational mode has a dedicated cluster of up to 256 nodes, which is expandable to 1,792 nodes on demand. The entire runtime software, released as open source, has been downloaded more than 1,000 times. (9200, 9300) Neil Pundit, ndpundi@sandia.gov

Software development within the CIO organization now uses processes assessed as meeting CMM level 2 criteria. CMM, the Capability Maturity Model developed by Carnegie Mellon University's Software Engineering Institute, is a standard that provides a framework in which software processes are developed and documented. The processes and resulting work products are described in the Software Information Life Cycle, an internal web document found at http://www-irn.sandia.gov/silc/. (9500) Paul Merillat, pdmeril@sandia.gov

The Simulation Enabled Product Realization Program (9900) completed the first year piloting a "Program Alignment" process with the NWSBU. The process engaged line management throughout the weapon engineering community with leaders in modeling and simulation capability development. The most critical needs of the Stockpile Lifetime Extension Programs and other weapon support activities were identified and resources adjusted to meet the needs. A major result of the alignment process is better alignment of the ASCI milestones with weapon needs. (2100, 8200,8900, 9100, 9200, 9300, 9900) Martha Ernest mjernes@sandia.gov



SIMBA workspace with simplified W80 model.

SIMBA (SImulation Manager and Builder for Analysts) is software that helps engineering analysts build complex hierarchical models for finite element simulations. A model of a weapons system is traditionally built by scaling, repositioning, reorienting, renumbering, and joining component and subsystem models. **SIMBA records and manages the details of this process, allowing quick visualization at every step.** The software can also diagnose and help correct problems that occur during model building. (8900) Paul Nielan, pen@sandia.gov

Hacking cyberspace is an international pastime and Sandia is always an attractive target. Over the past year, significant hardening of the open network was accomplished. The goal was to make the open network and the telephone system as inaccessible to outsiders as the internal network, but facilitate an open, collaborative environment. **World-class anti-virus software, a telephone firewall,** restructuring to a default deny-and-specific-permit strategy, and aggressive instrumentation of network traffic significantly reduced our vulnerability. (9300, 8900) Mike Cahoon, RMC@sandia.gov

Virtual Private Networking (VPN) extends the ability of Sandia's engineers, scientists, and administrators to do mission work while off-site. We created a technical and support infrastructure for Sandians to use specially configured government-owned computers for VPN connections to the Sandia Restricted Network. With broadband Internet access, **VPN allows working essentially the same as through an on-site connection.** The project was accelerated after Sept. 11 in case of further site closures. (9300, 9600, 8900) Charles Shirley, cshirle@sandia.gov

The Accelerated Strategic Computing Initiative (ASCI)/Distance and Distributed Computing (DisCom) Project successfully completed "with flying colors" ASCI's first tri-lab milepost. The Distributed Resource Management (DRM) project played a major role by developing and deploying the ASCI Grid. **The ASCI Grid is the world's largest computational grid with the most processors (24,548) and highest compute capability (~19 TeraOps).** Grid services enable both local and remote users to effectively use various ASCI resources from their desktops. For more information see: gridservices@sandia.gov. (6500, 9200, 9300) Kathie Hiebert-Dodd, klhiebe@sandia.gov

Nonproliferation programs and arms control technologies

The Nuclear Detonation (NUDET) Detection System (NDS) Analysis Package (NAP) developed a new space-to-ground communication path for data associated with the assessment, health, configuration, and performance of next-generation NDS sensors flown aboard DoD's GPS constellation of satellites. **The ground segment is a unique, autonomous earth station** capable of tracking multiple NAP-equipped

ANTENNA FARM, part of new space-to-ground communication path for NUDET detection system.

satellites simultaneously and capturing telemetry data. The January 2001 launch of a NAP-equipped GPS satellite significantly enhanced the nation's ability to perform space-based nuclear weapons treaty monitoring. (6500, 5700, 2300, 2600) Eunice Young, eryoung@sandia.gov

We demonstrated plume detection of chemical warfare simulants at the Nevada Test Site using the µChemLab™ chemical detector. The µChemLab hardware was installed in an instrument trailer and operational within 15 minutes of arrival at the site. A barrel of triethyl phosphate was exploded, releasing a plume that traveled downwind over the sensor position. Automated analyses at three-minute intervals detected the passage of the simulant plume at sub-ppb concentration levels. The same system has also detected actual chemical warfare agents in indoor tests. (1700, 8100) Steve Martin, sjmarti@sandia.gov

Sandia's Second Line of Defense (SLD) Program has successfully initiated strategies and processes to rapidly provide integrated, sustainable systems to **minimize the risk of nuclear proliferation and terrorism.** In Russia, 26 site surveys were performed at Russian airports, seaports, railroad checkpoints, and border crossings. These site surveys included the deployment and acceptance of SLD systems installed at eight Russian Federation State Customs Committee facilities to detect and deter the illicit movement of nuclear materials out of Russia. The program has been successful and is growing to include other key countries. (5300) Michael Garcia, mrgarcia@sandia.gov

MONITORING rail movement in Russia as part of the second Line of Defense program.

