

Sandia supercomputer simulations offer new explanation of century-old Tunguska mystery

Smaller asteroids may pose greater danger than previously believed

By Neal Singer

The stunning amount of forest devastation at Tunguska a century ago in Siberia may have been caused by an asteroid only a fraction as large as those postulated in previously published estimates, Sandia supercomputer simulations suggest.

"The asteroid that caused the extensive damage was much smaller than we had thought," says principal investigator Mark Boslough (1433) of the impact that occurred June 30, 1908. "That such a small object can do this kind of destruction suggests that smaller asteroids are something we should consider. Their smaller size indicates such collisions are not as improbable as we had previously believed."

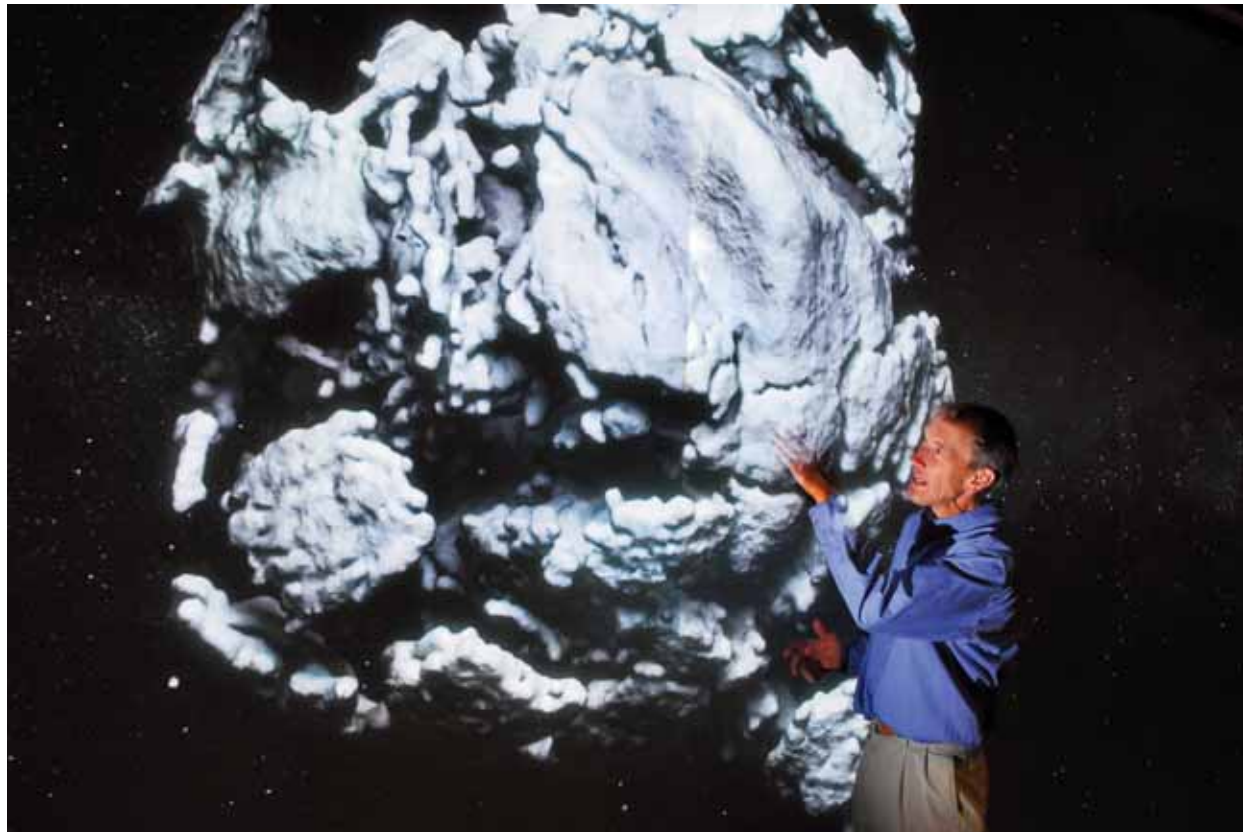
Because smaller asteroids approach Earth statistically more frequently than larger ones, he says, "We should make more efforts at detecting the smaller ones than we have till now."

The new simulation — which more closely matches the widely known facts of destruction than earlier models — shows that the center of mass of an asteroid exploding above the ground is transported downward at speeds faster than sound. It takes the form of a high-temperature jet of expanding gas called a fireball.

This causes stronger blast waves and thermal radiation pulses at the surface than would be predicted by an explosion from a point-source at the height where the burst was initiated.

"Our understanding was oversimplified," says Mark. "We no longer have to make the same relatively

(Continued on page 4)



DON'T LOOK BACK, IT MAY BE GAINING ON YOU — Mark Boslough uses a supercomputer simulation to demonstrate possibilities of dealing with an incoming asteroid, about which human knowledge is still in a primitive state. Factors include the materials composition of the asteroid as well as its mass, size, and velocity. (Photo by Randy Montoya)

60 YEARS OF THE LAB NEWS — With this issue, the *Sandia Lab News* begins its 60th year of continuous publication. The *Lab News* began its life before Sandia itself was established, serving as a simple mimeographed newsletter specifically for what was then called Z Division of Los Alamos Scientific Laboratory. That newsletter, called the *Sandia Bulletin*, assumed something close to its modern, newspaper-like look and feel in 1951. In 1954, the newspaper adopted its current name.

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Administrator Tom D'Agostino rolls out NNSA's transformation vision

By Bill Murphy

National Nuclear Security Administration chief Thomas D'Agostino on Dec. 18 introduced his agency's vision for the transformation of the nation's nuclear weapons complex. The vision, which encompasses NNSA's "Preferred Alternative" and other transformational elements, calls for changes at each site across the complex, including Sandia (see "Impacts on Sandia" on page 4).

The NNSA vision, says Sandia Labs Director Tom Hunter, "is consistent with our vision for the future of the laboratory." He notes that the NNSA transformation aims to move the complex away from its nuclear weapons-centric foundations and toward a broader national security enterprise. Likewise, he says, Sandia is already "well down the road" in that process, with more than half the Labs' funding coming from sources other than nuclear weapons work.

The specifics put forward in the NNSA vision, D'Agostino said, have been worked out over the past several months by NNSA officials working in close concert with representatives from across NNSA's program elements, across all eight sites, and with members of Congress.

(Continued on page 4)

Sandia scores highest yet on annual report card under model contract

By Chris Miller

Sandia's overall performance for FY07 was rated "outstanding" in the NNSA's annual Performance Evaluation Report.

The report showed Sandia making continued progress in virtually every major area, with an overall performance objectives score of 92 percent, up from 90 percent last year. The performance score consists of mission, which stayed at 93 percent in FY07, and operations, which jumped from 86 percent in FY06 to 89 percent in FY07.

The overall performance score was the highest Sandia has achieved on the annual report card since the model contract was put in place in FY04. This is the second year in a row that Sandia has achieved the outstanding rating, which, with the successful completion of award-term incentives,

allows Sandia Corporation's management contract with DOE/NNSA to be extended for one year beyond 2010 to 2011.

NNSA Sandia Site Office Manager Patty Wagner praised the Labs' FY07 performance, noting Sandia's exceptional leadership, its continued ability to provide high-quality science and engineering, and its continued improvements in operational excellence to include Sandia's efforts to mature the Integrated Laboratory Management System (ILMS) and obtain effective performance ratings in all areas of safeguards and security.

The report stated that "Sandia continues to demonstrate exceptional leadership across the nuclear weapons complex and provide high-quality scientific and engineering support of the United States' national security interests."

(Continued on page 4)



"This evaluation report represents significant progress in our efforts to transform the laboratory to contribute more effectively as the country's national security needs evolve."

— Tom Hunter

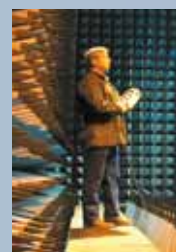


NW all-hands meeting

In an NWSMU all-hands meeting at the Steve Schiff Auditorium, Joan Woodard took up the theme of transformation, addressing the many ways in which this key Labs mission will evolve along with the nation's national security needs. See the story on page 6.

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FARM team scores big

Sandia's Facility for Antenna and RCS Measurement (FARM), centered around Bldg. 9972 in a remote locale near Sandia's solar tower complex, is up and running full-bore after a year-long renovation and upgrade project. See the story on page 7.

~~What's What . . . This & That . . . That's That~~

Well. Howard Kercheval, who's been writing a column in this space for the past six years, has up and done it. He's retired and hung up his keyboard, leaving me with this column space to fill. As is the case with all new columnists, I immediately had to tackle the really important question – what to call this collection of random musings. For inspiration, I looked to Rome. Some of you may remember that when Pope Paul VI died in 1978, the new Holy Father chose to name himself after his two immediate predecessors, Paul VI and John XXIII, becoming Pope John Paul I. For the sake of this column, I considered a similar approach: Throughout the 1990s, Larry Perrine wrote "This & That." When Howard assumed the august mantle of *Lab News* columnist, he settled on the name "What's What." Following Pope John Paul's lead, I have toyed around with the idea of calling the column "That's What" or alternatively, "What's This?" Or even – and this is cheating a little bit, borrowing Howard's cadences and Larry's words – calling the column "That's That," which has an authoritative finality that suits us opinion leaders. Ultimately, though, I'm not sure any of these permutations works for me. I'll have to give it a bit more thought. (After all, I've only had two years to consider this matter.)

* * *

One very tempting way to handle this space would be to use that old Sandia standby, common in the days when we printed lots of documents: "This space left intentionally blank." That really works for me, but I don't think my boss would like it. He actually expects me to write something. But I'm a trained professional and I'll muddle through. Writing's a piece of cake, after all. Like the feller said: "Writing isn't hard. Just get paper and pencil [this was the old days], sit down, and write as it occurs to you. The writing is easy – it's the *occurring* that's hard." Don't get me wrong. I like writing. In fact, I agree absolutely with one of my own favorite writers, Peter De Vries, who said, "I love being a writer. It's the paperwork I can't stand."

