

Sandia assists NASA with space shuttle rollout test

Project looked at massive mobile launch platform, shuttle transporter

By Michael Padilla

Transporting the space shuttle from the assembly building to the launch pad is quite a heavy task.

The three-million-pound shuttle sits on an eight-million-pound mobile launch platform (MLP) and is carried by a six-million-pound crawler. The crawler transports the vehicle and platform four miles from the Vehicle Assembly Building at Kennedy Space Center in Florida to the launch pad.

Moving the shuttle that distance, which normally takes five to six hours at 0.9 mph, had been considered a relatively low-stress process during most of the life of the shuttle system. As the equipment ages, however, more emphasis is being given to understanding how the rollout may fatigue the transport system.

NASA contacted Sandia to assist with a series of tests to help understand the fatigue caused by vibrations during the rollout. Overall, the tests are part of NASA's return-to-flight mission, with first flight scheduled between May 15 and June 3.

Sandia helped NASA design the test and instrumentation to measure the dynamic vibra-

(Continued on page 12)



TOM CARNE stands in front of NASA's massive mobile launch platform and the crawler that carries the space shuttle from the Kennedy Space Center's Vehicle Assembly Building to the shuttle launch pad, some four miles away.

(Photo by Jim Redmond)

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Ultrafast laser detection of cancer cells reported to APS meeting

Technique developed by Paul Gourley also may improve understanding of stem cells

By Neal Singer

To investigate tumors, pathologists currently rely on labor-intensive microscopic examination using century-old cell-staining methods that take days to complete and may give false readings.

A lightning-fast laser technique — its development led by Sandia's Paul Gourley (8331) — has provided laboratory demonstrations of accurate, real-time, high-throughput identification of liver tumor cells at their earliest stages, and without invasive chemical reagents.

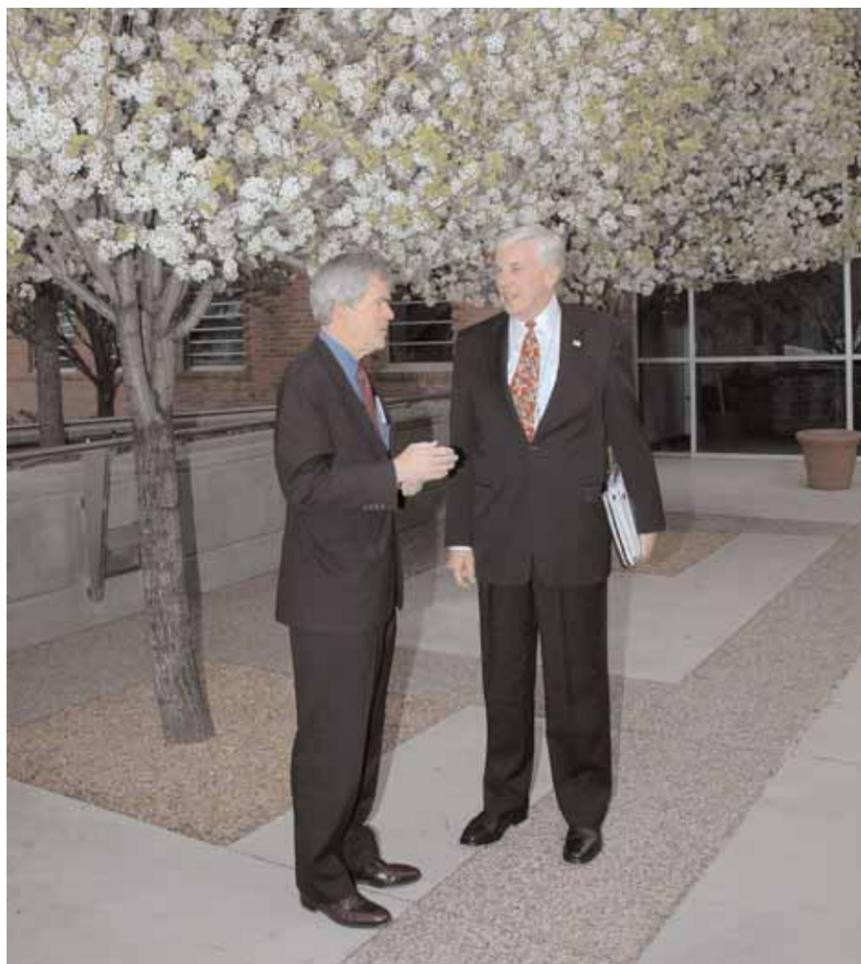
Paul released the information on March 21 at the American Physical Society meeting in Los Angeles.

The technique passes a laser beam through human cells pumped from a flask through tiny microchannels. The beam creates flashes of light when it encounters mitochondria, which act as focusing lenses to create conditions necessary for lasing. These changes, registered by a receptor, instantly identify cancer-modified mitochondria in cells gone wrong.

(Continued on page 4)



PAUL GOURLEY



SEN. JEFF BINGAMAN, left, is greeted in front of Bldg. 800 last week by Sandia President and Labs Director Paul Robinson. Bingaman met with Paul before presenting a colloquium to employees on the importance of national investment in R&D (see story on page 5). (Photo by Bill Doty)

Lockheed Martin to bid on LANL contract

Lockheed Martin Corporation announced Tuesday afternoon it is forming a team to pursue winning the contract to manage Los Alamos National Laboratory.

The Department of Energy decided to open the contract to bid late last year. This will be the first time the LANL management contract has been opened during its 62-year history. The current management contract, now held by the University of California, expires Oct. 1.

"Los Alamos National Laboratory is a vital national asset," said Sandia President and Labs Director C. Paul Robinson. "Sandia National Laboratories works in close partnership with Los Alamos on a variety of programs so we are very interested in the outcome of the contract bid. Lockheed Martin has a proven track record of exceptional management oversight at Sandia, so I am pleased that they have considered a bid proposal."

Martin Marietta won the management and operating contract for Sandia in October 1993. Martin Marietta later merged with Lockheed Corporation to form Lockheed Martin Corporation.



BROOM tool helps restore facilities after release of bio warfare agents. Story on page 6.



Pearl Garcia does a fishtail then fishtails down. Pearl's story and more on safety on page 8.



Egyptians learn how to handle sealed radioactive sources. Story on page 9.

What's what

Back when budgets allowed for Danish pastries and bagels and box lunches and other such niceties for Sandia visitors, leftovers occasionally showed up when the Protocol team tidied up and left whatever building had hosted the visit. Since our building (811) includes some nice-size conference rooms – and the Protocol offices – we became used to this hand-me-down largesse.

Then budgets tightened and policies changed, and it all went away. At least it went away for the level of most visitors who come to Bldg. 811.

Then one day recently, 10 canned soft drinks left over from a function came back to the building – Protocol gets a credit for unconsumed drinks – but disappeared before they could be credited. A mild, tongue-in-cheek chastisement from Protocol popped into the e-mailboxes of all the denizens of Bldg. 811, which prompted a variety of responses, ranging from “Buurrrrrrrp! . . .” to “Sorry. . . uurrrp! . . . Gulp, gulp, gulp. . . uurrrp!” to other onomatopoeic expressions. One even blamed pirates, or Jimmy Buffett, citing a scattering of parrot feathers, rum corks, and limes in the area of the disappeared pop.

All of which the Protocol chastiser responded to by posting a “Soda Breath Analyzer Sign-up Sheet” with the explanation that “You are over the legal limit if you register more than 1.67 burps during the session.”

So, shrink our budgets, downsize pay raises, take away parking spaces to build silly old labs, threaten to close our host base, jack up gas prices – whatever. All we need is 10 missing cans of pop to brighten our day.

* * * * *

If you ever read Isaac Asimov's science fiction short story “The Last Question,” you might sense at least a bit of a connection between his Cosmic AC and Google. But that's another story.

Anyway, Van Bailey Hord (no apparent Sandia connection) e-mailed that he had Googled up the Feb. 18 *Lab News* and enjoyed the What's what piece about ambient vermouth at the Nevada Test Site. His note:

“My father had told me that story many times, although he added that the scientist who was his host loved to quantify physical occurrences using complex formulas (that went on for pages) and had determined, from a bottle of vermouth exploded that day, that for every second the martini was held outside (at the location of his patio, with that particular martini glass, wind direction, etc.) one molecule of vermouth would land on the surface. It was thought that 10 molecules would be perfect. My father, who by coincidence had brought a bottle of vermouth as a gift to his host, agreed that it made the driest martini he had ever tasted. I always loved the story and have passed it on to my friends but now I'll tell them to add a grain of salt. Thanks for evoking fond memories of my father and his story-telling.”