Assessment of human exposure to bioweapons currently relies on pathogen replication or host responses using tests that can take from days to weeks. A collaborative DARPA-funded project between Sandia and the University of New Mexico Department of Pathology is **developing methods to rapidly detect the onset of infection.** Infrared data combined with sophisticated analysis tools are being used to quickly delineate cells presenting an infection-like response from healthy cells. (1800) M. Kathleen Alam, mkalam@sandia.gov

Researchers at the Explosive Components Facility have developed **a field-portable test kit that will provide law enforcement agencies with immediate confirmation of recent gun use** and assist in rapidly focusing on key suspects. The technology has been funded and licensed by Law Enforcement Technologies, a privately held New Mexico corporation that specializes in development of technologies for law enforcement, corrections, private security, and military markets. The technology is patent pending. (2500) Susan Bender, sfbende@sandia.gov

Sandia once again hosted Operation America, an **advanced training for Bomb Squad personnel throughout the US.** This opportunity for advanced technology transfer was conducted in Warrenton, Ore., last March. Participants joined in technical classroom sessions, live range demonstrations, and specific technical tactical scenarios. Operation America is funded by the National Institute of Justice and is conducted by Chris Cherry and his team. (5900) Patricia Gingrich, psgingr@sandia.gov

The Advanced Atmospheric Research Equipment (AARE) program completed its Preliminary Design Review. AARE will provide **a suite of modernized, computer-controlled gas- and particulate-sampling subsystems** to the Air Force with an Initial Operational Capability date of October 2003. AARE will provide a unique capability to do treaty monitoring and sampling against worldwide nuclear testing activities. (2900, 5700, 5900, 6200, 6500, 9100, 14400, 15300) Walter Caldwell, wfcaldw@sandia.gov)

The ability of an imaging radar to "see" underneath trees and foliage has remained an unsolved problem for many years. This year **the first successful creation of a high-resolution 3-D tomographic SAR (synthetic aperture radar) image** that achieves foliage penetration was developed at Sandia. The airborne radar system used to collect the data for this special processing is the Twin Otter SAR built and operated by Center 2300. (5900) Charles Jakowatz, cvjakow@sandia.gov

A multi-center Sandia team fabricated **a unique event-driven 3-D sensor assembly for satellite applications.** The assembly contains an optical sensor front end, signal-processing electronics, and custom processors to hunt out signals of interest in high-false-alarm environments. In a volume of approximately 1.5 cubic inches, this assembly is capable of ultra high frame-rate sensing (more than 80,000 frames per second) with signal processing at the equivalent speed of over a gigabit per second of raw data, a level of performance never before approached in a package near this volume. (1700, 5700, 14100) Anthony Medina, ajmedin@sandia.gov

The Multispectral Thermal Imager satellite (MTI) is a Sandia-led, multilaboratory R&D project sponsored by NNSA's Defense Nuclear Nonproliferation Office. MTI has been on orbit for 18 months and has gathered more than 3,200 multispectral and thermal image sets. As of the end of FY01, MTI had e**xceeded its operational life requirement of one year and was halfway through its operational goal of three years.** MTI has demonstrated the capability to measure absolute water temperatures from space to better that 2 degrees Kelvin and relative water temperature measurements better than hundredths of degree Kelvin. (2600, 5800, 5700) Anthony Medina, ajmedin@sandia.gov

The DOE AURA (Advanced UV Remote-Sensing Applications) program completed the second of three major field test deployments to Dugway Proving Ground, Utah. For this test the AURA payload, an advanced ultraviolet laser-induced fluorescence lidar, was installed in an environmentally controlled container and configured to operate from a fixed ground location. The payload was **tested against a broad range of weapons of mass destruction scenarios** and in many cases the demonstrated system performance far exceeded the original design goals. (1100, 2300, 5700, 6100, 8100, 8300, 8400, 8900) Anthony Medina, ajmedin@sandia.gov

Culminating four years of collaboration with the All Russian Institute of Experimental Physics (VNIIEF), we conducted a virtual ribbon-cutting of the Facility-to-Facility project on June 14, 2001. The goal of this project is to evaluate advanced fissile material monitoring and communications technologies in a

US LAW ENFORCEMENT attendees at Operation America learn bomb-disablement technologies.

bilateral regime. Two facilities, one at Savannah River Site and one at VNIIEF, are placing fissile material into a simulated bilateral monitoring regime. The results of this project will provide critical insight into the potential role of advanced monitoring and communications technologies for improved security and control of materials in the US and Russia. (5300) Tom Lockner, trlockn@sandia.gov