* * *

Over the past few years the nuclear weapons program has been getting smaller, to the point where it now accounts for something less than half of the Labs' work. But it's still – by far – our single biggest mission and still pays a lot of the bills around here. As Deputy Labs Director for Nuclear Weapons Joan Woodard and her leadership team took the stage during a recent all-hands meeting to answer questions from the audience, it struck me that the program is in good hands. These are serious people and they're engaged deeply and creatively with NNSA as it reshapes the complex for the 21st century. (See the story by Stephanie Holinka on page 6.)

* * *

On the subject of nuclear weapons, here's a rhetorical question for you: Has the fact that you work at a weapons lab ever become a conversation stopper in "polite" company? It has for me, though I must say it's never bothered me at all that where I work bothers some people. Quite the contrary. As a Sandian I take a lot of pride in being associated, however peripherally, with our primary mission.

See you next time.

– Bill Murphy (845-0845, MS 0165, wtmurph@sandia.gov)

Steve Rottler named Fellow of AIAA

Steve Rottler, VP of Weapons Engineering and Product Realization Div. 2000, has been named a Fellow of the American Institute of Aeronautics and Astronautics.

AIAA fellows are persons of distinction who have made notable and valuable contributions to the arts, sciences, or technology of aeronautics or astronautics. Steve will be formally inducted as an AIAA fellow at the organization's annual dinner in Arlington, Va., in May.

Steve is Sandia's chief engineer for nuclear weapons. He is responsible for leadership and management of nuclear weapon engineering and production activities. His responsibilities also encompass activities that provide advanced technologies and systems for missile defense, nonproliferation, homeland security, energy security, and critical infrastructure assurance.

Steve, who received BS, MS, and PhD degrees in nuclear engineering from Texas A&M, was born and raised in Texas.

During a long and accomplished career in weapons-related work at Sandia at both management and staff levels, Steve was part of a research team that developed radiation-hydrodynamics codes for nuclear weapon applications, and he led projects that supported the development of advanced nuclear and conventional weapon concepts.

Steve has led or served on independent review panels for the US Navy Strategic Systems Programs Office and the United Kingdom's Atomic Weapons Establishment. He is a member of the board of directors of the New Mexico Humanities Council and the Explora Museum and a member of the Albuquerque Committee on Foreign Relations.

Steve is a recipient of the US Air Force Award for Exemplary Civilian Service. He has published papers, reports, and conference presentations on the development and application of computational radiation-hydrodynamics codes.

The American Institute of Aeronautics and Astronautics advances the state of aerospace science, engineering, and technological leadership. The Institute serves over 35,000 members in 65 regional sections and 79 countries. AIAA membership is drawn from all levels of industry, academia, private research organizations, and government.



STEVE ROTTLER

ANS presents Dana Powers Tommy Thompson award

Dana Powers, a senior scientist in Advanced Nuclear Energy Programs Dept. 6770, has been awarded the Tommy Thompson Award from the American Nuclear Society (ANS) "in recognition of his outstanding contributions toward enhancing the safety of nuclear power plants and in particular toward an improved understanding of the phenomenology of severe accidents."

Dana, who has been at Sandia since 1974, has spent his career involved in issues regarding nuclear reactor safety.

Even early in his career, he was sought out by outside agencies for his expertise in the subject. He served as a consultant to bodies reviewing the Three Mile Island and Chernobyl reactor accidents.

Dana is a frequent advisor to DOE on reactor safety-related matters and has been involved with the Nuclear Regulatory Commission for many years, including a stint as chairman of the commission's Advisory Committee on Reactor Safeguards. Dana has been and remains active in the American Nuclear Society. He was elected an ANS fellow in 2002.

Dana earned his PhD from Caltech in chemistry, chemical engineering, and economics. He has served in increasingly responsible positions during his 33 years at Sandia. He was named a senior scientist in 1998.

Dana received the Tommy Thompson Award during the ANS winter meeting in Washington, D.C. The award was established in 1980 to recognize individuals who have made outstanding contributions to the field of nuclear reactor safety.



DANA POWERS

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! Take Note

Sandia will host the Hydrogen and Helium Isotopes in Materials Conference Feb. 6-7, 2008. Registration is required. The conference theme is the effect of hydrogen and helium (or other inert gases) isotopes on optical, mechanical, and electrical properties of materials. For details go to www.sandia.gov/tritides.

Thirteen is Tim Tooman's lucky number

By Patti Koning

About 25 years ago, with an empty nest looming in their future and a small inheritance, Tim Tooman (8134) and his wife Paula Gale made an extraordinary decision.

"Our two children were growing older and would be starting their own lives soon. We didn't want to do the RV thing — we thought, let's use this money and our time to make the world a better place," says Tim. "The Bible says to take care of widows and orphans, so we decided we would adopt a few children."

A "few" children turned out to be a baker's dozen — that's right, 13. Tim and Paula opened their hearts and home to 12 orphans from Ethiopia and one baby from northern California.

The journey from three to 13 began with Family Connections Christian Adoptions (www.fcadoptions.org), a nonprofit adoption agency that places children from the United States and around the world with adoptive families. From the start, Tim and Paula decided they would focus on hard-to-place children. In adoption lingo, hard-to-place means large sibling groups, older children (older than five for boys and eight for girls), or handicapped children.

Costa Rica, Ukraine, and Ethiopia

A group of three children in Costa Rica caught their eye, but by the time Tim and Paula were ready to commit, they'd been adopted by someone else. Next, they pursued a group of four siblings in the Ukraine, but changes in the Ukrainian government brought the process to a halt just before the adoption was completed.

Eventually, the Toomans heard about a group of six Ethiopian siblings who were unadoptable because of their numbers. "The next step would be to split off the younger ones, who had a better chance of being adopted, and leave the older kids in an orphanage," says Tim. "We thought that sounded pretty sad. So we decided to take them all."

The six children, ranging in age from 3 to 12 years old, arrived in the US in 1994. Just getting them here was no simple process.

One of the children, an 8-year-old boy, was so weak from malnourishment that it was uncertain if he'd survive the flight. Tim recalls waiting at the San Francisco International Airport, not being certain if there would be five or six children disembarking. "What a relief it was to see six kids get off the plane," he says.

Tim recalls taking the kids to the doctor for the first time. "We had no medical history, no genetic history — we couldn't even ask what was bothering them, although it was clear they were in poor health," he says.

Lab technician burst into tears

When Tim and Paula brought the malnourished 8-year-old to the laboratory for blood tests, the first lab technician burst into tears over his appearance. "He had a distended stomach, the thinnest arms you can imagine, and no tissue on his arms," says Tim. "No one had any idea how to draw blood from such a child."

Once in the Tooman's home, the children had to adjust to Western life — toilets, beds, utensils, and American food. This was a big obstacle, because the textures and flavors of Western food are much different than the children's diet in Ethiopia. Because the children had been suffering from malnourishment, eating was of the utmost importance.

Schooling was another challenge. "They were already in a strange environment, and public school would have been an even more alien environment. There was a huge language barrier because the kids spoke Amharic [a major language in Ethiopia]. Plus, they would have been split up according to their ages, and we didn't think that was a good idea either," says Tim. "So we began homeschooling them."

After a few years, Tim and Paula felt that they'd gotten a handle on their family of 10 and decided it was time to open their home once again. Because the first group had been five girls and one boy, they asked Family Connections to look for boys this time. Two groups

of Ethiopian boys were identified — a pair of siblings and three siblings.

"We couldn't choose one over the other, because we knew what it would mean for the group we didn't pick, so we decided to adopt all five," says Tim. Paula was interested in adopting a younger child, so they also adopted a baby who had been abandoned at an Ethiopian hospital.

About three years later, the Toomans adopted one more child, this time a domestic adoption. They heard about an infant girl who was hard to place because she had Down syndrome and had been born with nicotine, alcohol, and four illegal substances in her body.

"She was very quiet when we first brought her home, but boy she just came to life being around all the older kids," says Tim. "She's a delightful child."

\$2,000 monthly grocery bills

Tim and Paula face parenting challenges on a scale that most American families can't even fathom. They moved from Pleasanton, Calif., to a 6,800-square-foot home in the Central Valley town of Patterson.

They've had up to 14 children living at home at one time. That results in a monthly grocery bill of \$2,000 — and the Toomans grow a lot of their own food.

The biggest expense, says Tim, was adoption fees and transporting the children to America. He also cites the bureaucracy of the whole process as the biggest negative.

A case in point: The first group of siblings needed green cards. (Immigration laws have since changed and adopted children become US citizens as soon as the adoption is finalized.) The first set of green cards arrived with the name "Tooman" spelled five different ways, all incorrect. The corrected green cards (which, by the way were not entirely correct) took another six months.

"It has been delightful watching them grow and develop and adapt, and even go through teenage angst," says Tim. "When you're seeing the same



TOOMAN FAMILY — Tim and Paula Gale Tooman adopted 12 orphan children from Ethiopia. Back row: Marguerite (with white collar), Gabriel, Tim, Matthias (in front of Tim), Genevieve, Abigail, and Jonathan. Front row: Elizabeth, Samuel, Paula Gale holding Katrina, Susanne, Sarah (one of the Tooman's two natural children), Zechariah, and Patrick (sidewise). At the time of this photo, the Tooman's had not yet adopted their 13th child, Tiffany.

behavior pattern for the 12th time, you pretty much know what to expect."

Of his 15 children, five are still living at home. His biological daughter Sarah is helping homeschool three teenage children and Tippy, the youngest. The remaining 10 live around the San Francisco Bay Area in Modesto, Oakland, and San Jose. Six are in school, one is a nurse, one is a carpenter, one is a preschool teacher, and one is in hotel maintenance.

Margie, who was the fourth girl in the original group of six siblings, served in the US Army and recently returned from her second tour of duty in Iraq. She is now studying to become a dental hygienist. And Patrick, the 8-year-old who barely survived the plane ride to the United States? At 20 years old, he's studying business in college.