Our pleasure, Mr. Hord, if you Google up this edition.

– Howard Kercheval (844-7842, MS 0165, hckerch@sandia.gov)

Clay Sell sworn in as deputy secretary of energy

Clay Sell was sworn in last week as Deputy Secretary of Energy.

Sell was administered the oath of office by Energy Secretary Samuel Bodman after being unanimously confirmed by the Senate on March 17.



“Clay brings a tremendous amount of knowledge and

CLAY SELL, left, is sworn in as deputy secretary of energy by Energy Secretary Samuel Bodman.

experience to the department, which will be critical as we seek to ensure an affordable, reliable energy supply for America's future,” Bodman said. ”

“As Deputy Secretary, Clay will play a critical role in the management of our nuclear stockpile and the effort to continue America's leadership in science and basic research.”



This monthly column highlights Sandia Lab News items from 50, 40, 30, 20, and 10 years ago, but each column does not necessarily include items from each decade.

50 years ago . . . A recent deposit by Sandia paint shop employee Felipe Silva had for the first time brought the Sandia Laboratory Federal Credit Union past the half-million-dollar mark in total deposits, according to the April 23, 1955, *Lab News*. The Credit Union was chartered in October 1948, and its first monthly financial statement showed total assets of \$510.75. (The Credit Union annual report published this February showed assets totaling more than \$900 million in 2004, with deposits increasing more than \$67 million in that year alone.)

40 years ago . . . Sandia was evaluating operational safety aspects of a small nuclear reactor power system that was launched into a 700-mile polar orbit by the Atomic Energy Commission on April 3, 1965. The flight-test objective was to establish the feasibility of operating a nuclear reactor power system in space. The program's purpose was to develop reliable, long-lived sources of electrical power for satellites and space vehicles. Called SNAP-10-A (SNAP was short for Systems for Nuclear Auxiliary Power), this was apparently the first nuclear reactor ever launched into orbit. The April 9, 1965, *Lab News* article explained that future space, lunar, and planetary missions would require power supplies up to many thousands of kilowatts, with lifetimes up to several years and with near-perfect reliability.

20 years ago . . . The April 12, 1985, issue included a special eight-page section featuring Sandia's huge new Particle Beam Fusion Accelerator II (PBFA II) in its final year of construction in Area 4 and its role in the Labs' inertial confinement fusion program. Then vice president of research Bill Brinkman said, “We have a very reasonable chance of becoming the first lab in the country to achieve fusion ignition. That means we may well become the first to achieve break-even — where the machine starts to produce more energy than it consumes.” Completed and fired for the first time in December that year, PBFA II was the predecessor to what's now called the Z machine, itself currently being upgraded to deliver more power.

10 years ago . . . An April 14, 1995, article announced that uncertain budgets were driving planned staff reductions that were expected to shrink the workforce by about 600 FTEs (full-time-equivalent employees) by the end of FY96. Sandia had about 8,440 FTEs at the time of the announcement, down from more than 8,600 at the end of FY94. The Labs did indeed reduce the workforce in late 1995 and early 1996, partly through the Voluntary Separation Incentive Program (VSIP), but employment has since climbed back to nearly 8,500 FTEs today. — Larry Perrine

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Ken Frazier, Editor 505/844-6210

Bill Murphy, Writer 505/845-0845

Chris Burroughs, Writer 505/844-0948

Randy Montoya, Photographer 505/844-5605

Nancy Garcia, California site contact 925/294-2932

Contributors: Janet Carpenter (844-7841), John German (844-5199), Neal Singer (845-7078), Larry Perrine (845-8511), Howard Kercheval (columnist, 844-7842), Will Keener (844-1690), Iris Aboytes (844-2282), Michael Padilla (284-5325), Rod Geer (844-6601), Michael Lanigan (844-2297), and Michelle Fleming (Ads, Milepost photos, 844-4902). Dept. 12651 Manager: Chris Miller (844-0587).

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LOCKHEED MARTIN

Recent Patents

Kenneth Peterson (14152), Stephen Garrett, and Cathleen Reber (both 5744): Release Resistant Electrical Interconnections for MEMS Devices.

Thomas Weber (15244), Diane Callow, James Jones (both 15232), Michael Kuehl (15324), and Barry Spletzer (15200): Optical Probe for Determining the Fat/Lean Interface in Cuts of Meat.

William Sweatt (1743) and Todd Christenson: Optical Switch Using Risley Prisms.

Michael Malinowski (8753): Method and Apparatus for Detecting the Presence and Thickness of Carbon and Oxide Layers on EUV Reflective Surfaces.

Saleem Zaidi and James Gee: Enhanced Light Absorption of Solar Cells and Photodetectors by Diffraction.

Deborah Mowery-Evans, Timothy Gardner (14154), and Linda McLaughlin: Method for Selective Catalytic Reduction of Nitrogen Oxide.

John Bowers (14431): Method of Making a Power Electronics Capacitor.

James Martin (1112), Robert Anderson (1811), and Rodney Williamson (1846): Method of Using Triaxial Magnetic Fields for Making Particle Structures.

Sympathy

To Mary Bailey (10264-1) on the death of her mother, Theresa Chavez, in Albuquerque, Feb. 22.

W80 Life Extension Program design passes review 'with flying colors'

By Nancy Garcia

The W80 Life Extension Program passed a major milestone recently, completing the most significant Preliminary Design Review and Acceptance Group (PDRAAG) review held at the California site since 1990.

Chaired by the US Air Force, the nine-member panel had representatives from every branch of the military. Their assessment of whether the design and program meet customer requirements is reported directly to the Nuclear Weapons Council.

"We passed with flying colors," Center 8200 Director Doug Henson said after attending the three-day event and outbriefing.

The meeting was preceded, said W80 System Engineering Dept. 8241 Manager Doug Gehmlich, with a report written over a couple of months in conjunction with collaborators at Lawrence Livermore National Laboratory. Provided to the review team 60 days before the review, the report generated questions about one

aspect of the design, addressed in explanations at a "pre-meeting," he said, which was helpful.

Doug Gemlich also said it was helpful to talk to the groups that had undergone a PDRAAG review in the Life Extension Programs of the W76-1 and B61 weapons systems. They imparted lessons learned, and the W80 group took those into account, also undertaking many dry runs before the actual meeting.

The chair, Billy Mullin, representing the Air Force, commented that it was one of the best reviews he'd ever attended, Doug Gemlich recalled.

Phase 6.3 of the Life Extension Program for the W80 began in February 2001, with the design focused on extending the W80 service life 20 years and adding major security and safety improvements, he added.

Completing the PDRAAG reviews is a milestone that must be passed before the program can enter into Phase 6.4, during which the efforts of the team will shift from pure design issues to working out details of how to get the modifications into production.

The current first production unit is scheduled for January 2009.

Sandia team presenters included Carole Le Gall (8241), who pulled together the report and review, Bill Delameter (retired from 8242), Dan Hardin

(8241), Alvin Leung (8242), Raphael Molle (8241), Artie Ortega (8242), Jim Van De Vreugde (then 8241), Brett Wagstaff (8241), and Rena Zurn (8205).

Sandia California News

Manager promotions

Michael "Cass" Cassidy from PMLS, Strategic Planning & Studies Dept. 12127, to Manager, Lab Performance Evaluation Dept. 10731.

Cass joined Sandia in March 1999. Since coming to the Labs, he has served as Packaging and Transportation program leader for onsite/offsite hazardous materials transportation and storage in the Logistics Program Office; worked in the S&T Business Office in Div. 10000; and worked with corporate 10/5/1 plans, executive communications, and executive council support in Lab Planning and Strategic Studies Dept. 12127.

At the time of his promotion, he had been working in Lab Performance Evaluation Dept. 10731, managing the Labs' performance evaluation process.

Cass has an AB in history from Duke University, an MA in liberal arts from St. John's College, and an MA in English from the University of Dallas.

Andrew "Butch" Cox from Manager, OATSD Technical Advisor Dept. 2117, to Level II Manager, Integrated Studies & Support Group Dept. 9731.