The Cooperative Monitoring Center worked with retired military officials from India and Pakistan to develop concepts for cooperation along their contentious border. Maj. Gen. Mahmud Durrani of Pakistan has proposed **specific ground-based border monitoring systems to be deployed cooperatively between India and Pakistan.** Air Marshals M. A. Chaudhry of Pakistan and K.C. Cariappa of India worked with the Center to develop plans for cooperative aerial overflights along the India-Pakistan border. Both efforts seek to reduce border tensions between these nuclear weapon-capable states. (5300) Kent Biringer, klbirin@sandia.gov

PROTECTing subways from chemical warfare (CW) agent attacks: The PROTECT program, funded by DOE and the Justice Department, has collaborated with the Washington Metropolitan Area Transit Authority to **demonstrate a system for continuous CW-agent monitoring.** For more than a year, a chemical detector testbed, consisting of several net-worked state-of-the-art commercial sensors, has been operated in the subway. The system provides timely agent detection, and transmits measured agent concentrations to an emergency management information system being developed by our collaborators at Argonne National Laboratory. (8100, 8900, 1700, 1800) Susanna Gordon, spgordo@sandia.gov

In a team effort with the Washington Institute, Sandia has examined and analyzed approaches to the **defense of cities against biological attack.** This work was aimed at exploring alternate defensive architectures, including both protection and medical response measures coupled with detection and information coordination elements. An approach to analysis using Master Timeline Curves was developed to integrate biological agent, physical, and medical phenomena in bioterrorist attacks.Results are being used to guide technology development and policy implementation strategies. (8100) Patricia Falcone, pkfalco@sandia.gov

WARHEAD monitoring test uses empty Russian weapon cases.

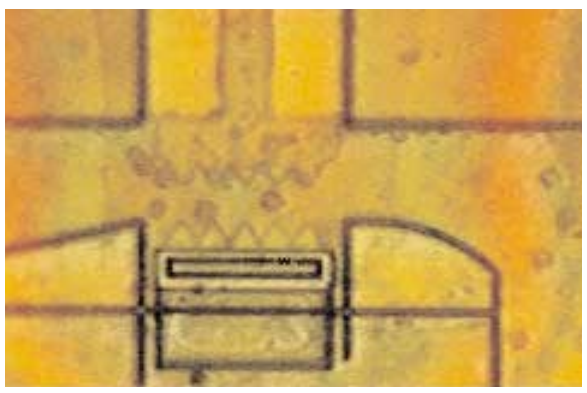
Under the sponsorship for the Defense Threat Reduction Agency, **we have developed a new relationship with the Russian nuclear weapons forces** in the area of warhead monitoring. This multi-year project will explore monitoring concepts and technologies for enhanced warhead security and safety. The US/Russian project team has selected a military site in St. Petersburg for technology development and field trials. Results of the effort will lead to Russian-certified technologies for enhanced security and safety of the Russian stockpile. If necessary, these technologies could also be applied to monitoring regimes associated with the recently announced deep reductions in strategic forces. (5300) Greg Mann, gremann@sandia.gov

Tech partnerships

A broad (national lab/industry/government) celebration and press coverage of the operation of the world's first Extreme Ultraviolet Lithography alpha tool was held at Sandia/California facilities in April 2001. Shortly thereafter, at an international SEMATECH-sponsored Next Generation Lithography critical review, **experts favored EUVL over competing technologies for fabricating circuits with sub-50-nm features by a margin of 3 to 1.** Also, a three-year extension (eight-year running total) of the Virtual National Laboratory CRADA was executed, with additional funding of up to $65M. (8700, 2300) John Goldsmith, jgold@sandia.gov

Sandia and Goodyear Chemical (of the Goodyear Tire & Rubber Co.) are **exploring energy-efficient processes that reduce energy consumption, waste, and emissions.** Goodyear will provide engineering and economic models from the company's solution polymer plant, which uses petrochemicals to produce synthetic rubber and specialty polymers. Sandia will use computer-aided design and engineering to test fabricated material recovery devices and quantify results. The agreement was the sixth cooperative research and development agreement between Goodyear and Sandia since 1993 — and Goodyear Chemical's first. (1300, 6200) Mary Monson, mamonso@sandia.gov

From across New Mexico, small businesses are expressing their appreciation to the state legislature and Sandia for the **New Mexico Small Business Assistance Program,** a versatile, effective, and immediate economic development tool that solves issues facing small businesses. The program, made possible by an act of the 2001 New Mexico legislative session, enables Sandians to work with small business to solve technical and business problems at no cost to the federal government. The program finished its inaugural years with outstanding results: Sandia experts participated in more than 325 projects. (1300) Mariann Johnston, mjohns@sandia.gov



"PACMAN" microtransfection device, designed with help of SUMMiT technology.

A SANDIA ENGINEER makes fine adjustments to the highly complex EUVL tool, developed by a DOE labs-industry partnership.