Tim, who holds a PhD in atomic physics from New Mexico State University, has been with Sandia for 29 years and currently is working in the Exploratory Systems & Analysis Department.

Sandia California News

Sandia, Milken Institute join forces to educate Wall Street on key energy issues

In collaboration with the Milken Institute, Sandia recently conducted a workshop in New York City designed to provide attendees insight into technologies that will reduce greenhouse gas emissions and increase energy security. Some 50 attendees, representing Wall Street's largest and most prestigious investment firms, participated.

"Wall Street investors in search of unbiased technical information on energy and fuels often don't get the complete picture," says Ron Stoltz (8302), head of Sandia's California Energy Liaison Office. Ron helped develop the workshop to provide answers about energy technologies to key capital market leaders and to generate further questions and discussion. Workshop attendees included representatives from Goldman Sachs & Co., Allstate, GM, and Lehman Brothers, among others.

"Those of us in Sandia's energy programs have often focused our attention on startup companies and traditional venture capitalists," says Les Shephard (6000), Sandia VP for Energy, Security, and Defense Technologies. "Ron's strategy in developing this workshop was well thought out. It's very encouraging to see that the event attracted top-level financiers and long-term investors whose future decisions may very well mobilize capital and markets at a sufficient scale for real changes in energy security and emissions reductions."

Once known as the "junk bond king" for his role in developing the junk bond market, financier and philanthropist Michael Milken today devotes his time and still-substantial fortune to a number of philanthropic ventures designed to achieve positive societal out-

comes. One arm of his Milken Institute (an independent economic think tank) is the SAVE project, or Strategic Action Volunteer Effort, which enlists volunteer partners who tackle major economic and public policy problems. The SAVE initiative, says Ron, helped line up the attendees for the recent workshop, while Sandia developed the agenda and speaker list.

Joel Kurtzman, a senior fellow at the Milken Institute and executive director of the Institute's SAVE project, says he was overjoyed yet not surprised at the positive response from the workshop's attendees, whose organizations were collectively worth upwards of \$200 billion in assets.

"They were impressed," he says. "Market leaders like this usually get a lot of biased information from organizations that are simply seeking funding. Sandia delivered speakers who were able to cut through all the hype, which cemented its already stellar reputation among the attendees."

Speakers at the Oct. 23 event included Sandia's Terry Michalske (8300) and Andy McIlroy (8350). Terry spoke about biofuels, while Andy addressed novel concepts in carbon sinks and carbon recycling. Other workshop speakers included Yale professor Arnulf Grubler ("Putting Climate Change in Context"), National Renewable Energy Laboratory Director Dan Arvizu ("Alternative Energy: Solar, Wind, Geothermal"), and Stanford professor Franklin Orr ("Carbon Sequestration").

A follow-up workshop, says Ron, is planned on nuclear energy and the issue of water in the energy sector.

— Mike Janes

Supercomputers

(Continued from page 1)

primitive assumptions because present-day supercomputers allow us to do things with high resolution in 3-D. Everything gets clearer as you look at things with more refined tools.”

The new interpretation also accounts for the fact that winds were amplified above ridgelines where trees tended to be blown down, and that the forest at the time of the explosion, according to foresters, was not

healthy. Thus previous scientific estimates had overstated the devastation caused by the asteroid, since topographic and ecologic factors contributing to the result had not been taken into account.

Revising deflection strategies

“There’s actually less devastation than previously thought,” says Mark, “but it was caused by a far smaller asteroid. Unfortunately, it’s not a complete wash in terms of the potential hazard, because there are more smaller asteroids than larger ones.”

Mark and colleagues achieved fame more than a decade ago by accurately predicting that the fire-

ball caused by the intersection of the comet Shoemaker-Levy 9 with Jupiter would be observable from Earth.

Simulations show that the material of an incoming asteroid is compressed by the increasing resistance of Earth’s atmosphere. As it penetrates deeper, the increasingly dense wall of air causes it to explode as an airburst that precipitates the downward flow of heated gas.

Because of the additional energy transported toward the surface by the fireball, what scientists had thought to be an explosion between 10 and 20 megatons was more likely only three to five megatons. The physical size of the Tunguska asteroid, says Mark, would depend on its speed and whether it is porous or nonporous, icy or waterless, and other material characteristics.

“Any strategy for defense or deflection should take into consideration this revised understanding of the mechanism of explosion,” says Mark.

The work was presented at the American Geophysical Union meeting in San Francisco on Dec. 11. A paper on the phenomenon, coauthored by Dave Crawford (1541) and titled “Low-altitude airbursts and the impact threat” has been accepted for publication in the *International Journal of Impact Engineering*.

The research was paid for by Sandia’s Laboratory Directed Research and Development office.



INCINERATION POSSIBLE — Fine points about the “fireball” that might be expected from an asteroid exploding in Earth’s atmosphere are indicated by researcher Mark Boslough in a Sandia supercomputer simulation image. (Photo by Randy Montoya)

Transformation

(Continued from page 1)

NNSA, D’Agostino said, is at a crossroads; the direction it takes today will have a major effect on its continued ability to contribute to the nation’s security in the years ahead. Ultimately, the aim of the transformation, D’Agostino said, is to create “a smaller, safer, and less expensive enterprise that leverages the scientific and technical capabilities of our workforce to meet all our national security requirements.”

It will take up to 10 years to fully realize the NNSA transformation, which includes challenges associated with the location and configuration of plutonium and uranium-related activities.

The plan envisions significant reductions in NNSA’s landlord footprint and a reduction of 20 to 30 percent in workers directly funded by NNSA’s weapons accounts. D’Agostino emphasized that the workforce changes do not mean actual lost jobs; many current weapons workers will be needed to address the technical challenges associated with other critical national security priorities of the 21st century.

Sandia Deputy Labs Director for Nuclear Weapons Joan Woodard says the NNSA Preferred Alternatives set the complex on a path of agility as the nation’s decision-makers determine the appropriate stockpile strategy for the 21st century. There is still a level of uncertainty about how the nation will transition the stockpile from a legacy state (i.e., largely a Cold War construct) to a future state. “That issue requires more clarity, which is expected over the next year or two,” Joan says, adding that “this current uncertainty requires more agility in the complex and we need to start creating that agile enterprise now.”

“This [NNSA vision] is not a point solution,” Joan says, but an important step in a journey that began more than a decade ago when Cold War facilities at Mound, Rocky Flats, Pinellas, and other locales were closed and their capabilities located at other sites.

Report card

(Continued from page 1)

Labs President and Director Tom Hunter said he is extremely pleased that the “dedication, commitment, and hard work” of all Sandians was recognized. “Thanks to everyone who contributed. This evaluation report represents significant progress in our efforts to transform the laboratory to contribute more effectively as the country’s national security needs evolve.”

In addition to scoring high on the performance objectives, Sandia scored an outstanding rating of 91 percent on performance incentives and Sandia passed all three award-term incentives.

The award-term incentives included continuing to strengthen strategic relationships with DOE and other federal agencies and a demonstrated implementation of the model contract, with improvements to management performance and effectiveness resulting in gains in operational efficiency and significant cost savings.

The report highlighted a number of achievements in mission performance, including:

- Completion of all scheduled deliveries of all first production unit components for which Sandia was responsible in the W76 life extension program and B61 Alt 357 program.
- Receipt of numerous prestigious awards and honors for scientific, technology, and engineering advances, including five R&D 100 Awards, four of which were LDRD-funded projects.
- Realization of numerous advances in scientific discovery and innovation in such areas as basic energy sciences, advanced scientific computing, biological and

environmental research, fusion energy sciences, energy efficiency research, energy technologies, critical infrastructure, water research, and advanced nuclear energy technologies.

- Outstanding performance as the lead laboratory for the Yucca Mountain Project, particularly in regard to risk identification, risk mitigation, and risk management of the proposed nuclear waste repository. “Sandia has delivered high-quality work products in support of the YMP license application,” the report said.

- Delivery of three types of burst detector sensors and systems to the Air Force contractor for space vehicle integration, which will greatly enhance US capability to detect and analyze nuclear detonations from a space-based platform.

The report highlighted a number of achievements in operations performance, including:

- Completion of the implementation of ILMS, the Integrated Laboratory Management System, a factor in enabling NNSA to complete implementation of the model contract and to share lessons learned with the NNSA complex.

- Improvement in the Labs’ safety programs, including meeting the total recordable case rate goal of 1.7, a 54 percent improvement over the 2003 rate.

- Completion of the MESA project three years ahead of schedule and \$40 million under budget.

- Completion of the joint Sandia/Los Alamos National Laboratory Center for Integrated Nanotechnology project on schedule and \$70,000 under budget.

In the area of performance incentives, Sandia was cited for achievements in such diverse areas as nuclear weapons work, reduction of indirect costs, continued improvements in emergency management and response, and the disposal of nuclear material.

Impacts on Sandia

Under the NNSA plan, Sandia would be impacted in several areas:

- Sandia/California would become a multi-agency laboratory, with a smaller NNSA landlord footprint by 2010. (Sandia/California is developing a plan that will meet the NNSA’s short- and long-term objectives.)
- All nonnuclear weapon component work would be consolidated to Sandia/New Mexico by 2010.
- Gas transfer system design work would be assigned to Sandia. (With the location of that work left to management discretion, it is likely Sandia management would locate GTS work at Sandia/California)
- Virtually all major environmental testing would consolidate to Sandia/New Mexico by 2010. (Currently, Los Alamos National Laboratory and Lawrence Livermore National Laboratory have some limited environmental testing capabilities.)
- NNSA would cease operation of the Tonopah Test Range by 2009, with operational ownership reverting to the US Air Force. (It appears possible, based on current negotiations, that Sandia would continue to maintain a Tonopah capability as a tenant rather than as operational “owner.”)
- High-performance computing platforms (the hardware) would be located at LANL and LLNL by 2012. Sandia’s intent is to develop partnership relations with LANL and LLNL and to remain deeply involved in high-performance computing platform development.