Butch joined Sandia's Aeroballistics Projects Division in February 1981. His formal training is in applied optimal control theory. Butch managed hypersonic vehicle projects from 1982-1986. From 1986 to 1999, he managed projects and organizations in the nuclear weapons advanced development area.

In 1994, Butch was promoted to manager of the Advanced Systems Development Department. He became manager of the Inertial Systems Department of the Electronic Systems Center in 1999. His most recent assignment was Special Scientific Advisor in the Office of the Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs, in Washington, D.C.

He has a BA and an MS in mechanical engineering, both from Rice University, and a PhD in applied mechanics from Stanford University.

Mark Smith from Manager, Joining and Coating Dept. 1833, to Level II Manager, Manufacturing Process Science and Technology, Org. 14150.

Mark joined Sandia in 1981 as a staff member in what is now Materials and Process Sciences Center 1800. There, he started a new Sandia capability in thermal spray R&D that grew to become the Thermal Spray Research Laboratory. He also served as principal investigator on one of the first Sandia CRADAs, a five-year, \$5 million program with General Motors to develop SprayBore™, a process to rapidly deposit highly wear-resistant coatings onto the cylinder walls of aluminum automobile engines.

In 1999, Mark was promoted from DMST to manager of the Joining and Coating Department, where he pursued interests in new technology and program development to build an eight-company consortium to support refinement and commercialization of Cold Spray, a technology that can rapidly deposit a wide range of metals in the solid state at or near room temperature. Cold spray is now in commercial use, and it is also being evaluated for possible nuclear weapon applications.

Mark holds BS, MS, and PhD degrees from Iowa State University in geology, geophysics, and metallurgy, respectively. He is also a co-founder, board member,



MICHAEL CASSADY



ANDREW COX



MARK SMITH

and former president of the international Thermal Spray Society; founding Chairman of the Editorial Review Committee of the *Journal of Thermal Spray Technology*; and a Fellow of ASM, International.

Nick DeReu from PMTS, W76-0, W88 System Engineering Dept. 2138, to Manager, Weapon System and Software Quality Dept. 12341.

Since coming to Sandia in 1982, Nick has worked extensively in the New Mexico Weapon Systems Engineering Center. He has supported many nuclear weapons programs including B61-7 development, W88 development, B90 development, B61-0/2/5 dismantlement, B61-11 development, B61-3/4/7/10/11 stockpile support, and finally W88 stockpile support as the system lead. Nick led or was part of teams that introduced SS-21 and interactive electronic procedures at the Pantex Plant and a team that conducted B61-11 horizontal actuator testing that supported the certification of the B61-11 in a high-shock environment. As the W88 system lead, Nick has been involved in the Annual Assessment Report process, redesign of the JTA-2 telemetry, environmental testing, structural modeling, and production support within the NNSA complex.

Nick has an Associate in Technology degree from the Morrison Institute of Technology.

Neal Fornaciari from PMTS, Advanced Systems Deployment Dept. 8154, to Manager, Applications and Systems Integration Dept. 8944.

Neal joined Sandia in July 1990 as a member of the technical staff in the Combustion Research Facility, where he spent the next eight years. He was the Sandia lead in the Burner Engineering Research Facility, a cooperative venture between DOE and the Gas Research Institute focused on improving the efficiency and reducing emissions from industrial gas process-heat burners.

Neal spent the next three years in the Extreme Ultraviolet Lithography (EUV) program leading the development of the EUV Capillary Discharge Source. He then moved on to the W87 systems group, where he was Lead Mechanical on the JTA4 development program. The year before his promotion was spent working in the homeland security area developing strategies for deploying radiation detection systems to protect high-profile special events.

In 1987 Neal was awarded a Sandia *Las Positas* Summer Scholarship and worked that summer in the Combustion Research Facility. He continued there part-time and summers through 1989 while earning his bachelor's degree. Neal has a BS and MS in mechanical engineering from University of California, Berkeley.



NICK DEREU



NEAL FORNACIARI

Sandia California Travel Fair



Who: SNL/CA Travelers & Arrangers

**When: April 13th
10:00am - 2:00pm**

Where: Outside the New Building 915

Sandia/California

Take Our Daughters and Sons To Work Day

Thursday, April 28 • 7 am-5 pm

All guests must be US citizens • Grades 3-12

Students 16 years of age or older MUST bring a valid picture ID (examples include a California driver's license/ID card or school ID)

Cancer

(Continued from page 1)

Mitochondria are known as the power pack of cells, energizing them like batteries do flashlight bulbs.

"There are hundreds of mitochondria, sometimes thousands, in a cell," Paul says. "To see them in the old way requires a time-consuming process like fluorescent tagging or a chemical reagent. We've found we can see them immediately by light alone."

The techniques could be critical to advancing early detection, diagnosis, and treatment of disease.

More technically put, "To rapidly assess the health of a single mammalian cell," Paul says, "the key discovery was the elucidation of biophotonic differences in normal and cancer cells by using intracellular mitochondria as biomarkers for disease. This technique holds promise for detecting cancer at a very early stage and could nearly eliminate delays in diagnosis and treatment."

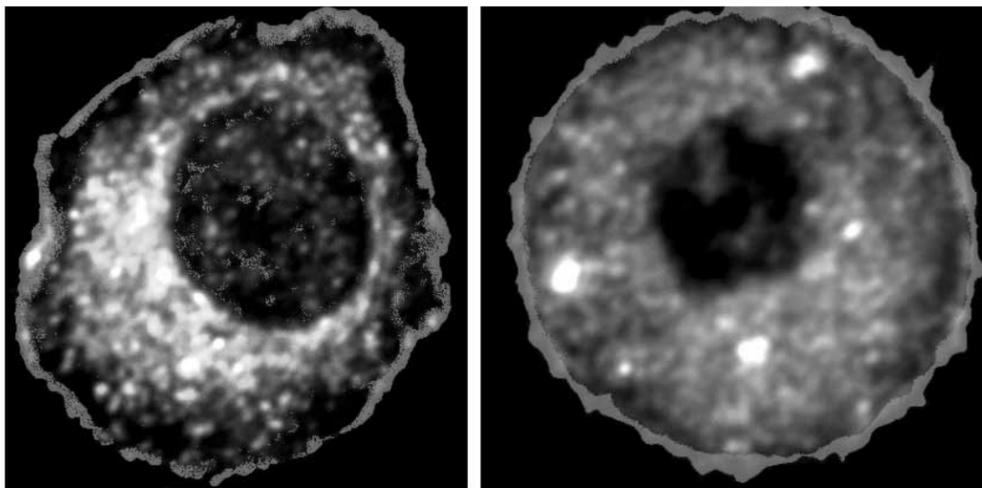
The technique is effective because "it measures changes in the cell architecture, especially those arising from alterations in protein density, cytoskeleton shape, and distribution of mitochondria — changes that occur when a cell becomes cancerous," says Paul.

"One would think that if a cell became non-functional, it would become disorganized. In cancer, however, that's not the case. A cancer cell is like an insurgent terrorist with a very well-defined agenda. It rearranges the cytoskeleton. It's no longer a cooperative agent in a collection of cells but becomes malicious, tries to get outside the area, and hijacks the respiratory machinery of a cell."

The biocavity laser

It is these changes — a kind of beefing-up of the criminal forces — that Paul's device, called a biocavity laser, detects.

A nano-thin layering of gallium aluminum arsenide combinations send up numerous tiny beams from a small cross-sectional generating area. These beams are reinforced or thwarted by



PROOF POSITIVE — The difference between a normal and cancerous liver cell is shown clearly by the location of mitochondria, as revealed by Sandia's biocavity laser. The healthy cell (on the left) shows very few mitochondria near the outer cell wall; they cluster densely as they approach the cell's nucleus (the black center). In the cancerous cell, shown at right, the mitochondria are spread throughout the cell, do not cluster, and under the same beam produce a more subdued effect.

the position and density of the mitochondria.

"The pictures we get from normal and cancer cells are very different," says Paul. "Mitochondria conspire to cluster around the nucleus and work together to supply energy to the healthy, functioning cell. In contrast, the mitochondria in the cancer cell sit all over, isolated

"A cancer cell is like an insurgent terrorist with a very well-defined agenda. It rearranges the cytoskeleton. It's no longer a cooperative agent in a collection of cells but becomes malicious"

and balled up in a quiescent, nonfunctioning state. Apparently, the rapidly growing cancer cells derive energy from an alternative source such as free glucose in the cell."