We have demonstrated the applicability of Sandia's SUMMiT™ (Sandia Ultra-planar Multi-Level MEMS Technology) to biological and medical applications. For example, we have **designed and manufactured a microtransfection device** (a.k.a. cell Pacman) that has shown how MEMS microscopic mechanical and fluid-handling capabilities can be used to handle individual cells. Also, SUMMiT™ technology is being used at Fairchild Semiconductor's South Portland, Maine, wafer fabrication facility, resulting in a manufacturing source of high-volume MEMS devices for commercial and government products. MEMS technologies can be used to build a wide range of micron-scale devices such as sensors for automobiles, micromirrors for optical switching and projection displays, and microfluidic components for injet printers and chemical/biological detection systems. (1700) Jay Jakubczak, Jayj@sandia.gov

With $1.47 million in royalties earned in FY01, the **California site more than doubled its lifetime earnings from licensing for the second year in a row**, bringing the site's lifetime royalty income to $2.54 million. Success is the result of three factors: 1) A few very large licenses with upfront fees, including two licenses of µChemlab™ liquid-phase technologies in FY01 and one license of LIGA process technology in FY00; 2) A software product, JESS, that is a commodity product (37 licenses in FY01); and 3) A number of reliable technologies that continue to generate running royalties year after year. (8500) Denise Koker, dekoker@sandia.gov

A leading chromatography instrument manufacturer, Waters Corporation, has entered into a multi-year cooperative research and development agreement with Sandia to **miniaturize High Performance Liquid Chromatography instruments.** The company has licensed rights to Sandia's electrokinetic pumping technology and will work with the Labs to jointly develop further microfluidics-based systems. We have also established a licensing agreement with Sandia spin-off, Eksigent Technologies. The technology developed will enhance the µChemLab™ miniature analysis systems for chem/bio national security needs. (8100, 8300)

The Sandia Science & Technology Park completed a master development plan for the 200+ acres of land outside the Eubank gate and selected BUILD New Mexico as the Master Developer. Two new EMCORE facilities were built in the Park, while Applied Technology Associates and the Sandia Laboratory Federal Credit Union also began construction on new buildings. In addition, the Park was honored with Public/Private Partnership Awards from the New Mexico State Land Office and the Middle Rio Grande Council of Governments. (14004) Jim Clinch, jpclinc@sandia.gov

Labs support, facilities, and human resources

Sandia and other labs demonstrated their top antiterrorism technologies for DOE Secretary Spencer Abraham and Homeland Security Director Tom Ridge in a show at DOE Headquarters in Washington, D.C. Sandia presented decontamination foam, ChemLab, Hound and Hound II, robotics, Rapid Syndrome Validation Project (RSVP), and the National Infrastructure Simulation and Analysis Center (NISAC). Ridge said afterward that **"technology-based solutions will be a huge component** of a comprehensive national homeland security plan." (12600, technical line organizations)

In response to 9/11 terrorist events, Sandia staffed the Emergency Operations Center with senior management, DOE/KAO representatives, and support staff. Mission-essential personnel were retained on-site, but non-essential personnel were released for two days. Liaisons were established with KAFB, DOE, and the Sandia intelligence community. Increased security measures were implemented. Employees on travel and those assigned to the Washington, D.C., area were contacted. Security Police Officers worked closely with military police to perform ID checks and vehicle searches for personnel accessing KAFB. (3100, 10000, 12000, 14000)

More than 1,300 new employees were hired in FY01. Staffing organizations at both sites successfully surpassed our FY01 goals by hiring 628 regular employees, including 299 members of technical staff and 104 technologists. This was accomplished by giving emphasis to recent graduates, high GPAs, and top schools/programs. In addition to regular hires, we hired 188 temporary employees and 542 new students, enhancing our potential-candidate "pipeline," as well as hiring 177 staff augmentation contractors. While acceptance rates exceeded national norms, the California site faced additional challenges due to the area's cost of living. (3030, 8500, 12600, and recruiters and hiring managers Labs-wide)

New Mexico Health Services Center's Back Injury Reduction Program was recognized for proven results in r**educing occupational costs and decreasing days away and restricted days** associated with back injuries. The Center demonstrated a commitment to disease management through the implementation of a unique workplace Diabetes Pilot Program. Onsite coordination and accessibility of best-care diabetes services promises reduced healthcare costs. The Center surveyed all current and former employees, assessing possible exposure to beryllium and offering a comprehensive exam to those indicating risk. (3300, 3100)

In August **the NNSA Tri-Labs Diversity Workshop, focusing on Asian/Pacific Island American (APIA) issues,** convened Gen. John Gordon, directors of the three labs, members of the APIA communities within the laboratories, and a sampling of labs managers to inaugurate a senior management protocol for developing solutions to systemic workforce diversity issues and concerns. As a result of the partnership initiated by Sandia, the three NNSA laboratories are collaborating with teams now working to address identified issues related to the laboratories' image in recruiting, career development, and security. (0002, 3000, 8000)

The Sandia President's Advisory Council (SPAC) concluded seven successful years of advising Sandia's president on issues of strategic significance. **SPAC helped identify opportunities where Sandia's competencies could contribute to national security** and suggested appropriate program initiatives for the Laboratories' consideration. SPAC was actively involved in the development of Sandia's administration transition initiatives, the creation of the Surety Institute, and consultation with the laboratory director on nuclear test ban policy. (1, 12100)