Up to 20,000 soldiers a year may be trained in nonkinetic engagement with video game enhancements

Game modules developed by team led by Sandian Elaine Raybourn recently delivered to DARPA

By Chris Burroughs

Some 20,000 soldiers a year may soon be trained in interpersonal skill building and cross-cultural awareness using a videogame recently developed by researchers from Sandia and BBN Technologies.

Funded through the Defense Advanced Research Projects Agency (DARPA), the nine-month project resulted in the creation of an adaptive thinking training methodology that prepares warfighters for difficult situations in places such as Afghanistan and Iraq, says project lead and scientist Elaine Raybourn (6341).

"We are talking about training for nonkinetic engagement — interpersonal communication, negotiation skills, and interpersonal rapport," she says. "The goal is to make soldiers better thinkers and communicators under stress."

Elaine and her team recently delivered DARPA's "DARWARS Ambush NKI" to the Program Executive Office for Simulation, Training, and Instrumentation (PEO-STRI), which will distribute the enhanced system to the Army and eventually the other armed forces.

The training tool is conceptually similar to an earlier multiplayer simulation game she developed several years ago. That same game is currently used by members of the US Army Special Forces to hone their skills in adaptive thinking, negotiation, conflict resolution, and leadership in cross-cultural settings. The Special Forces' game is being used to train soldiers on a regular basis at Ft. Bragg in North Carolina. (See "Game wins award" at right.)

Like the first game, the new one developed for DARPA will allow as many as 64 people to play on networked computers. Instructors can easily modify or create scenarios, monitor training, and jump in and change the direction of the game at any time.

Participants serve as either role-players or evaluators. Their tasks and experiences vary according to their role.

Elaine says DARPA came to her seeking help in building the new game after it became aware of the one she developed for the US Army Special Forces. DARPA already had a training game in the works designed by



COGNITION SERIES



A USER TESTS the new interpersonal skill building and cross-cultural awareness videogame technology Sandia researcher Elaine Raybourn and her team enhanced and recently turned over to DARPA.

BBN Technologies. That game had a strong kinetic focus on physical aspects that could go wrong, such as improvised explosive devices going off or a convoy being ambushed.

"DARPA also wanted a nonkinetic adaptive thinking piece for the soldiers, to learn how to negotiate with tribal leaders, for example," Elaine says. "When things go wrong, troops have to learn to shift how they think in environments that are potentially dangerous."

A major enhancement made by Elaine to the existing DARPA system was the addition of a peer/expert evaluation element, she says.

"I found Elaine's idea of using a set of soldiers as observers and assessors particularly innovative and hope the Army can adopt it with its digital training tools," says Ralph Chatham, former DARPA program manager who selected Elaine to work on the project. "The Army is the only big organization in the world that has institutionalized introspection in their after-action review process [AAR]. Sergeants can talk back to lieutenants in an AAR, and both are pleased with the process. That part of the ATL [Adaptive Thinking and Leadership] simulation game Elaine and the team produced fits the Army perfectly."

Elaine estimates that the number of people who could be trained with the DARPA-sponsored game could be "huge." PEO-STRI is putting the nonkinetic modules on its website where it will be available free to all US military services and government.

The nonkinetic modules are comprised of a socio-cultural overlay for a geographical area that is linked to key events and roles of host nation civilians.

Team members who contributed to designing the roles include subject-matter experts from the Fort Lewis Battle Command Training Center in Fort Lewis, Wash.; Pravin Rajan, a US Marine (formerly 6724); and Alan Rolli, former US Army (6341). Elaine says that creating a serious game is "truly a collaborative effort that often involves pulling together a distributed, virtual team of industry, military, and government partners, just to name a few." Game design teams often represent diverse cultural orientations and face the same challenges encountered by trainees.

"We hope this training will help soldiers better understand the cultural environments they are exposed to and better handle difficult situations," Elaine says.

Game wins award

A multiplayer simulation game developed by Sandia researcher Elaine Raybourn that is being used by members of the US Army Special Forces was recently awarded the New Mexico Information Technology and Software Association's 2007 Excellence Award for Best Solution in the area of innovative research.



The simulation uses

computer game technology to train Special Forces soldiers in critical skills and allows players to discover their strengths and weaknesses in mental agility, cultural awareness, interpersonal adaptability, and communication.

The research was performed as part of the Defense System and Administration Strategic Management Unit (SMU) headed by VP 5000 Jerry McDowell. The award event, held Nov. 15, was sponsored by the *New Mexico Business Weekly*, News Radio 770 KKOB-AM, and Sandia.

Jay Keasling discusses synthetic biology during Truman lecture

By Chris Burroughs

When Terry Michalske, director of Biological & Energy Sciences Center 8300, introduced Truman lecturer Jay Keasling to an audience at the Steve Schiff Auditorium in December, he referred to him as a "scientific pioneer inventing a new field."

And Keasling, named *Discover* magazine's 2006 Scientist of the Year, spent an hour and a half during the lecture demonstrating the truth of this statement as he shared his discoveries in the emerging science of syn-

Truman Lecture series

In 1949 President Harry S. Truman charged Sandia National Laboratories with the responsibility for performing "... exceptional service in the national interest." To celebrate the accomplishment of unparalleled excellence in science and engineering, Sandia honors the memory of President Truman with a series of distinguished lectures.

The series brings in lecturers who have made meaningful contributions to technology, science, engineering, business, or public policy in the national interest. These individuals are selected from the business community, academia, or the public sector. They are at the forefront of their fields.

Each distinguished lecturer receives a personalized, custom-designed President Harry S. Truman Distinguished Lectures medallion.

Norm Augustine, chair of the National Academy of Sciences committee on the future of American science and technology and former CEO of Lockheed Martin, will be the next Truman lecturer in April.

thetic biology, a field that is already contributing to major breakthroughs in medicine and energy.

Keasling is a professor in the Chemical Engineering and Bioengineering departments at the University of California, Berkeley; director of the Physical Biosciences Division at the Lawrence Berkeley National Laboratory (Berkeley Lab); director of the Berkeley Center for Synthetic Biology; and CEO of the recently announced DOE Joint BioEnergy Institute (JBEI) for biofuels research.

As described by Keasling, synthetic biology is a way to remove entire biosynthetic pathways to the genomes of organisms to get them to produce better drugs, materials, and fuels.

The bioscientist spent the first part of his lecture explaining how he used synthetic biology to develop an ultra-low-cost source of artemisinin, the active ingredient in modern antimalarial drugs.

He said that for 400 years the drug of choice for treating malaria — a mosquito-borne disease that annually sickens nearly 500 million people living in the tropics and subtropics and kills 1.5 million, primarily children — was quinine. But malarial parasites become resistant to it, making quinine no longer effective,

much like some antibiotics.

In the 1970s scientists rediscovered an ancient Chinese malaria remedy found in the plant *Artemisia annua* that Keasling described as a "miracle." It not only eases the burning fever and severe pain that accompanies malaria, it completely cures the disease.

Current drugs made from the plant are expensive, in the range of \$2.40 a dose — which might as well be several thousand dollars to poor people in Third World countries. Using synthetic biology, he discovered a way to extract the genes responsible for making artemisinin, transplant them into a harmless strain of *E. coli*, and use that to develop a medicine that cures malaria at a cost of 25 cents a dose.

Three years ago Keasling was awarded a \$42.6 million grant from the Bill and Melinda Gates Foundation that enabled him to further his research.

"The science is done," he said. "Now we want to get it out and are looking for a pharmaceutical company to manufacture it."

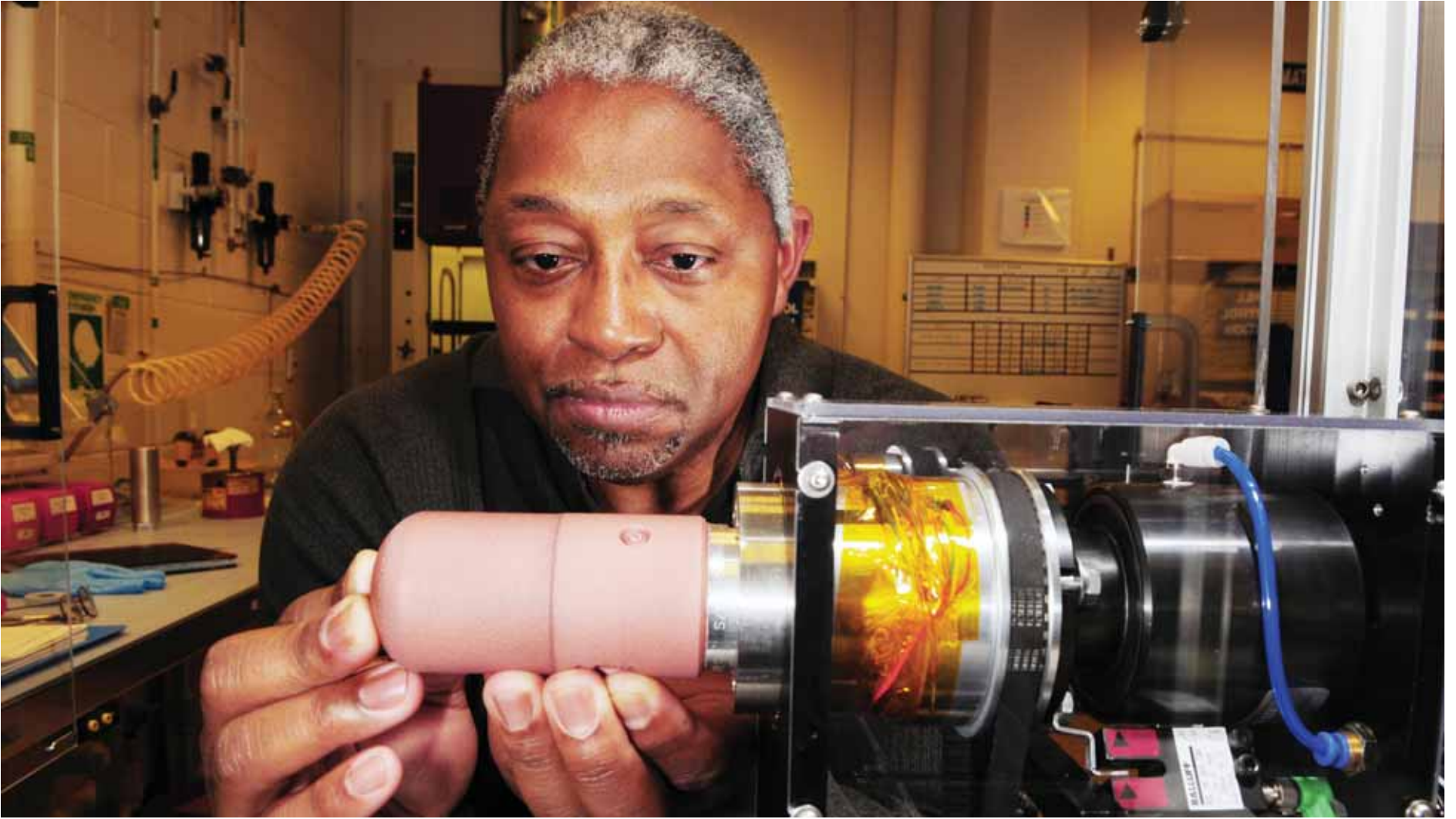
Keasling said his new endeavor is to use synthetic biology to create better biofuels — liquid fuels derived from the solar energy stored in plant biomass. He is seeking ways to reengineer plants' intertwined networks of lignin and cellulose to make it easier for microbes to break them down and eventually convert them into biofuels. He said there are better biofuels to make than ethanol.