Working with UCSD

Fortunately, a mitochondrion is nearly the same size as the light wavelength of about 800 nanometers, a frequency otherwise little absorbed by the body. Because of this close match, the laser is exquisitely sensitive to subtle changes in mitochondria size and effects of clustering. To date, the

research team has found that 90 to 95 percent of light scatter generated is from optical properties of mitochondria.

According to Bob Naviaux, professor at the School of Medicine at the University of California at San Diego and co-director of its Mitochondrial and Metabolic Disease Center, "What's attractive about this novel optical method for identifying cancer cells is that it's a very rapid and general method that potentially can be applied to cancer cells from solid tumors as well as hematological malignancies like leukemia."

Naviaux looks forward to examining a wider population of cancer cells to validate the method, combining the resources of his Center with Sandia's laser expertise.

A project proposal has been filed with Sandia to support collaborative work between the unique research capabilities of UCSD and Sandia. "There are 300 different cell types in the human body and different mitochondria for each different shape and arrangements," says Naviaux. "We want a library of spectra from different cell types and their cancers."

Aiding stem cell research

Of further interest is that the biocavity laser may be applied not only to identifying the spectra associated with cancer cells but also those associated with stem cells, and how these optical signals change as they differentiate into nerve, muscle, and other tissues. "At present, there's no rapid method for identifying the transitional states [of a stem cell] with the functional cell type it eventually becomes. That process is a mysterious sequence of metabolic and genetic changes." There are, he says, metabolic similarities between stem cells and cancer cells, and researchers would like to clearly identify the differences.

"Stem cells are therapeutic," says Naviaux. "How are their spectra distinct from cancer?"

A difficulty still ahead is viewing cancer cells in fluids taken directly from the body, rather than isolated by type in a flask. The cells should be distinguishable from other floating material by their responsiveness to particular wavelengths.

Compensation planning period will start later to better align with DOE approval process, allow managers to work with approved numbers

To avoid a repeat of the multiple iterations of compensation review experienced in last year's process, the Labs will shift the compensation review period later by several weeks, to begin in mid-August rather than in early July.

That annual compensation review is when managers get together, center by center, to decide on compensation adjustments, both base and

nonbase, for their staff members.

Last year, the managers had to go through the planning process twice as a result of a decrease in the amount of available salary money approved by NNSA. The managers had done their planning based upon preliminary numbers.

"What we experienced last year," says Chuck Maheras, Compensation Dept. 3552 Manager,

"was that the managers conducted the compensation review for employees in the normal July-early August timeframe. But when we received final approval from NNSA [for our compensation package], we ended up having to do a secondary review for employees as a result of the decreased compensation increase plan approval.

"One of the things we want to accomplish this year is to avoid having the managers plan twice. In years past — including last year — the compensation planning period would kick off right after the Fourth of July. Managers would then be able to work through the first week of August to complete the compensation review. The numbers would then come in to the Compensation Dept. for a corporate review and to get the actions ready for the effective date in October.

"What we're doing this year is shifting the planning period to begin Aug. 15 and end on Sept. 12. We've shifted the schedule to make sure we're forecasting and planning with DOE-approved numbers. NNSA has set Aug. 1 as its target date to get approved compensation package numbers back to the labs across the complex," Chuck says.

Employee raises will be effective Sept. 30, with raises showing up in the Oct. 21 paycheck. Nonbase awards will also show up on that same Oct. 21 paycheck.

— Bill Murphy



Sandia Family Day Employee Car Show



An employee car show will be held on Family Day, May 14, 2005, 9 a.m.-3 p.m., in the parking lot east of the Technology Transfer Center (Bldg. 825). All Sandia employee vehicles, including customs, restored vehicles, trucks, race cars and motorcycles will be accepted. There will be no judging, but each entrant will receive a memento acknowledging participation. Questions should be addressed to Reggie Tibbetts (4232) or Matt Torres (4211) on 844-5244. To enter, return the entry form below to Reggie at MS 1341. Registration deadline is May 11.

(Cut on dotted line)

To: Reggie Tibbetts, MS 1341

Sandia Family Day Car Show Entry Form

Name: _____
 Org.: _____ Mail Stop: _____ Phone: _____
 Vehicle make and model: _____ Year: _____

US needs to shake off complacency about science and technology preeminence, Bingaman says

Senator tells Sandia audience America needs to respond to 'fast track' R&D growth around the globe

By Bill Murphy

The US can no longer take for granted its preeminence in science and technology, Sen. Jeff Bingaman, D-N.M., told Sandians last week during a colloquium at the CNSAC (Bldg. 810) auditorium. "The fact is, other nations are on a fast track to overtake the US in scientific discovery and innovation and we need to respond to that."

He said the administration's proposed 2006 federal budget does not represent a sound response to the challenge of science and technology leadership. There were "very poor decisions in the proposed 2006 budget for science and technology that I think could further weaken our economic and scientific posture in the world," Bingaman said.

Bingaman was introduced by Sandia President Paul Robinson, whom he met with privately before the talk.

In his remarks, Bingaman outlined his concerns and spelled out what he proposed as a number of ways in which those concerns could be addressed. He specifically cited Sandia's potential role in boosting research partnerships and technology transfer as ways to enhance US technology leadership.

Disturbing indicators

Bingaman augmented his remarks with four charts and graphs to reinforce his point that there are "disturbing indicators" about the status of science and technology in the US.

Among those indicators:

- Undergraduate degrees in the US for science and technology-related fields are awarded at about half the rates for similar degrees in Taiwan and South Korea (5.7 sci/tech/eng degrees per 100 college-age population in the US vs. 11 such degrees in Taiwan and South Korea, for example).

- For doctoral degrees, the US has a smaller share than either Asia or Europe; in fact in 2000, about 89,000 of the 114,000 PhD degrees earned worldwide were earned outside the US. "And to make matters worse," Bingaman said, "the trend is now for students pursuing PhDs to do so in their own countries rather than seek them here."

- The number of Asian students pursuing PhDs in the US has declined by 19 percent in the last few years, while it has doubled in those countries they come from.

"These trends indicate to me that our science and engineering workforce is aging, while overseas that workforce is much younger. In fact, more than half those with science and engineering degrees in our workforce are over 40. I believe this is a main reason — not the only reason, but a main reason — why we're seeing the movement of corporate R&D centers from the US to overseas locations."

US ranks fifth in R&D investment

Bingaman said that with an R&D investment rate of about 2.7 percent of GDP the US ranks number five in the world, behind (for example) Korea and Japan, which invest more than three percent of GDP in R&D. Even more telling, Bingaman said, is the rate of change: "From 1995 through 2001, the US increased its R&D investments by 34 percent, while the world's fastest growing economies, such as China, Korea, and Taiwan, boosted their R&D investments by 140 percent."

Bingaman said US federal investment in the physical sciences has declined by 50 percent over the last 30 years, from 0.1 percent of GDP to today's 0.05 percent.

"What do these trends indicate?" Bingaman asked. "It means that other nations are on a fast track to try to overtake the US in scientific discovery and innovation. Rapidly developing Asian economies are forging ahead; they are nearly matching their R&D investments with their GDP growth rates. And of course their GDP growth rates are substantially higher than ours. These



SEN. JEFF BINGAMAN, second from right, meets with Sandia President Paul Robinson, right, Div. 6000 VP Les Shephard, left, and Sandia chief economist Arnie Baker to discuss economics, water, and modeling work just before Bingaman's March 23 colloquium. Arnie has developed several computer tools that help policy makers understand complex energy-related issues. (Photo by Bill Doty)

nations have an expanding workforce of undergraduate engineers to staff manufacturing facilities and a growing increase in intellectual property because of a flourishing number of graduate degree scientists.

1.2 million job applicants — at one firm

Bingaman shared some observations from a recent fact-finding trip to high-tech hotspots in India, China, and Taiwan, including an anecdote about his visit to the Indian software company Emphasis, which employs some 30,000 people.

"I asked the CEO what kind of hiring program they have," Bingaman said. It was aggressive, and on a scale probably unheard of in the US. In 2004, Emphasis received 1.2 million applications. The company administered a standardized test to 300,000 of those applicants. Based on the results, it interviewed 30,000 people, from which it hired about 10,000 employees. "They expect they'll repeat that again this year," Bingaman said.