Training/Education investment funds, provided by Executive VP Joan Woodard's office, have paid Labs-wide dividends: University Programs increased participation; Doctoral Studies Program increased 28 percent; Special Masters Program increased 100 percent; University Part-Time increased 20 percent. New curricula were introduced to address some of the Labs' critical skills areas. Twenty-eight individuals were retrained and assumed new positions through the Information Technology/Computer Science program with a 100 percent customer satisfaction rating. (1000, 3000, 6000, 8000, 9000)

New Benefits plans and improvements were delivered involving medical, dental, and vision plans, health care reimbursement spending accounts, voluntary group accident insurance, sickness absence plan, vacation donation plan, vacation buy plan, personal absence time, vesting for savings plans, and benefits for students and LTEs. Changes will control rising

(Continued on next page)

Labs support

(Continued from preceding page)

costs, provide competitive benefits to support hiring and retention goals, and provide more family-friendly choices. A personalized Total Rewards Statement that quantifies the extent and value of benefits that employees receive was delivered to regular employees. (3300, 3000, 8500, 10300)

HR improved electronic delivery and access: Top Recruits, a web-based tool, assists hiring managers in identifying outstanding candidates. The HR Graphalyzer provides helpful attrition trending and projection information to support Centers and Divisions in responding to the Annual Staff Planning call. Online course registration allows employees to register directly for classes with a single password system that has reduced help-desk calls by more than 80 percent and resulted in faster registration. The Mission Critical Designator System identifies those employees deemed critical to operations during high security alerts. (3000)

Sandia was selected as WasteWise Federal Government Partner of the Year for 2000 for efforts in sustainable design, construction, and demolition waste recycling, waste reduction efforts within Custodial Services and the Cafeteria, and results in environmentally preferable procurement. The City of Albuquerque's Industrial Pretreatment Program presented DOE and Sandia/N.M. with three Gold and two Silver Pretreatment Awards for demonstrating 100 percent compliance with permit reporting requirements and 100 percent with permit discharge limits. Three organizations received the Commitment Level award from New Mexico's Green Zia Environmental Excellence Program. (3100, 10800, 3300)

A large volume of liquid gunk from remote area septic tanks was successfully managed during FY01 by the Radioactive & Mixed Waste Management Facility (RMWMF). The unsavory stuff was filtered through two screens to remove large debris and sediment. Six hardy RMWMF employees donned protective clothing and full-face respirators to handle the highly odoriferous goo. Four tanker truckloads containing more than 14,000 gallons of the filtered water, tainted with trace amounts of solvents, were shipped to a RCRA-permitted facility in Tennessee for disposal. (3100)

The Corporate Access Control System experienced dramatic growth during 2001 due to development of WebCAT (Web Based Custodian-controlled Access Tool). This software tool allows Sandia line personnel responsible for a physical location to add/delete/modify access control lists for the card readers. Changes are immediately transmitted to local card readers. With real-time access to the Badge Office database, the system automatically updates for replacement of worn or lost badges. WebCAT allows areas to implement "need-to-know" controls in a cost-effective manner. (3100)

The Environmental Management Department in conjunction with the Earth Day Coalition of New Mexico conducted **the Fifth Annual Youth Conference on the Environment.** DOE, Sandia, and the Earth Day Coalition sponsored the conference. The all-day event was held April 20, 2001. High school and middle school students from the Albuquerque area participated in workshops and debates on topics including: drilling in the Arctic National Wildlife Refuge, controlled burns as a forest fire management technique, rainforest culture, and effects of the Cerro Grande fire on wildlife. (3100)

The Rapid Reactivation Project has **more than doubled Sandia's neutron generator production capacity** while maintaining on-going production operations. The project renovated space in several buildings, constructed an addition to Bldg. 857, and installed new equipment, with only minimal impacts to existing production and no lost production schedule time. The project was finished on time and under budget. (10800, 14400)

In FY01 the Facilities Management and Operations Center **increased the overall completion rate of Preventive Maintenance tasks** from 78 percent to 90 percent. Since FY98, overall preventive maintenance completion has increased from a 40 percent level. This focus on preventive maintenance tasks on building and infrastructure equipment has resulted in increased reliability of building systems and increased life expectancy of equipment resulting in an overall improvement in efficiency. (10800)

In partnership with Center 1700, Facilities engineering staff **designed and installed new infrastructure systems resulting in a $200,000 per year savings** in electrical energy for chilled water systems serving the Microelectronics Development Laboratory. Results were achieved through creative engineering solutions like installing variable frequency drives on chilled water pumps and hot water pumps, installing a larger compressed dry air receiver tank, changing start sequencing of air compressors, optimizing cooling tower system flow, and changing the energy management system code to utilize more sensible cooling. (1700, 10800)