This is one idea to be explored at the newly formed JBEI, where research will focus on biofuels. Keasling serves as the center's CEO. Sandia is a participating institution of JBEI, along with Berkeley Lab — the lead laboratory — and the University of California campuses in Berkeley and Davis and Stanford University. The center is expected to receive \$125 million in DOE funding over its first five years.

"Synthetic biology gives us the tools to do this bio-fuel research," Keasling said.



JAY KEASLING speaks at Truman lecture. (Photo by Bill Doty)



ALL HANDS — Moses Jones (2712) installs a neutron generator subassembly that will be marked with a unique identification number. The efforts of weapons program workers throughout the Labs were lauded by Labs Deputy Director for Nuclear Weapons Joan Woodard during an all-hands meeting last month. In addition to citing the Nuclear Weapons Strategic Management Group's successes and milestones over the past year, Joan offered a fresh perspective on Sandia's nuclear weapons program, discussing the need for transformation and the challenges that entails. (Photo by Randy Montoya)

Nuclear weapons program all-hands meeting highlights challenges, change in store for vital Sandia mission

By Stephanie Holinka

The 2007 all-hands meeting of Sandia's Nuclear Weapons Program was all about change.

Deputy Labs Director for Nuclear Weapons Joan Woodard opened the meeting with a metaphor. Speaking in a video produced for the occasion, Joan noted that her son used to play with those familiar toys called "transformers." Like those transformer toys, Joan said, Sandia must make bold changes, transforming itself into a swift and lean entity better able to respond to the country's 21st century nuclear deterrent requirements.

The meeting's opening video montage featured key people from Sandia, all talking about the changes they expect to see in the next few years. Sandia Div. 8000 VP Paul Hommert said President Bush has asked for "smaller numbers in the stockpile, and supporting that [request] requires a different makeup of the complex." Butch Cox, Sandia senior manager detailed to the Office of Transformation in Washington, said the complex must now be "smaller, more efficient, and more affordable in the long term," yet still have "all the required capabilities to maintain the nuclear deterrent."

Joan noted that, consistent with the Labs' 2007 strategic plan, Sandia is working closely with NNSA to define the 21st century nuclear weapons complex and to clarify Sandia's role for the future.

She noted in particular how Sandia's long-standing role as weapons systems integrator has uniquely positioned the Labs to assist NNSA as it considers the systemic aspects of complex transformation

Joan praised the effectiveness of the new Strategic Management Unit\ management structure, which divides the SMU into four strategic areas. Each area is led by a VP, who works with a principal program director who coordinates nuclear weapon programs with headquarters and within Sandia.

She discussed the ongoing work with the military on projects like the Mark V fuze study in support of the Navy and the work with the Air Force on fuze systems for life-extension projects.

This year, Sandia has become the first complex entity to make substantial progress toward removal of its Category I and II special nuclear material (SNM),

Joan said. The NNSA program to consolidate SNM at fewer locations is intended to better manage the substantial costs associated with securing and working with these materials.

The Preferred Alternative

Joan said that NNSA's "Preferred Alternative for Complex Transformation" seeks a mindful approach to complex transformation. The overall goal is to streamline and reduce redundancies in the complex, to con-

solidate special nuclear material in the complex (see above), and to revitalize critical resources — including the environmental testing facilities at Sandia.

systems integration for nuclear weapons. In order to meet those responsibilities, Joan says Sandia must maintain its active engineering development, modeling/simulation, computing capability, and environmental testing facilities and programs.

In a review of NW accomplishments over the past year Joan noted that, when Sandia's NW mission performance was assessed by NNSA this year, Sandia received a score of 96 on performance objective 3. Specific accomplishments cited for this score were delivery of the W76 arming, fuzing, and firing system and the successful completion of the B61 Alt 357 first production unit. Other notable accomplishments were found throughout the NW program, including in the areas of science, research and development, construction programs (including MESA and ZR), surveillance, manufacturing, process improvement, and the engineering campaigns.

New business models

Sandia's contributions to the Preferred Alternative have resulted in new ideas and notable changes to NNSA's proposal, Joan said. New business models for the California site and for Tonopah both came out of Sandia's clarification of their importance to the nuclear mission.

NNSA's initial strategy, Joan said, was to close the California site. She said that Sandia was able to champion California's role as an essential facility, providing the systems engineering support for Livermore-based designs. She said she hopes that the California site serves as a testbed for developing new business models for "a different type of site stewardship." Similarly, Sandia has proposed an alternate business model for Tonopah and is undertaking discussions with the Air Force.

At the close, Joan talked about the current budget situation in Congress, reminding the audience that Sandia put a good plan into place before the fiscal year started. She says that those plans have been continuously reviewed at every step of congressional action, and will be reviewed when the budget situation finalizes. Joan also emphasized the importance of strategic staffing where the Labs is losing critical skills.

Like the transformer toys her boys used to play with, Joan Woodard said Sandia must make bold changes, transforming itself into a swift and lean entity better able to respond to the country's 21st century nuclear deterrent requirements.

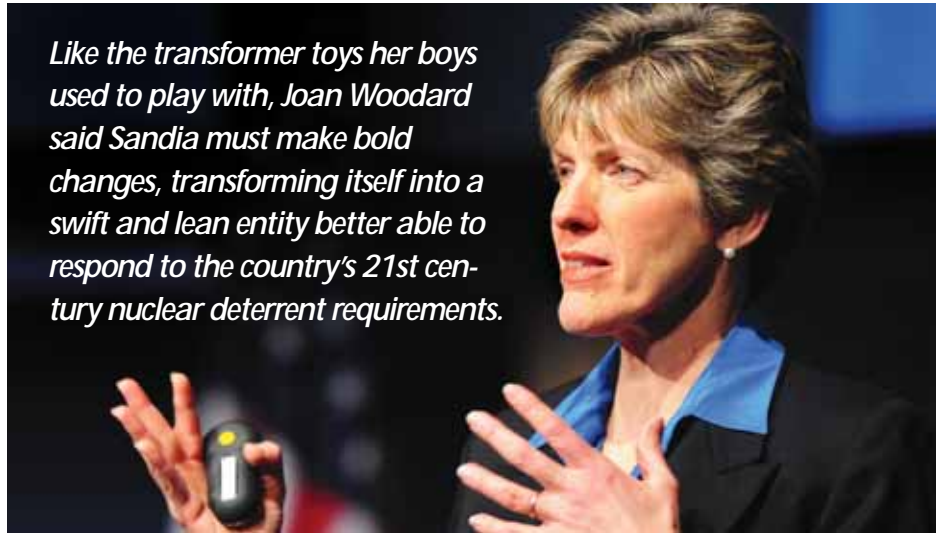
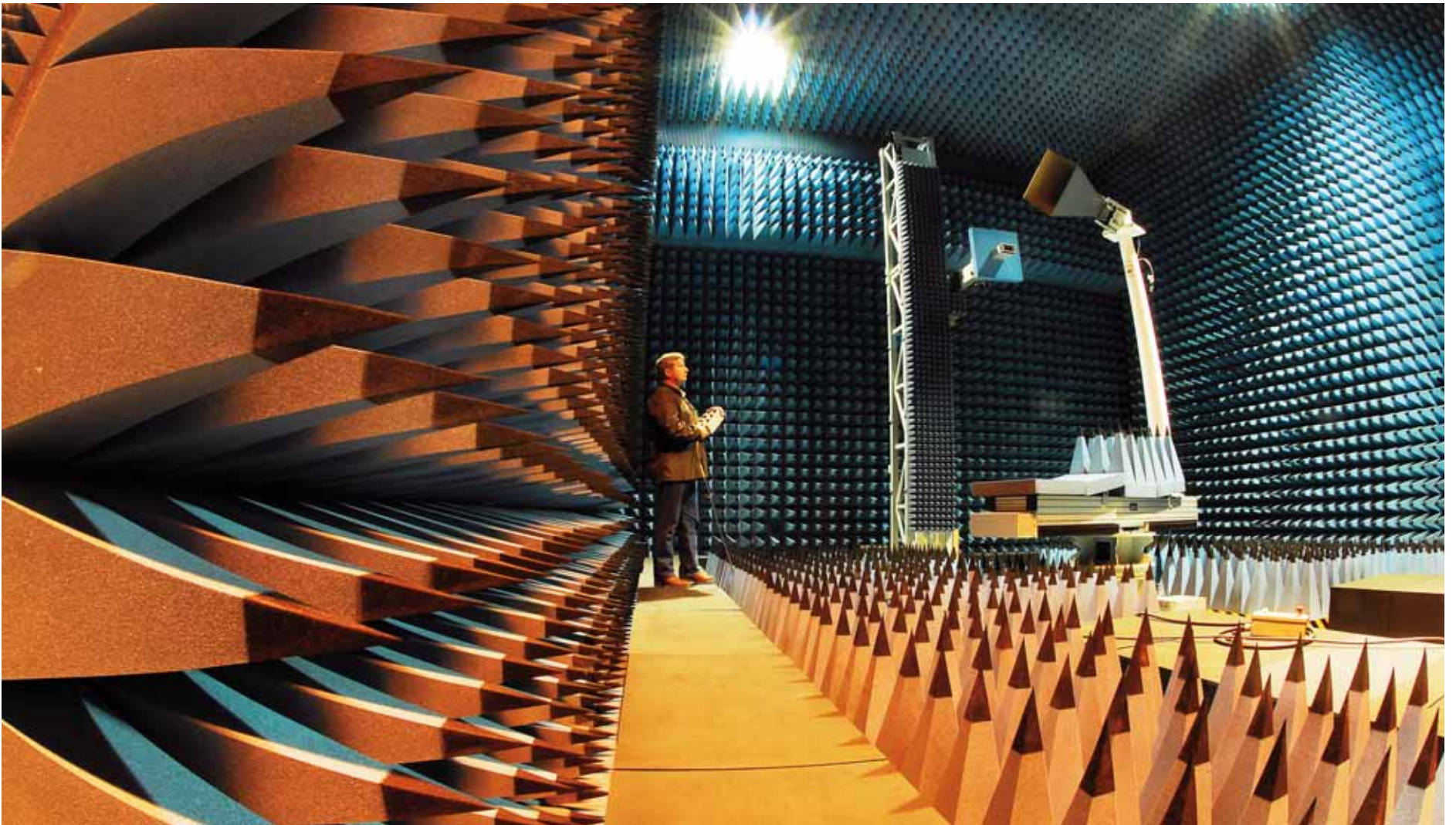