A sobering paradigm shift

Bingaman said he was struck by the number of companies from the US and other developed economies that are now building their newest R&D centers in these rapidly developing nations to tap into the intellectual capital and highly skilled workforces that exist there.

"Intel has just built a design center in Bangalore [India] employing 2,000 engineers — they're soon planning to expand that to 5,000 — where they are designing chips that are produced here in Rio Rancho. So the paradigm of the US producing cutting-edge research and development which then is manufactured in less-developed countries has been turned on its head.

"The point I want to make is that US companies are not waiting for the skilled workforce to come here; they're simply building their R&D centers where the intellectual capital is located, bypassing the visa issue entirely."

Washington's inadequate response

Bingaman cited numbers: Next year's proposed federal science and technology budget is slated for a three percent decrease in real buying power, a reduction of \$877 million to a level of \$60.2 billion. That budget proposal, Bingaman said, "slashes" K-12 science and math education funding. In addition, he said, the National Science Foundation is "woefully underfunded in this proposed budget. And NSF's science education programs continue to be devastated. They're down another 24 percent from last year. I don't see how you can concern yourself with closing the gap in math and science performance between our students and the rest of the world while proposing to cut the funding for math and science education programs."

Bingaman also said a number of DOE and DoD science and R&D program budgets are slated for deep cuts.

What to do, then

"The question then, is, what can we do, what should we be doing in Washington to change this? I would suggest that one realistic course of action would be to develop a five-year funding profile that would grow our long-term basic sciences by five percent per year. . . That's not the entire federal R&D budget, which is now \$133 billion, but it is the R&D sweet spot." Bingaman said investment increases in basic research will spur innovation and strengthen the nation's science and tech workforce.

"I believe that Sandia can lead the nation — has led the nation — in this area of tech transfer. And it's here where you can take the next step by assuring that the nanoscience center [CINT, the Center for Integrated Nanotechnology, a joint program with LANL] will not only push back scientific frontiers but also develop close working relationships with emerging industry."

Bingaman called on the DOE Office of Science to expand international collaborations and said he is introducing legislation to offer incentives to bolster science R&D parks. He suggested that the Department of Commerce should administer a program of incentives to encourage US and foreign firms to locate high-tech manufacturing in the US.

A perverse circumstance

"Today, we have the perverse circumstance that when we are competing for a manufacturing plant here in Albuquerque, it's the Albuquerque Economic Development organization and our economic development agency in Santa Fe going toe-to-toe with the government of Canada, the government of Ireland, the government of Singapore," Bingaman said. "Frankly, Washington is nowhere to be seen in that equation."

"We need to have an effort at the federal level to level the playing field so that local communities and states are not put at a competitive disadvantage relative to other countries."

Bingaman concluded with a perspective from Intel CEO Craig Barrett, quoted recently in a *Barron's* magazine article. Barrett said: "The challenge we face is global in nature. It's broader in scope than anything we've faced in the past. It will take a massive, coordinated research effort involving academia, industry, and state and federal governments to ensure that America continues to be the world leader in information technology."

Said Bingaman: "I share that concern [about information technology], but I believe we are being challenged in a whole range of other technologies and we need to have that same kind of massive, coordinated effort in order to retain our preeminence in those other areas as well."



HOSE DOWN — NIOSH crews wash off after collecting simulated samples during the recent exercise at the Coronado Club.

Sandia's BROOM tool can help restore facilities following release of biological warfare agents

Exercise tests Sandia software-based equipment that streamlines the process of restoring buildings

The gathering of samples following a release of a biological warfare agent in a public facility can be time consuming, and possibly delay the decontamination process.

To help speed and improve this process, Sandia has developed a software-based tool called BROOM — short for Building Restoration Operations Optimization Model. BROOM is intended to assist airports, transportation centers, and high-traffic public buildings in pre-planning for a possible restoration event as well as to assist clean-up personnel in restoration operations.

A major piece of the tool is a component that assists HazMat crews in collecting and managing the many thousands of samples that are collected to characterize contamination in a facility and to verify that the facility is clean following decontamination.

The three-year joint project with Lawrence Livermore National Laboratory is sponsored by the Department of Homeland Security, and partners with the San Francisco Bay area airports as model facilities for restoration. The project is a collaborative effort between Sandia organizations 9117 and 6245, led by Richard Griffith and J. Bruce Kelley, respectively. The project principal investigator is Mark Tucker (6245), and the lead BROOM developer is Jim Ramsey (9117).

The BROOM team from 9117 includes Brad Melton, Patrick Finley, and John Brockman. From 6245 are Gary Brown, Pauline Ho, Wayne Einfeld, Mollye Wilson, Matthew Tezak, Kathryn Walsh, and Ray Boucher. Rounding out the team are Bob Knowlton (6874), Chad Peyton, Sean Mckenna (both 6115), and Veronica Lopez (10755).

Mark says the main objective is to develop methods to minimize the economic impact of a release of biological agent by conducting restoration operations more rapidly than can be done now.

"The current process in collecting samples is very cumbersome," says Mark. "BROOM helps streamline the process."

HazMat responders can gather samples only during short periods of time due to the heavy gear they must wear, and for safety reasons. To make it easy for the responders to carry the software tool, researchers assembled a handheld device that



TEAM EFFORT — Sean McKenna (sitting) shows (from left) Mark Tucker, Gary Brown, and Jim Ramsey where samples are being collected during the recent BROOM exercise held at the Coronado Club.

incorporates the BROOM software, a barcode scanner, and a wireless laser range finder to accurately identify where the sample was taken.

Device reads barcodes

The handheld device looks simple, but lots of information can be stored in the pocket PC. The device also holds the contamination map and layout of the location where the responders are collecting samples.

The device's scanner reads barcodes placed on vials where the samples are stored. Sample barcodes provide a way to monitor the transfer of samples from the field to the lab. They also help automate the process of merging field data with laboratory results. In addition to barcodes, data specific to each sample are recorded in the handheld device.

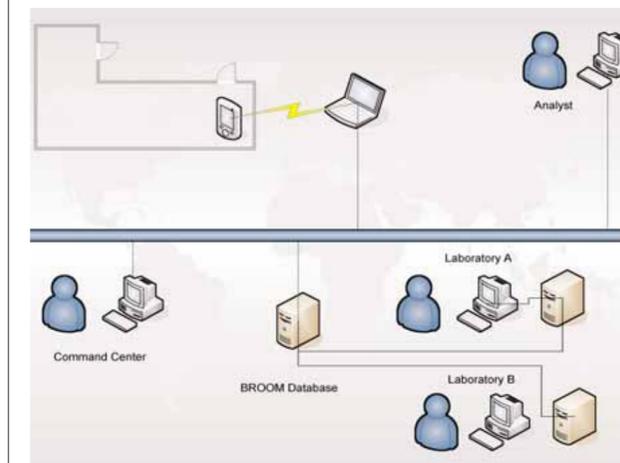
Information such as the sample type, surface type, surface orientation, surface area, and surface texture are recorded for each sample. The sample collector records himself as the person who acquired the data and may also write additional information about the sample in a notes field.

All data are then transferred to a PC outside the contaminated area by a wireless transmission. The results are then displayed on a map on both the handheld device and the PC.

The first sampling is done right after contamination where a determination is made of what the contamination is, where it occurred, and what techniques should be used to gather samples. If spores or other biological contaminants are found, the facility requires decontamination. During the decontamination process, strips of paper containing a nonpathogenic bacterial spore similar to anthrax are mounted throughout a facility. Immediately following decontamination, these spore strips are collected and analyzed for live spores. If live spores are found on the spore strips, the decontamination process must be repeated.

Collection and analysis of the spore strips constitutes the second stage of sampling. The third stage focuses on clearance sampling to ensure that the area is safe and clean for reentry. The BROOM tool can be used to assist in each stage of the restoration process.

How BROOM works



This schematic diagram shows how BROOM works. Data are collected on a handheld device within the contaminated area and sent to a PC by wireless transmission. The data on the PC can then be accessed by anyone who needs it, including personnel at the laboratory where samples are analyzed, personnel managing the restoration operation, and analysts (possibly at remote locations) assisting the emergency management personnel.



DATA COLLECTION — The handheld device displays building floor plans and collected samples. Barcodes and other relevant sample data (i.e. type) are recorded and later transferred to the BROOM database.