The Spend Plan Tool Redesign Team formed to **develop the requirements for a new Spend Plan Tool** that would both interface with and use the functionality of Oracle 11i applications. The team's focus was to assure customer input to provide a system where project managers and business units could perform 3-year financial planning. The Spend Plan Tool is designed to capture information at either a summary or detail level, and was developed with usability in mind. (2300, 10300, 10500)

Sandia received DOE approval in FY01 to fund and construct an Institutional General Plant Project (IGPP) building. The first building provides office space in the New Mexico tech area. **IGPPs are indirect-funded construction projects** that will provide general-purpose, institutional space and infrastructure to offer an option from direct funding for obtaining needed space. Sandia was the first DOE contractor to pilot such an alternative that is permitted by special Congressional authority. Sandia is seeking approval to construct two additional buildings in FY02. (10500, 10800)

A study of "actual and reasonable" versus "per diem" reimbursement statistically compared Sandia's travel costs to Federal Travel Regulation per diem allowances and documented that the **Labs saved $400,000 for the first half of FY01 using actual and reasonable methodology.** These confirmed Sandia cost savings persuaded DOE to allow Sandia travel expense reimbursement based on reasonable, actual travel expenses. The success of the request for waiver of Federal Travel Regulation requirements is unique among Sandia's peers. (9500, 10500, 12300 12800)

The Pension Investment Organization periodically searches for investment management firms to invest Sandia's pension fund assets. It's part of an ongoing review of the pension fund portfolio. Recently, the team determined that performance and risk measures could improve if it modified the funds' exposure to capitalization sizes and investment styles. By hiring three new firms and eliminating one, the team achieved **an improved investment risk profile compared to the fund's benchmark index.** The change involved $250 million. (10300)

Web Shipper, a Sandia-developed on-line web-based application, has taken the place of a paper Shipper form that was used to ship equipment and material offsite. Implemented in FY01, the new on-line Web Shipper advantages include automatic assignment of a shipper number, no manager approval required with shipping activity viewable on-line at any time, e-mail and workflow processing with no more hand-routing for approvals, and tracking of shipments available from submission through release to carrier. (10000, 9000)

Prior to release of property Sandia must review those assets for high risk and export control. Terrorists, rogue nations, and competing developers of technologies must not benefit from Sandia's sales and loans of property. This need is balanced with the requirement to maximize return on taxpayer investments. This process of collaboration between Sandia's Property and Import/Export Organizations has **streamlined an expensive and labor intensive process** by combining effort and reducing risk. (10200)

An innovative and cost-saving approach to property utilization reviews has been developed and implemented by Sandia's Property organization. Previously, a bi-yearly formal walkthrough of work areas by management was conducted in accordance with DOE regulations. **Sandia now combines utilization reviews with activities such as inventories**, office clean-ups, and corporate storage reviews, while still fulfilling the intent of the regulation to minimize mission impact. (10200)

The P-Card program gives frontline workers an alternative to making low-value, low-risk purchases. It is a popular "self-service" option that reduces both costs and cycle times. In FY01, 1,600 cardholders used their cards 75,000 times and spent $55 million (one-third of Lockheed Martin's total P-Card spending), **helping the Labs avoid $3 million of unnecessary oversight.** By giving cardholders that purchasing authority, the contributions of Procurement's buyers are more appropriately aligned with strategic purchases. Sandia's P-Card program is considered best-in-class by several outside organizations. (8500, 9500, 10200)

Sandia was **among the first companies to implement the full suite of Oracle's Enterprise Resource Planning software.** Our success has led DOE/HQ,

(Continued on next page)

Environmental remediation

How can you keep a high-level nuclear waste repository cool? You could ventilate, and that is what the Yucca Mountain Project is considering to maintain rock temperatures below boiling. Ventilation is a key component to thermal management in the potential geologic repository. Knowing how much heat can be removed must be demonstrated by testing. Last year **Sandia conducted 22 tests in a 132-foot-long test train containing 25 simulated heated waste packages.** Ventilation was forced through at various flow rates to provide data for ventilation model validation. (6800) Cliff Howard, cliff_howard@ymp.gov

CLIFF HOWARD sits next to a line of simulated waste packages inside the 132-foot-long test assembly where the effectiveness of ventilation for heat removal is being measured for the Yucca Mountain Project.