Photo by Randy Montoya

The relationship of testing and modeling

Regarding testing, Joan said Sandia has been demonstrating the relationships between modeling and simulation, which require vast amounts of computing power and physical testing facilities. Because the testing process can be expensive, Sandia's computing capabilities allow it to better plan its physical tests and to maximize the data it derives from each test it performs.

One of the other elements in NNSA's Preferred Alternative calls for Sandia to be the design agent for all nonnuclear design including consolidating all gas transfer system design to Sandia. That means that Sandia is responsible for all nonnuclear design, engineering, and



RANGE MANAGER WARD PATITZ checks out the just-refurbished anechoic chamber at the FARM, the Facility for Antenna and RCS Measurement. The chamber in the photo above is used for antenna characterization and related functions. The wall behind Ward is a partition; on the other side is an even larger chamber that is used to conduct radar cross section measurements. (Photo by Randy Montoya)

Sandia FARM team takes antenna/RCS measurement capabilities to the big leagues

By Bill Murphy

Sandia's Facility for Antenna and RCS Measurement (FARM), centered around Bldg. 9972 in a remote locale near Sandia's solar tower complex, is up and running full bore after a yearlong renovation and upgrade project.

The facility, operated by SAR Sensor Technologies Dept. 5345, features both indoor and outdoor test capabilities. The FARM's mission is to measure antenna characteristics and radar cross sections of materials,

THE ANTENNA/RCS TEAM: Kurt Sorensen (Manager), Steven Allen, Karen Coperich Branch, Billy Brock, Gary Froehlich, Hung "Jacques" Loui, Ward Patitz, Ed Powell, Troy Satterthwait, Matthew Sena, Bernd Strassner II

shapes, and devices ranging from a few inches across to several feet across.

The FARM opened for business more than 20 years ago. It was brought on line to play a key role in DOE weapons programs, as well as to provide RCS analyses for ballistic missile defense applications. The facility has also been a key component in Sandia's development and refinement of synthetic aperture radar systems. Today, in addition to its long-standing applications, the FARM provides antenna and RCS measurement capabilities to a wide range of customers from Sandia, the military, and other government agencies.

The FARM's large anechoic chamber — it measures about 110 feet long by 42 feet wide by 26 feet high, enclosing 21,000 cubic feet — was the focus of major

upgrades over the past year. The temperature-controlled chamber, actually a box within a box, is physically isolated from its host building (9972). It sits on its own isolated slab, with sensitive structures sitting on a shock-absorbing four-foot-thick concrete foundation, providing an environment that is as shock- and vibration-proof as possible. Even the overhead crane in the chamber — newly acquired as part of the upgrade — is not physically part of the chamber.

The FARM's anechoic chamber is covered — floors, walls, and ceilings — by thousands of blue-black foam cones designed to absorb RF transmissions. Those cones, vitally important in providing a suitable environment for RCS and antenna measurements, were upgraded in an improved, computer-modeled configuration, as well.

Other upgrades involved new radar instrumentation, on-site shop facilities, better temperature control, and other improvements.

The FARM's capabilities in a nutshell

- Near-field measurement system (planar, cylindrical, and spherical) for characterization of antenna-gain patterns, RF coupling, and electromagnetic transfer functions
- Broadband, high-resolution compact range for direct-illumination antenna measurements and for monostatic radar cross-section measurements (including low-observables)
- Shielded light-electrical lab for assembly, testing, and operation of electronic instrumentation in an RF-isolated environment
- Broadband, high-isolation measurement chamber for characterization of RF-transmission properties of thin materials and measurement of electromagnetic transfer-functions
- Precision Gaussian-beam measurement system for characterizing millimeter-wave properties of engineered materials
- On-site staff machine shop for custom fabrication or modification of antennas, mounting fixtures, and measurement-related hardware
- Outdoor measurement range with inverted-V diffraction fence and positioner stations at approximately one-eighth and one-quarter mile, for longer-wavelength measurements and/or larger objects
- Outdoor space for special test activities
- Underground rooms (large and small) that can be used for measurements needing reduced coupling to above-ground RF phenomena



ED POWELL (left) and Gary Froehlich mount an antenna for a series of tests at the FARM's outdoor range. (Photo by Randy Montoya)

Did early Southwest Indians ferment corn and make beer?

Sandia research finds data samples from potsherds provocative but inconclusive

By Neal Singer

The belief among some archeologists that Europeans introduced alcohol to the Indians of the American Southwest may be faulty.



TRACING ORGANIC MATERIALS — Sandia researcher Ted Borek examines a potsherd sample for trace evidence that might indicate intentional or incidental fermentation processes. (Photo by Randy Montoya)

Ancient and modern potsherds collected by New Mexico state archeologist Glenna Dean, in conjunction with analyses by Sandia researcher Ted Borek (1822), open the possibility that food or beverages made from fermenting corn were consumed by native inhabitants centuries before the Spanish arrived.

Dean, who conducted her research through her small business Archeobotanical Services, says, "There's been an artificial construct among archeologists working in New Mexico that no one had alcohol here until

the Spanish brought grapes and wine. That's so counter-intuitive. It doesn't make sense to me as a social scientist that New Mexico would have been an island in pre-Columbian times. By this reasoning, ancestral Puebloans would have been the only ones in the Southwest not to know about fermentation."

Not only does historical evidence for fermented beverages exist for surrounding native groups, but people around the world have found ways to alter their consciousness, she says: "Wild yeast blows everywhere." In the Middle Ages in Europe, "Everyone drank ale because the fermentation purified water." Egyptian tombs contained loaves of bread "that we used to assume were to eat, but they're actually dry beer: put bread in water, you get beer."

Closer to home, the Tarahumara Indians in northern Mexico to this day drink a weak beer called tiswin, made by fermenting corn kernels.

Could ancestral Puebloan farmers — whose ancient mud and rock homes have been found in New Mexico, Arizona, Utah, and Colorado — have done the same?

To check her hypothesis, Dean presented Ted with three types of

samples: pots in which she herself brewed tiswin, brewing pots used by Tarahumara Indians, and potsherds from 800-year-old settlements in central New Mexico. The question: Would analysis support the idea that ancient farmers enhanced their nutrition — and perhaps enjoyment of foods — by manipulating wild yeast and corn mixtures centuries before Columbus arrived?

Ted, working under a Sandia program that permits limited use of Sandia tools to aid local small busi-

nesses, used gas chromatography and mass spectrometry (rather than destructive solvents) to analyze vapors produced by mild heating of the pot samples.

From Dean's pots, Ted developed a profile of gases emitted from a known tiswin source. Then he examined Tarahumaran pots to see whether the gaseous profiles corresponded. Finally he examined potsherds that had been buried for centuries to see if the obviously weakened fumes would match, in kind if not in volume, his previous two samples.

Comparing peaks across the three data sets showed the presence of similar organic species, Ted says, though more work must be done before positive conclusions can be drawn.

"We see similarities. We have not found that 'smoking gun' that definitely provides evidence of intentional fermentation. It's always possible that corn fermented in a pot without the intent of the owner," he says, "and that it wasn't meant to be drunk."

Analysis is now underway to highlight patterns of organic species that might provide a more definite, intentional result.

"There appear to be consistencies across the modern home brew and Tarahumara pots," Borek says. "We are currently examining all data to look for markers that would indicate intentional fermentation occurred on archeological articles."

The work opens new, unexpected doors, he says, for understanding the human past by means of gas chromatography and mass spectrometry.

Curt Mowry (1822) is examining data and comparing all sets across the provided references, Tarahumara, and ancient samples.

The equipment used in this study is commercially available hardware, modified by Sandia to investigate traces of organic materials in the ambient air of the Washington, D.C., Metro system and on weapon components and materials.

The results were presented by Ted in a talk at the Materials Research Society fall meeting in Boston last week.

Chris Morgan receives IMPACT! Award

Computer scientist is honored for efforts in getting girls interested in science and engineering

By Chris Burroughs

Efforts to get girls interested in science and engineering through several Girl Scout programs recently earned Sandia computer scientist Chris Morgan (9317) the first annual IMPACT! Award.