Story by Michael Padilla
Photos by Randy Montoya



SAFETY FIRST — An exercise, in conjunction with the National Institute for Occupational Safety and Health (NIOSH), to test BROOM was held in February at the Coronado Club. The exercise involved a release of a harmless simulant used to mimic a biological agent. Here, NIOSH crews get suited in full HazMat gear before entering the Coronado Club. The crew used the BROOM tool in the realistic sampling exercise.

Team members

Mark Tucker (6245), J. Bruce Kelley (6245), Jim Ramsey, Richard Griffith, Brad Melton, Patrick Finley, John Brockman (all 9117), Gary Brown, Pauline Ho, Wayne Einfeld, Mollye Wilson, Matthew Tezak, Kathryn Walsh, and Ray Boucher (all 6245), Bob Knowlton (6874), Chad Peyton, Sean Mckenna (both 6115), and Veronica Lopez (10755).



POCKET PC — The handheld device is easy to carry during collection of samples.



BREATHING APPARATUS — A NIOSH crew member prepares his gear prior to the exercise.

BROOM exercise conducted at Coronado

An exercise, in conjunction with the National Institute for Occupational Safety and Health (NIOSH), to test BROOM was held in February at the Coronado Club. NIOSH establishes standards and methods for biological sampling, such as anthrax. Previous work done by NIOSH includes anthrax sampling at the Hart Senate Building and at the Brentwood and Trenton postal facilities after the 2001 anthrax incident.

The exercise involved a release of a harmless simulant used to mimic a biological agent. NIOSH crews in full HazMat gear using the BROOM tool conducted a realistic sampling exercise.

During the first day of the three-day exercise 24 samples were collected and entered into BROOM. The diagram showed hot spots in the area where the contamination occurred. The remaining two days consisted of additional sample collection, as well as analyzing and testing BROOM.

The exercise was a tremendous success, says Mark. "Although the NIOSH crews provided some feedback about minor changes to the BROOM software, they were, in general, very impressed with the product," Mark says. "In fact, they want to further evaluate BROOM by using it in their future sampling operations — both those that involve biological agents and those that involve more routine sampling operations for investigations of occupational hazards."

Pearl Garcia does a fishtail then fishtails down

By Iris Aboytes

Pearl Garcia (10762) went to a birthday party for her nephew Jordan. Grilling burgers, sitting on the patio, and visiting with her family were her plans for a beautiful afternoon in May 2004.

Pearl and her family had owned a trampoline that she used for exercise. Her brother and his family also owned a trampoline. Sitting in the patio watching Jordan on the trampoline, Pearl asked Jordan, "Can you do a fishtail?" Jordan answered no, and she got up to show him. She finished the tricky trampoline maneuver and Jordan got up to try it.

Pearl was still on the trampoline when he tried. "I had a bad landing," says Pearl. "As I landed on the trampoline I heard my knee go crunch, crunch, pull, pull. I fell and held on to my knee. I felt excruciating pain. I knew I had hurt myself. My brother saw me fall and instantly — it seemed like an eternity — ran to help me. My sister-in-law called 911. My husband and my brother held my knee trying to keep it stable. My knee was fatiguing and had started to shake."

"When I got to the hospital, my dislocated knee was set in place twice. It had popped out after being set the first time. An MRI and X-rays two days later revealed I had torn several ligaments including my ACL and I had suffered contusions to my femur and tibia.

The accident happened on May 2, and Pearl was not able to have surgery until July 27. During that time, Pearl could not drive. She could not cook. She could not be on her feet for long



PEARL GARCIA was severely injured in a trampoline accident. Now she does a risk analysis before attempting anything that could possibly be dangerous. (Photo by Bill Doty)

periods of time. She had someone bring her to work and then pick her up. She had physical therapy to strengthen her knee for surgery. "I lost a lot of my independence," says Pearl.

Pearl was off work initially four weeks after her accident. After her surgery she was off four more weeks. Since her accident, she had physical therapy for about 12 weeks. She continues to do exercise on her own now to regain the full use of her leg. "I will never be at 100 percent," says Pearl. "My quality of life will never be the same." "The accident changed my way of life," she

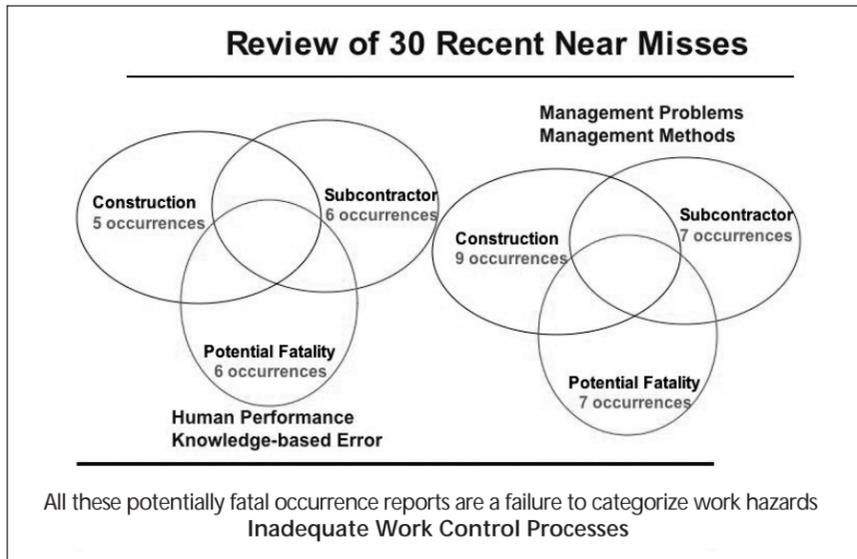
says. "I lost my entire summer. That meant no vegetable garden, camping, four-wheeling, walking at noon, and certainly no step aerobics. I doubt that I will ever return to step aerobics."

Pearl says the accident was not just about her. Her family was affected. So were her coworkers. It did not matter that the accident happened at home. If the accident had happened at work, it would have affected the same people.

"It was an accident," says Pearl. "After an accident everyone has the solution or reason why it happened. It happened. I know about trampoline accidents and how people can get hurt. Being careful is not just about trampolines, it is about everything we do."

"I always used to say, 'I can do that. Oh yeah! I can do that,'" says Pearl. "Now I quickly do a risk analysis. If I hurt myself, how will I be affected? My quality of life will probably never be the same. I will never have my same knee back."

I met Pearl Garcia at aerobics class several years ago. I saw her as a high-energy individual, full of enthusiasm. Leaving my office after the interview for this story, Pearl walked with a slight limp, a remnant of her accident. As with most accidents, the event that took seconds is still visible 10 months later. Pearl said something that really made me think. "Imagine all our near misses."
— IRIS ABOYTES



Have you had an accident that could have changed your life?

Marilynn Gabel (12115) — "I was home sick sleeping," says Marilynn. All of a sudden something heavy hit my head. I had blood all over. It really was a rude awakening."

Her cat, Oliver, knocked over a vase that Marilynn had on her headboard, which was about 18 inches above her head. When Marilynn looked in the mirror she had a huge gash on her head. Her hair look like it had been dyed a dark shade of red. She decided she might need stitches so she went to the hospital where she got 12 of them.

"I waited at the hospital for a long time," says Marilynn. "When it was finally my turn, my throbbing head had to have 12 shots all around my gash before it was stitched. But my pottery vase is OK! Oliver is still part of our family."



MARILYNN GABEL

Mike Lanigan (12651) — "It was a nice summer day," says Mike. "I did not realize my daughters were playing with water outside. They watered the rocks, the wall, everything they could think to water. I went outside and saw water all over the place."

Mike, in a hurried step, went to turn the water off. He slipped on the water-saturated patio and fell backwards. To brace his fall Mike used his right hand.

"Falling down I knew I had hurt my hand," says Mike. So he was off to the hospital and in a cast for six weeks. The hamate bone in his right hand was broken.

Keith Mote (14131-2) — "It was a little chilly and I decided to build a fire," explains Keith. "There was no firewood split, so I decided I would split some using a hand axe. My axe got lodged in the piece of firewood so I thought 'just this time.' I will use it as a splitting wedge. I used a hammer and smacked the face of the axe trying to split the



MIKE LANIGAN

(Continued on next page)

Sandia aims for best-in-class for safety among the nuclear weapons complex within three years

Ranking among the best in the nuclear weapons complex for safety within three years and the best-in-class nationally within a decade is a goal Sandia aims to achieve.