The Chemical Waste Landfill was the primary location for disposal of laboratory chemical wastes from 1962-1982. **Excavation of the landfill began in 1999 and was completed in 2001, ahead of schedule and under budget.** Along with 50,000 cubic yards of soils and various large vessels and glove boxes, excavation yielded 1,437 intact chemical containers, 357 gas cylinders, 900 thermal batteries, 26 ordnance debris pieces, and three vials labeled "polio." (Research indicated that the vial contained a polio strain that had been autoclaved and destroyed before being disposed of in the landfill). This extremely hazardous operation was conducted safely, without significant injury or environmental release. (6100) David R. Miller, drmille@sandia.gov

The Sandia/California Mixed Waste Disposal Management Team worked to open a direct path for disposal of mixed waste. The resulting quality process meets the strict requirements for both DOE radioactive and California hazardous waste disposal. **In 2001, disposal of mixed waste prevented cost and schedule impacts,** regulatory citations, and fines while supporting building demolition and closure of legacy waste management units dating back to the mid-1960s. (8500, 3100) James Bartel, jjbarte@sandia.gov

Labs support

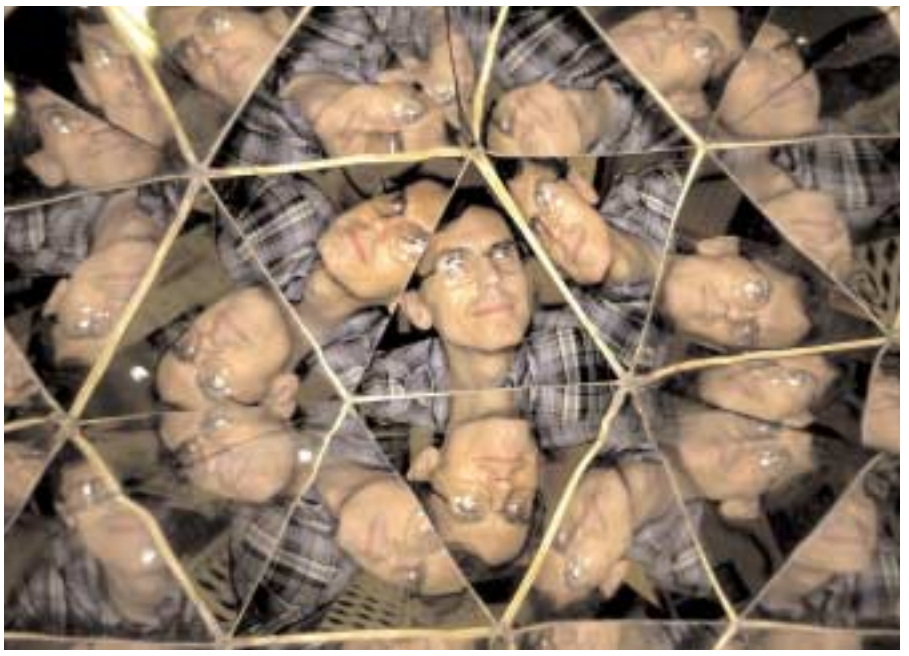
(Continued from preceding page)

Nuclear Weapons Complex Defense Programs Division, Los Alamos National Laboratory, Bechtel Nevada, Idaho National Engineering and Environmental Laboratory, Bettis Atomic Power, Knolls Atomic Power Laboratory, and the Atomic Weapons Establishment of England to consult us. We have also provided consultation to the US House of Representatives, the Internal Revenue Service, and Indian Health Services. (9500, 10300, 10500, 14400)

Three hundred Sandians submitted a total of 303 Technical Advances during FY01 disclosing inventions to be evaluated for possible patenting. **One hundred and ninety patent applications were filed during FY01.** These 190 patent applications listed 257 Sandians as inventors. A total of 112 patents were issued during FY01 representing the culmination of what is typically a two- to three-year patent prosecution process. In the area of copyrights, which are used primarily to protect software developed at Sandia, DOE during FY01 approved 49 copyright assertions. (11500)

In December 1999, the DOE Office of Inspector General issued an Inspection Report on Sandia's sale of a Paragon supercomputer that noted that the Department of Commerce was investigating the possibility of a deemed export violation from the transfer of Paragon manuals. **This sale had generated a lot of unfavorable publicity, but Sandia believed there was no export control violation.** In December 2000, Sandia was notified that Commerce had determined that there was **no violation of export controls.** (10200, 10000, 11500)

Court trials can be risky and expensive. Settling a case at nuisance value can be cheaper, but may invite unfounded claims in the future. Recently, Sandia was sued in a case depending on events supposedly occurring almost 40 years ago. **Based on a new strategy, we ended the case without a trial and without paying a settlement.** Our strategy included substantial investment in pre-trial legal work that led to dismissal by the court. The cost of the pre-trial work was about the same as the cost of nuisance settlement. (11600)



SANDIA VOLUNTEER Len Duda, seen here during an educational demonstration at Explora science museum, is one of thousands of Sandians who donated their time, talent, and treasure to the community in 2001. (Photo by Randy Montoya)

Security

We were asked by the National Institute of Justice to provide assistance at the World Trade Center by **outfitting search and rescue dogs with miniature video** and audio equipment. This capability allowed search efforts to be carried out in spaces inaccessible to humans. Interacting with the dedicated police, fire, and rescue personnel was inspirational and gave new meaning to the term "exceptional service." (5800) (NPMC)

SEARCH and rescue dogs at the World Trade Center site were fitted with a Sandia-developed mini-cam system.