CHRIS MORGAN with Girl Scouts at a recent Lego League Regional Competition at the West Texas A&M campus in Canyon, Texas.

The award was presented to Chris by the New Mexico Commission on the Status of Women and the New Mexico Network for Women in Science and Engineering for her role in encouraging and helping women enter and succeed in science, technology, engineering, and math and for promoting networking and communication among women in those careers.

"I find it really important for girls to be exposed to science and math at an early age," Chris says. "It opens up avenues of discovery and exploration that carry into their future and build their self-confidence."

Chris began volunteering with the Girl Scouts 15 years ago when her now 27-year-old daughter was first a member. She established an annual hands-on activity day that focused on math one year (Math Magic) and science (Science Spectacular) the next.

Girls in first through fifth grade were encouraged to attend and visit numerous stations featuring hands-on math or science activities. Many of the stations relied

on science and math educational materials originally developed for teachers.

The first few years were somewhat overwhelming, Chris says. More than 250 girls attended the morning session and another 250 attended the afternoon session of the first daylong event. At this year's Math Magic event, about 125 girls participated at each offering.

"In the years we focus on science we'll have fun activities such as building solar systems, building and testing the aerodynamics of paper airplanes, perusing through archeological dig tanks, and studying the ecosystem of a dragonfly pond," she says. "Math activities might include creating geometric shapes from

paper, math games, or trying to figure out how many paper clips it takes to cross a door horizontally."

She says she can tell that the girls are excited about what they are discovering when she hears one shriek, "I got it," or when another is so engaged in one of the activities that she doesn't want to move on to the next station.

Chris is also the liaison between Sandia and the Girl Scouts for the annual 10-day Girl Scout Fair Play Technology Summer Camp for their tour at the Labs. In addition, she participates in the Labs' mentoring program, supporting younger coworkers and peers in their career growth.

STRATCOM chief Gen. Kevin Chilton visits Sandia



US AIR FORCE GEN. KEVIN CHILTON, commander of the US Strategic Command, pauses during a visit to Sandia, where he received a series of briefings about the Labs' capabilities. Chilton, fourth from left, is joined in the photo above by, from left, Center 6700 Director Sid Gutierrez, USSTRATCOM official Gene Schroeder, Labs Deputy Director Al Romig, Gen. Chilton, Labs Director Tom Hunter, NNSA Deputy Administrator for Defense Programs Bob Smolen, Sandia Site Office Deputy Manager Kim Davis, USSTRATCOM official Ken Callicut, Maj. Lonnie Carlson, and Sandia Div. 5000 VP Jerry McDowell, head of Sandia's Defense Systems and Assessments Strategic Management Unit. (Photo by Randy Montoya)

This month in the past

50 years ago . . . Sandia Corporation's part in the development of the warhead for the "Betty," an atomic depth charge, has been officially announced by the AEC. The weapon is now in the hands of the Atlantic Defense Forces. Design, development, and evaluation of the nonnuclear components of the warhead were carried out at Sandia. The announcement marks the second time that Sandia's name has been officially linked with a specific nuclear weapon. Sandia's Engineering Reactor Facility (SERF)



THE SANDIA ENGINEERING REACTOR FACILITY (SERF) shown in this cutaway model reveals the remote handling facilities used to transport test materials in and out of the radiation cell (center).

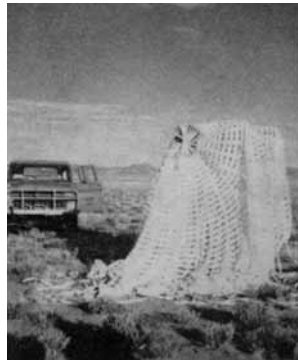
on which construction will begin soon, will have two advanced features making it the only one of its type in existence. These features will be a remote system for inserting or removing samples to be tested while the reactor is running at full power and a large "hot room" in which previously irradiated materials can be moved about by a remotely operated overhead crane system or by an operator riding in a shielded "Mobile Remote Handler" (MRH), equipped with a mechanical arm. The other unique feature of the SERF is that irradiated test components will be analyzed in a large post-irradiation testing chamber, rather than in individual "hot cells" as in other testing reactors.

40 years ago . . . Sandia is studying changes plutonium microspheres undergo during simulated reentry into the Earth's atmosphere because billions of them in the size range of .002 to .01 of an inch in diameter are used in fuel capsules of isotopic generators. These generators will supply some of the electric power for the Nimbus-B weather satellite and the SNAP-27 power source for the Apollo



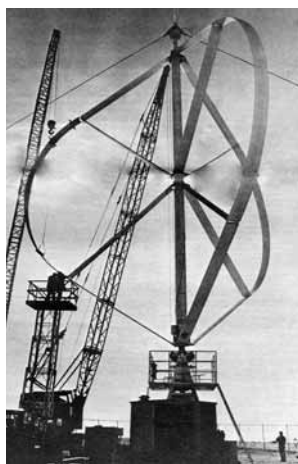
PREPARING TO BLAST A MICROSPHERE of plutonium dioxide in the plasma jet facility in Bldg. 849.

Lunar Surface Package. A Sandia-designed 20-foot parachute established a new national record for dynamic pressure loadings on this size chute when it withstood 5,500 pounds per square foot of dynamic air pressure, or a total of 100 tons, during a recent test at Tonopah Test Range. The previous record of 4,700 pounds per square foot was set earlier last year by Sandia with the same type of chute.



RIBBON CHUTE used in a recent test is shown draped over an instrumentation payload after impact at Tonopah Test Range.

30 years ago . . . Nine months of testing in a two-blade configuration was completed recently at Sandia's experimental vertical axis wind turbine (VAWT). A third blade has been added to the eggbeater-shaped machine, and the project now moves into a new phase of testing. With two blades the VAWT produces 45 kW in a 33 mph wind. With the addition of a third blade, the VAWT is expected to increase output to 60 kW in winds around 30 mph. Sandia's goal in the VAWT project is the development of technology leading to design of high-strength, long-life, low-cost wind machines that can be produced and marketed by private industry. VP Walter Mondale came to see Sandia's solar facilities on Jan. 10. In one hour the VP and an entourage covered the solar facility, the wind turbine, and the central solar test facility (power tower).



A NEW PHASE of testing starts at Sandia's Vertical Axis Wind Turbine Facility with the addition of a third blade.

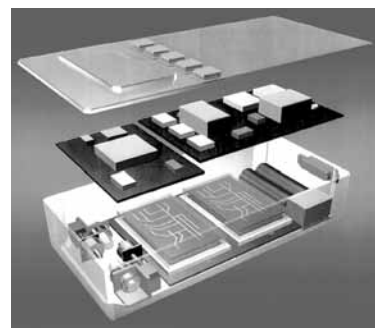
20 years ago . . . In 1983 nine sites for the first nuclear waste repository were identified in six states — Louisiana, Mississippi, Nevada, Texas, Utah, and Washington. In May 1986, the president narrowed the list of sites to be further characterized to three — Deaf Smith County in the Texas Panhandle, the Hanford Site in Washington state,



YUCCA MOUNTAIN straddles the southwest boundary of the Nevada Test Site, which is about 100 miles northwest of Las Vegas. More than 30 geologic and hydrologic exploratory drill holes have been drilled into the mountain. One of the drilling rigs is shown in the lower left.

and Yucca Mountain at Nevada Test Site. Site characterization work has concentrated in those three locations since then. **Congress recently selected Yucca Mountain at Nevada Test Site as the front-runner among possible sites for the civilian nuclear waste repository.**

10 years ago . . . The effort by Sandia researchers to build a self-contained chemistry laboratory in a handheld device received high marks as well as guidance in the project's second review by an independent panel at Sandia/California. The intent is to create a user-friendly analyzer that quickly will characterize chemical agents in both gasses and liquids. Finishing touches were completed to the Center for National Security and Arms Control (CNSAC) building before the area was opened for use. The CNSAC building was dedicated on Aug. 28. Lockheed Martin announced that Al Narath is retiring as president of the corporation's Energy & Environment Sector in Albuquerque. The E&E Sector manages Sandia and several other government labs and projects on DOE's behalf. Robert J. Stevens, president of Lockheed Martin Air Traffic Management, will replace Al Narath, a former Sandia President, as the E&E Sector's president and chief operating officer.



LAB ON A CHIP DESIGN — Top level view shows pushbutton controls and viewing screen; mid level encasements perform (l to r) computation and power management; and bottom (l to r) are pumps, gas and liquid analysis channels, and batteries.

Recognize a remarkable coworker with a nomination for a coveted Employee Recognition Award

The Employee Recognition Awards program is a way for Sandians to recognize individuals and teams whose work or contributions in support of Sandia's mission and values have been exceptional. Take this opportunity to acknowledge a deserving individual or team. Nominations will be accepted from Jan. 8-28.

The ERA program recognizes excellence in four categories: three for individual nominees and one for teams. The individual categories are: **technical excellence**, which recognizes individuals whose innovative science and predictive, science-based engineering capabilities contribute to the transformation of Sandia's business practices and provide solutions to national security problems; **exceptional service**, which recognizes employees distinguished by their commitment and efforts to enable others to succeed; and **leadership**, which demonstrates exceptional creativity, courage, and integrity in leading others to the successful accomplishment of Sandia's work. The team category recognizes teams whose exceptional achievements are critically enabled by teamwork and model the value of people working together toward a common goal.

Nomination forms with detailed instructions will be available from Sandia's internal web homepage or at <http://www-irn.sandia.gov/era/08era.htm>. The website will be available Jan. 8. Each division has an ERA coordinator who is also listed via the link above.

Any current, regular Sandia employee may nominate individuals or teams. A separate nomination form must be submitted for each individual and team nomination. A combined total of 122 individuals and teams will receive corporate Employee Recognition Awards.

ERA individual winners and designated representatives from winning teams will be recognized at the Corporate Employee Recognition Night Banquet, Saturday, July 12.

Manager promotions

New Mexico

Donna Kao from PMLS, Payroll Services Dept. 10502, to manager of that same department.