"One of the most important aspects of improving safety at Sandia involves learning from near misses," says Jaime Moya (6333). A near miss is when only one barrier or none at all prevented a serious injury or event from occurring.

Reportable accidents, called occurrences, are monitored, tracked, and analyzed for lessons learned. A review of 30 recent near misses for a 17-month period ending in December 2004 (see chart above) showed all those with potential fatalities arose from failing to properly categorize work hazards and identify adequate work controls.

"By being aware of our current safety behaviors both on and off the job and by our commitment to change, we can all contribute to keeping Sandians safe and there-

fore enhancing Sandia's overall ES&H performance," says Jaime.

Sandia's journey toward becoming "best-in-class" is based on three principles:

- Every Sandian and contractor takes responsibility and is accountable for ES&H performance at Sandia, improving the work environment, and minimizing our impact on the environment.
- We operate from an unwavering belief that job-related injuries, illnesses, and environmental incidents are preventable.
- Working safely is a condition of employment.

"We all have a responsibility to create an environment where people can expect and are able to have an injury-free career," says Kathleen McCaughey, director of ES&H and Emergency Management Center 6300. "It will happen, for us, our coworkers, and our families, when we all strive and work together."

Egyptians spend eight weeks at Sandia learning how to safely handle sealed radioactive sources

Special training tied to 2000 incident in Egypt where farmer and son died from handling sealed source

By Chris Burroughs

Fourteen Egyptian engineers, physicists, and chemists are spending eight weeks at Sandia this spring learning the intricacies of safely handling sealed radioactive sources. This training program is part of a larger project to greatly improve the cradle-to-grave management of sealed radioactive sources in Egypt.

Sealed sources are radioactive materials typically encapsulated in small metal vials or containers. They can be used for a variety of purposes — medical for eradicating cancers and industrial for anything from sterilizing surgical instruments to detecting erosion inside pipes.

“Of the 14 Egyptian students, only five had prior education and/or background in radiation protection,” says John Cochran (4163), project manager of the Integrated Management Program for Radioactive Sealed Sources (IMPRSS) in Egypt. “We are giving them a condensed version of the training Sandia’s Radiological Control Technicians receive.”

The special training the 14 Egyptians are receiving is tied directly to an incident in 2000 when an Egyptian farmer living in a rural area outside Cairo discovered a small shiny piece of metal on the ground. Thinking it unusual, he took it home to show his family. Five weeks



BRIAN THOMSON, left, is the Sandian who developed the eight-week program to train the Egyptians in cradle-to-grave handling of sealed sources. Here he instructs Yasser Zaghlol, Abdel Salam Abdel Fattah, Ayman Farid, and Yasser Lasheen.

later the man and his son were dead, and several other family members were seriously ill.

After much investigation, which even involved temporarily quarantining an Egyptian village, it was determined that the cause of death and illness was radiation exposure. The man had found a sealed source that came from a pipeline inspection instrument. It was accidentally left at the site.

The incident set off a national uproar that resulted in the government of Egypt wanting to greatly improve the country’s infrastructure to safely manage sealed radioactive sources.

Starting in 1994, Sandia hosted several Egyptians in the US on fellowships, and Sandia’s capabilities were known by the Egyptian Atomic Energy Authority (EAEA). After the incident the EAEA contacted Sandia to help the country develop a program that would help protect the people of Egypt by improving the safety of cradle-to-grave management of sealed sources.

Sandia and the EAEA submitted a joint proposal to the US Agency for International Development in Cairo for funding.

“Three years went by between making the pitch and getting the money in the door. We were persistent,” John says.

They then put together a program that covered the full life cycle of sealed source management, including tracking, awareness, security, regulatory reform, recovery, conditioning, storage, recycling, disposal, and the ability to respond to an emergency involving a sealed source.

Before training the 14 Egyptian engineers, chemists, and physicists, Sandia presented three-day classes in Egypt on sealed source



EGYPTIANS Nasser Awwad and Samia Kamal train on how to safely handle sealed sources as part of a program coordinated by Sandia.

management for members of the EAEA and the Egyptian Ministry of Health and another for users, like hospital personnel.

Brian Thomson of Behavior-Based Safety and Training Dept. 6342, who developed the eight-week program, says the curriculum is customized for the Egyptians’ needs. The program involves six weeks of lecture and hands-on training in a mock radiological area, one week of training on teletherapy devices (devices used for medical purposes such as cancer treatment), and one week of radiological emergency training and exercises.

Upon their return to Egypt, the 14 students will share their new knowledge of how to safely handle sealed sources with their colleagues.

Egypt learned the hard way about sealed sources

John Cochran, IMPRSS project manager, says the incident that killed two people in Egypt alerted the authorities and the public about how dangerous radioactive sources can be.

“They don’t shine or glow, and they are not typically hot. You can’t sense the radiation, and yet the radiation can be harmful or even fatal,” John says. “If only the worker who lost the sealed source in the field had reported it to the authorities, or if the farmer had known what it was, no one would have died.”

He adds that even spent sealed sources — radioactive material that is no longer strong enough to be used for medical treatment — can be deadly. That’s why it’s important that this material be treated with respect.

Exercises to involve real-life scenarios in Playa, N.M.

The radiological emergency training and exercises in which the Egyptians will participate next week will be conducted at the former copper mining town of Playas, N.M. It’s a former company town that was to have served workers of a Phelps Dodge smelting plant located in southwestern New Mexico, halfway between Lordsburg and Deming. New Mexico Tech bought the whole town — houses, med-

ical clinic, and post office — for \$5 million to be used as an antiterrorism training center.

Two sets of exercises are planned. One will include a radiation material transportation accident complete with “injured” people. The Egyptians will simulate taking care of the injured and cleaning up the accident site.

The second exercise will have a lost radiation source scenario.

Accident

(Continued from preceding page)

wood.”

A piece of metal flew down the axe handle and lodged in Keith’s thumbnail.

“After several unsuccessful attempts to remove it,” says Keith, “I went to the hospital to have it removed. The doctor had a hard time removing it. He told me he



KEITH MOTE

would have to cut it out. I begged him to try again and he was able to remove it.”

Keith teaches machine-safety classes at Sandia. He begins each class by showing his students the piece of metal. He tells them that if they get only one thing from the class, it would be that if you think “I can get by just this one time,” STOP! Look at it and see what your subconscious is telling you. Is it safe? Is there a better way to do it? Do you need safety glasses or other protection? Are you taking all safety precautions?”

Three Egyptian agencies

The 14 visiting Egyptians are from the Egyptian Atomic Energy Authority (EAEA), the Egyptian Nuclear Materials Authority, and the Egyptian Ministry of Health.

The Ministry of Health is responsible for the sealed sources while they are in use and the EAEA is responsible for unwanted sources — recovery, conditioning, storage and disposal.

University of New Haven now offers two graduate degrees in national security at Sandia/New Mexico

By Chris Burroughs

Nellie Ward (9317) has eight hours to go before she gets her master's of science degree in National Security in Information Protection from the University of New Haven.

It makes her feel good that she's so close to completion. She feels even better that she can finish her degree at Sandia/New Mexico.

"I began the program at Sandia/California, taking classes mostly online and traveling to Livermore occasionally," Nellie says. "But this January the University of New Haven started a program in New Mexico, and now I can finish right here in Albuquerque."

She was the first student from Sandia/New Mexico to enroll in the University of New Haven master's degree program at Sandia/California two years ago. The program was started in California in 2001.



NELLIE WARD

Courses in Albuquerque

In January 2005 the University of New Haven began offering accredited, on-site, executive-style courses at Sandia/New Mexico for master's degrees in National Security and Public Safety and in National Security with a concentration in Information Protection and Security. It has the same degree programs at the main campus in West Haven, Conn., UNH-California Campus in Sacramento, UNH-Sandia in Livermore, and UNH-Crystal City Campus in Arlington, Va.

The current Albuquerque program has 14 students. There is room for plenty more since each class can accommodate 32 students, says Bernadette Montano (3520), University Programs administrator. The University of New Haven's master's degree program, one of only 35 of its kind in the nation, provides Sandians a unique opportunity to study both cyber security and the protection of information systems, Bernadette says.

Last November the University of New Haven had an information session at Sandia/New Mexico attended by 150 people. Sandians interested in becoming students have to apply directly to the university. To be admitted to the program, prospective students must have a bachelor's degree from an accredited university and a mini-

mum 3.0 GPA.