We have jointly developed with Precision Remotes Inc., **a remote response platform system that can improve the protection of high-value assets** while reducing the operational costs. The platform provides armed response to terrorist attack under the remote control of a security officer. The key issues involve command/control and providing high assurance that accidental discharge cannot occur. Approval from line organizations and safety officials to conduct performance testing has recently been obtained. (5800, 6400, 7100) D. S. Miyoshi, dsmiyos@sandia.gov

To help fill the void that currently exists for information security specialists, Center 6500 launched the College Cyber Defender student internship program in Albuquerque, modeled after a similar successful program at the California site. Thirteen students from across the US were trained in **protecting electronic information and defending computer systems from attacks.** Mentored by Sandia staff members, students worked on computer security-related research projects, aimed at protecting Sandia's information systems. (6500, 9300, 8900, 3000) Karen L. Shanklin, klshank@sandia.gov

Sandia will receive a foundational patent for extracting water from the atmosphere. This foundational patent represents a good example of considering the IP protection at the earliest stages of development. The patent covers a technology aimed at extracting liquid water from the atmosphere with minimum energy consumption. This technology could provide a personal portable water production system capable of producing sufficient drinking water for an individual. Large systems may have the potential of alleviating water shortages around the world. We are pursuing international patent rights and several US patents on improvements to the basic technology. (11700, 15211)

Sandia has secured DOE approval to release several Sandia codes under open source licenses (like those used for Linux). **Open source licensing allows Sandia to make technology available** to researchers and ensures that Sandia will have free access to improvements made by others. Sandia's operating contract did not contemplate open source licensing, so Sandia has worked with DOE to analyze concerns and risks and to agree on cooperative processes for decision and approval to release codes under open source licenses. (11700, 1300)

Sandia has released the CPlant™ distributed computer operating system software under GNU's General Public License (GPL). The release was enabled by several months of negotiating the needed permissions from DOE. The software also builds on many other software projects. **Clearing Sandia's title to software before release was a significant undertaking.** The release under open source will allow researchers free access to the software and encourage improvement by the entire research community. The GPL requires that improvements be made available under similar terms to others, so that Sandia and the research community will benefit from the collective efforts of all those working in the technology. (11700, 1300, 9200)

In Fall 2000, the Government Relations group put together a team of 20 people from across the Labs to **identify major national policy initiatives where Sandia could make contributions.** Six issues were identified and forwarded to the new administration. Three areas we identified were consistent with major initiatives that were adopted by the administration, including protection of the nation's critical infrastructures, development of an integrated national energy policy, and cooperative border development. Sandia's previous work in these areas has been a resource for the federal government as it has implemented these initiatives.

Strengthening Quality in Schools, a Sandia-sponsored initiative, teaches Baldrige-based concepts to educators. Here are some results: Gallup students go **from the lowest to the highest level ranking in math in one year;** Reading scores jump dramatically; Teachers do not retire; 90 more schools join SQS. A former Sandia manager and current South valley teacher sums up the impact of SQS, "It has given my students ways to become successful, independent, lifelong learners." (12600)

The National Atomic Museum has provided a variety of community outreach activities this past year. The Summer Science Camp expanded to serve 180 local children and a gifted class from California. A youth volunteer program was initiated with great participation. **The museum staff and docents provided tours and educational programs to more than 13,000 visitors.** In partnership with KNME-TV, a ZOOMzone site was located at the museum for budding young scientists. The museum recognized the cultural diversity our community with three ethnic programs. (12600)

For the sixth year in a row, Sandia has achieved an overall rating of Outstanding in DOE's appraisal of the Laboratory. DOE and Sandia have been committed to a performance-based management system that relies heavily on laboratory self-assessment, which reduces and coordinates DOE oversight while maintaining a responsible DOE stewardship role. Over the past several years, significant improvements in the overall appraisal process have been made due to a solid DOE/Sandia partnership, and our joint lessons-learned activity continues to identify additional improvements. (12100)

To support the central purpose of the National Nuclear Security Agency (NNSA), Sandia's executive management proposed that Sandia initiate **a governance pilot to develop an improved relationship** that reverts back to the Government determining what is needed from Sandia and allowing the leadership of Sandia to decide on how best to accomplish that work. The NNSA has accepted this proposal, known as the NNSA/Sandia Governance Pilot; the goal of the program is to develop a common-sense governance system that builds trust and accountability, enables good decisions and great work, effectively manages risk, and saves time and money. The assessment of the implementation of this pilot will lead to a consideration of extending this program to the other laboratories. (2, 7002, 12100)

Recognizing outstanding science teachers was the focus of the **first annual Excellence in Science Teaching Awards, created by the Community Involvement Department and funded by Lockheed Martin.** Eleven teachers from Albuquerque and surrounding communities were recognized at an awards dinner in May. For many, this event marked the only formal recognition of their careers. Nominated by their peers and supported by student recommendations, each teacher received a small financial award for use in their classroom. (12600)

Sandia LabNews

Sandia National Laboratories

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