Donna joined Sandia in August 2005, working as the lead for payroll operations, tax, and control functions. Prior to coming to Sandia, Donna managed various finance groups at Intel and for Bernalillo County. She also worked as a tax auditor for the IRS and the state of New Mexico, preparing financial statements as well as notes to the financials and managed the procurement department for Bernalillo County.

Donna received a BBA in finance from the University of New Mexico and an MBA in human resources from the College of Santa Fe. She is licensed as a CPA.

Alex Roesler from PMTS, NG Design Integration Dept. 2723, to manager, Ceramic & Glass Dept. 2454.

Alex joined Sandia in June 2002 and has worked in pulsed power design for miniature firing systems (2600) and in neutron generators (2700).

Alex received his PhD and MS in electrical and computer engineering from Carnegie Mellon University, and his BS in electrical and computer engineering from the University of Texas at Austin.



DONNA KAO



ALEX ROESLER

Al Beradino from PMTS, Cyber Security Technologies Dept. 9312, to manager, Security Operations Dept. 5997.

Al recently celebrated his 30th service anniversary at Sandia. During his first 10 years, he implemented computer-aided design and manufacturing systems, rapid model making, and a variety of tooling systems to manufacture prototype telecommunications products. Also during this time, he contributed to the machine tool industry in its migration from the international automated programmed tool system to integrated, stand-alone systems. His assignments in the production capability assurance program and advanced design and production technologies contributed to the deployment of product realization throughout the nuclear weapons complex. He has been in the cyber security department for almost a decade, focusing on threat/risk management, self-assessment, and patch deployment.

Al received a PhD in mathematics from St. Louis University.

Charlie Harmon from PMTS, International Border Monitoring Dept. 6753, to manager of that same department.

Charlie joined Sandia in August 1981 working in nuclear reactor engineering and program management.

Charlie is a graduate of the US Army Nuclear Reactor Engineering School.



AL BERADINO



CHARLIE HARMON

Mileposts

New Mexico photos by Michelle Fleming
California photos by Randy Wong



Michael Bukaty
35 5432



Johnny Ellison
30 8518



Laurie Farren
30 8516



Douglas Weaver
40 10710



Stanley Kawka
30 2916



Merri Lewis
30 10265



Joane Maese
30 3012



Wayne McMurtry
30 2611



Sandra Simmons
30 8527



Roger Rizkalla
39 4825



Jerry Smith
35 10827



Anthony Baca
25 4826



Jeff Bobbe
25 5933



Jerome Cap
25 1523



Marty Carr
25 5933



Neill Gilbertson
25 4241



Ken Bell
31 5742



Robert Parson
30 2555



George Greer
25 4825



Michael Hannah
25 301



John Henfling
25 1515



Joseph Henfling
25 6331



William Hensley
25 5342



Peggy Dubois
25 12830



Sharon Walsh
25 9312



Jeffrey Kern
25 5713



Anthony McDonald
25 8331



Daniel Naru
25 9752



Cathleen Ann Reber
25 5765



Walter Rutledge
25 5422



Greg Homicz
22 1541



Heather Tate
15 5933



Mark Brynildson
20 8516



David Gardner
20 5432



Ramona Myers
20 12332



Ruth Boyd
15 9329



Cynthia Burns
15 10507



Nancy Clise
15 12820



Paul McConnell
15 6764



Barbara Meloche
15 6034



Norman Schwers
15 1383



Cassandra Shaw
15 9511



Gregory Shirley
15 5057



Linda Sickles
15 12330



Barbara Williams
15 252



Jeffrey Young
15 2996

Recent Retirees

Determination and attitude, not all the medals, make Jessica Long a true champion

By Iris Aboytes

When she was 13 months old, she was adopted from an orphanage in Russia by Steve and Beth Long from Baltimore, Md. At 18 months both her legs were amputated below her knees. Today at 15 years old, Jessica Tatiana Long is a champion swimmer and motivational speaker.

Cosponsored by Sandia's Disability Awareness Committee and NNSA's diversity initiatives in the area of disability awareness, Paralympic swimming gold medal champion Jessica was at the Steve Schiff Auditorium for a talk on overcoming adversities. "I have missing legs," says Jessica. "I don't have a disability. When I was younger the hardest part was convincing kids that they could not get my disease."

Jessica was born without fibulas, ankles, heels, and most of the other bones in her feet. When Jessica had her legs amputated she started walking by pushing a child's shopping cart. "She required no physical therapy," says her dad. "She has always had a lot of determination."

"I never say I might," says Jessica "I always say I will. I have to work harder to break even, but I am determined enough to make it happen."

She was a very active child and her parents introduced her to different activities — gymnastics, hiking, cheerleading, basketball. Her parents encouraged her swimming because that way she could save her knees. She has been swimming competitively and winning medals for the last five years. "Many times people do not realize I have missing legs until I get out of the

pool," she says.

Jessica is the owner of three gold Paralympic medals, nine world championship medals, and 14 world records. She is also the first Paralympic athlete to win the Amateur Athletic Union (AAU) James E. Sullivan Award presented to the USA's best amateur athlete.

The Paralympic Games are a multisport event for athletes with physical, mental, and sensorial disabilities. This includes amputees and those with mobility disabilities, visual disabilities and cerebral palsy. The Paralympic Games are held every four years, following the Olympic Games. The Paralympic Games are sometimes confused with the Special Olympics, which are only for people with intellectual disabilities.

Jessica has five sets of prostheses that she uses at different times. She says she has a cool pair of legs that



CHAMPION SWIMMER and motivational speaker Jessica Tatiana Long shows off one of her favorite prosthetic legs. (Photo by Randy Montoya)

are mostly yellow with a splash of green. She even has a pair with adjustable ankles that allow her to wear high heels. She says they have lifelike toes that can be painted.

She would like to write a book about her life. She says there are many chapters to be written. "Think about it," she says, "You may not get what you want, but you always get what you expect. You make a choice to rise above."

"God has a plan for my life," says Jessica. "Things always happen for a reason. He gives me the strength to be what I want to be."

She says she would not mind being a model like Tyra Banks in the future, or studying nutrition or dermatology, but for now Jessica and her family have their reservations

Sanado Woman's Club was Sandia's personal welcome wagon

By Iris Aboytes

Hats and gloves were the style of the day. Fashion shows with extravagant productions were held. Sanado debutantes were introduced at one of two elaborate formal balls. Sanado Woman's Club, which recently celebrated its 50th anniversary, has a history of all this and more.

Sanado Woman's Club was formed at the suggestion of James McRae, then president of Sandia Corpo-



STYLE OF THE DAY — Ladies show off the latest in style at one of many fashion shows held in the Coronado Club by the Sanado Woman's Club.

ration, as a social club for many Sandia wives. The organization was named Sanado Woman's Club — the "San" coming from Sandia, the "ado" coming from the Coronado Club, which opened on base in 1958. At one time, Sanado was the largest women's club in the state with more than 500 members. Both the *Albuquerque Journal* and the *Albuquerque Tribune* covered the club's monthly events. Most of the members in the early years had young children. Sandia made it possible for women to use the Sandia Base

nursery for about 40 cents an hour so they could attend the various events. "There was lots of bonding," says former president Pat Goettsche. "Our children grew up together. We all became friends."

Pat Millsap, who joined Sanado in 1959, says, "It was a life-saver for me because it put me in contact with people and activities to alleviate the feeling of isolation I had. We lived in an apartment building across the street from the Coronado Club. At that time, many employees lived on base and shopped at the commissary."

One of the events Pat remembers best is when Mr. Blackwell (famous fashion critic) was a special guest. He called one of the members onstage and critiqued her appearance. It was cruel, but she was a good sport. He later sent her a dress he had designed.

Carol Larson, who was president from 1978 to 1979, says she especially remembers sitting next to Sen. Pete Domenici at a special luncheon.

"All of our meetings were held at the Coronado Club," says another past president, Millie Tjeltweed. "The club had a large ballroom, catering facilities, and a stage — everything needed to accommodate luncheons for a large group. Luncheons were only \$1.75."

Members were notified of the programs by newsletter. Interest groups included: art, arte de cocina, bowling, bridge, quilting, choral, gardening, golf, horseback riding, skiing, social living, and tennis. Today there are five interest groups — books, bridge, quilting, and Arte de Cocina II and IV.

In 1973 Sanado coordinated the Le Grande BAL International for the foreign ambassadors, balloon contestants, and other dignitaries and visitors attending Balloon Fiesta. The event was held at Albuquerque's convention center ballroom with a gondola large enough to hold the dance band.

"Although Sanado membership is much smaller today, the club is still very active," says President

Cherry Swartz. "Lifelong friendships were made through this wonderful club, and it still provides a welcoming and friendly atmosphere for new members." Membership is no longer limited to wives of Sandia employees.

In honor of its anniversary, the club recently published its second cookbook, with proceeds going to Meals on Wheels and Barrett House.

For more information on the Sanado Woman's Club contact Cherry Swartz at swartz2@flash.net or 867-6767.



MR. BLACKWELL

TVC accepting business plans

Technology Ventures Corporation is currently accepting business plans and executive summaries for technology companies/startups interested in presenting at the 2008 Equity Capital Symposium. For the past 15 years the Equity Capital Symposium has served as a vehicle to connect growing or expanding technology companies with investment opportunities.

This year the New Mexico Equity Capital Symposium will be held May 14-15 in Albuquerque. TVC project managers are currently soliciting business plans or executive summaries from New Mexico technology

companies and entrepreneurs. Preference will be given to those opportunities that are based on technology developed by or with one of the national laboratories or research institutions in New Mexico.

According to venture capitalist Len Rand, the symposiums are an effective tool. "I've been to several of these and they are both an excellent source of leads and a great chance to interact with quality entrepreneurs," he says.

Interested companies should contact TVC or a TVC project manager now for assistance with their business plan development. Contact information is:

- Technology Ventures Corporation
1155 University Blvd SE
Albuquerque, NM 87106
- www.techventures.org/whatwedo/submit.php
- For more information call 505-246-2882