The first set of classes started Jan. 7 and is now concluding. The next series starts in April followed by the third round in July.

The program follows the "executive MBA model" with classes held Friday evenings from 5:30-8:30 p.m. and Saturday and Sunday from 9 a.m. to 6 p.m. To graduate with a master's degree, students must complete 36 credit hours.

These programs and professional certification qualify for Sandia education assistance via the Tuition Assistance Program that pays tuition for regular employees up to \$6,000 per calendar year with a maximum of four classes annually.

Bernadette and Linda Stackpole of Corporate Education, Development, and Training Dept. 3520 worked closely with Roy Fitzgerald (10763) from the Homeland Security Strategic Management Unit and the University of New Haven to bring this advanced-education program to New Mexico. Unlike the Sandia/California University of New Haven program, which is open to people outside the Labs, the Sandia/New Mexico program is available only to Sandia regular employees.

Coursework rigorous

Nellie says the coursework is rigorous, but she enjoys it.

"It's a condensed master's program, and the work is intense," Nellie says. "We have to write papers, give two presentations, and take two or three exams per class."

She says the work is worth it. Besides learning more about her field, she's developed a network of colleagues who will help her throughout her career at Sandia.

As part of the School of Public Safety and Professional Studies, the University of New



INFO SESSION — Some 150 people attended a session in November where information about the new master's degree program was provided.

"It's a condensed master's program, and the work is intense. We have to write papers, give two presentations, and take two or three exams per class."

Haven program is designed to prepare staff in applying systems approaches to creating robust solutions to help the US overcome a range of homeland security and other national security challenges. These are part of Sandia's expanded mission. The program provides individuals opportunities to learn more about those missions and contribute more to Sandia and the country.

Strategic Education Committee

The program reflects the goals of the Strategic Education Committee, chartered by Executive VP Joan Woodard and led by VP 2000 John Stichman, which is for Sandia to have a national security learning environment. This is an environment where the Labs anticipates problems not yet imagined and answers questions not yet asked. This New Haven graduate program is one component of a larger overall activity to accomplish this.

More about the University of New Haven program can be found at www.newhaven.edu.

Mileposts

New Mexico photos by Michelle Fleming



Marc Polosky
20 2614



Marty Shaneyfelt
15 1762



Michael Knoll
25 1730



David Kuntz
20 9115



Todd Sterk
15 2952



Howard Walther
15 9127

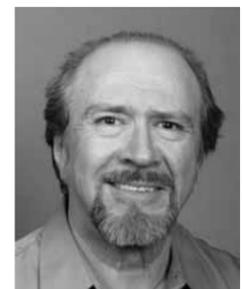
Recent Retirees



Tom Picraux
35 1100



Daniel Luna
32 15423



Jose Padilla
28 14133

MAKING ITS WAY at a stately 0.9 miles per hour along the four-mile-long causeway linking the gargantuan Vehicle Assembly Building with the launch pad at Kennedy Space Center at Cape Canaveral, Fla., the mobile launch platform and crawler dominate the salt-marsh landscape. For a sense of scale, note the size of the trucks and other support vehicles that flank the crawler. Mounted on the crawler are two solid-fuel booster rockets like those that help lift the space shuttle to orbit. Sandia has been closely involved with NASA on several projects lately as the space agency gears up for its much-anticipated return-to-flight mission, now scheduled for next month. The shuttle has been grounded since the January 2003 accident that destroyed the *Columbia* during reentry. Sandia was also involved with NASA in analyzing that accident. Its research helped confirm that the accident was caused by launch-related damage to the shuttle's heat-shield tiles.

(Photo courtesy of NASA)



NASA support

(Continued from page 1)

tion environment of the rollout. Sandia is also providing additional support to NASA by computing the input forces that the crawler applies to the MLP, which are being used by Boeing and NASA to compute the fatigue life for critical shuttle components.

Tom Carne (9124) has assisted with a series of tests beginning in November 2003 to develop the data necessary to understand the environment and the response of the space shuttle vehicle during rollout.

"NASA requested Sandia to assist them in this project because of our expertise in planning and conducting structural dynamic tests on very large structures," Tom says, adding that the Solid Mechanics/Structural Dynamics Group has done numerous structural analysis projects on large structures including the I-40 Rio Grande bridge, numerous large wind turbines up to 110 meters tall, and the Armored Tractor with SafeGuards Transporter. One of the group's main missions is analysis and testing of the shock and vibration requirements for weapons.

Rollout data analysis

Data were collected for rollouts of the MLP-only and the MLP with the two solid rocket boosters, at five different speeds ranging from 0.5 to 0.9

mph. For the tests more than 100 accelerometers were placed on the MLP, crawler, and solid rocket boosters. A data acquisition system installed inside the MLP for the road test measured and recorded the accelerations. The data were analyzed so that the character of the rollout environment is understood and can be analytically imposed on the shuttle using a finite element model to predict fatigue damage to critical components. Even though these stresses are much lower than those seen during the launch, the five- to six-hour duration of the transport and the low-frequency content in this environment could cause fatigue in components within the orbiter.

Tom says the rollout analysis team determined that there are two families of forcing harmonics caused by the crawler drive train that excite the MLP as a function of crawler speed, in addition to the random inputs induced by the road bed. Fortunately, he, says the harmonic forcing frequencies can be adjusted by merely changing the drive speed of the crawler, moving the inputs to less damaging frequencies.

Forcing function analysis

The team used a Sandia-developed algorithm, the Sum of Weighted Accelerations Technique (SWAT), to estimate the applied forces. Tom says the SWAT results were very beneficial in choosing a new rollout speed that will extend the fatigue life of the shuttle components that were affected by rollout.

The SWAT-generated input forces have subsequently been used as the force input for NASA's

NASTRAN structural analysis of the MLP, emulating the test conditions. The correlation between the rollout-measured data and the predictions from the NASTRAN analysis has engendered confidence in both the SWAT computed forces and the NASTRAN model of the MLP and solid rocket boosters.

"We are able to help NASA and Boeing by providing force input to their computer models to predict fatigue life," says Tom.

The analyses showed that modifying the speed of the crawler would reduce the fatigue stresses of the critical shuttle components. They showed through analysis that merely reducing the speed from 0.9 mph to 0.8 mph would significantly reduce the vibrations in the shuttle by shifting the impact frequency of the crawler treads. The shuttle's vibration response can be much reduced when the driving frequencies are shifted away from its own resonant natural frequencies.

Space shuttle *Discovery* is scheduled to roll over to the VAB this week for STS-114, the space shuttle's return-to-flight mission. Tom will again be on-site at Kennedy Space Center to help analyze and interpret the rollout vibration data from this return-to-flight mission.

Sandia News Briefs

Sandia intern Robert Cordwell fourth in nation in Intel Science Talent Search

Sandia intern Robert Cordwell finished fourth in the nation in the 2005 Intel Science Talent Search, America's oldest and most prestigious high school science competition. The top 10 winners were named March 15 at a black-tie banquet in Washington, D.C., hosted by Intel CEO Craig Barrett. Robert's project was titled "Some Results on Inclusive and Exclusive Partitions of Complete Graphs."

For his fourth-place finish Robert will receive a \$25,000 scholarship. Robert, a Manzano High School student and the son of Sandian Bill Cordwell (15623), works part-time in Dept. 9215. In the previous round of competition, which is conducted by Science Service, he had been named one of the top 40 finalists (*Lab News*, Feb. 4).

Sandia's corporate education and training group honored among top 100 nationally

Sandia's Corporate Education, Development & Training (CEDT) organization was recently recognized for its enterprise-wide workforce training and development efforts by *Training Magazine's* Top 100 award. Top 100 companies stand above their peers in workforce training and development and not only make sizable investments in their human resources, but do so strategically and creatively. Sandia placed 31st on the Top 100 list because training is routinely tied to business objectives and is considered a competitive advantage. CEDT currently offers a variety of services and training-related products.

The CEDT web site offers one central location for all Sandia training and education needs: <https://hrprod.sandia.gov/cfdocs/prod/hris/ctd/apps/cedtweb/cedtmain/index.cfm>



Sandia Family Day is coming. Show off your place of work to your friends and family members.

The much-anticipated event, last held in conjunction with Sandia's 50th birthday party in 1999, is scheduled for May 14 in New Mexico and May 21 in California.

Watch for more information over the next few weeks.

