

July 4, 1776

"We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness."



THE SOUND OF INDEPENDENCE — The USAF Thunderbirds team soars into the desert air above Albuquerque during a 2006 air show at Kirtland Air Force Base. *Lab News* photographer Randy Montoya captured this striking image of the F-16s with contrails streaming and just a hint of the moon in the background.



Elected officials, community leaders, family, and friends — lots of friends — turn out to honor New Mexico native son Pete Domenici as he winds up a 36-year career in the US Senate. See the photos and story on **page 8**.

Sandia LabNews

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Managed by Lockheed Martin for the National Nuclear Security Administration

NNSA vision articulates broader role for labs in US national security issues



Sandia takes three R&D 100 awards

Wide range of applications honored

By Neal Singer



Every 12 months, teams of experts selected by Chicago-based *R&D Magazine* name their choices of the year's 100 most outstanding advances in applied technologies.

Sandia researchers — competing in an international pool that includes universities, private corporations, and gov-

ernment labs — this year were selected for three of those hundred awards.

These were for the Xyce™ Parallel Electronic Simulator 4.0.2., submitted by Eric Keiter (1437); the Silicon Micromachined Dimensional Calibration Artifact for Mesoscale Measurement Machines, submitted by Hy Tran (2541); and the Superhydrophobic Coating, submitted by Jeff Brinker (1002). (For the names of all researches, see "R&D 100 team members" on page 2.)

"This is yet the latest example of how the Department of Energy and our national laboratories are continuing to demonstrate world-class leadership in innovation as we enhance our energy security, national security, and economic competitiveness," Energy Secretary Samuel Bodman said. "On behalf of the Department, I would like to congratulate all of our employees who have earned R&D 100 awards and in particular this year's winners."

Simulating extremely complex circuits

Xyce™ is the world's first analog tool capable of full simulation of large digital circuit systems

(Continued on page 2)

NNSA, its national labs, and the Nevada Test Site have articulated a new vision statement in which the science, technology, and engineering capabilities developed largely to address Cold War strategic demands will serve a broader national security mission in the future.

This evolutionary vision recognizes that NNSA's roles in nuclear nonproliferation and nuclear counterterrorism are growing and, through agreements with other federal agencies, the laboratories can and do contribute to national security more broadly than

To respond to the evolving 21st century global security threats, NNSA will bring our science, technology and engineering enterprise to bear on solving large, urgent national security challenges.

— NNSA Administrator Thomas D'Agostino

in the past (see "A future vision for NNSA national security laboratories" on page 4).

This new direction has been endorsed by DOE Secretary Samuel Bodman and was developed by him, NNSA Administrator Thomas D'Agostino, DOE Undersecretary for Science Raymond Orbach, Lawrence Livermore National Laboratory Director George Miller, Los Alamos National Laboratory Director Michael Anastasio, Sandia National Laboratories Director Tom Hunter, and Stephen Younger, president and general manager of



(Continued on page 4)



Truman Fellows named

After a nationwide search, Patrick Hopkins and Bryan Kaehr have been selected as Sandia's 2008 Truman Fellows. They join eight other Fellows who have been appointed since the program was established in 2004. See story on **page 4**.



Power to save the world

At a recent Tech Symposium, author Gwyneth Cravens and retired Sandian Rip Anderson talked about the promise of nuclear energy — both as a way to address the nation's energy security and as a way to slow the pace of global climate change. See story on **page 5**.

That's that

I don't know if you had a chance to go to the recent Tech Symposium (that's a fantastic program by the way) that featured writer Gwyneth Cravens and retired Sandian Rip Anderson talking about nuclear power. Cravens, author of *Power to Save the World: The Truth About Nuclear Energy*, and Rip, an expert in probabilistic risk assessment and nuclear and environmental health and safety, made a compelling case for the benefits of going nuclear. Their case was bolstered by an impressive array of facts (see story on page five).

And that reminded me of the oft-cited comment from John Adams: "Facts are stubborn things; and whatever may be our wishes, our inclinations, or the dictates of our passion, they cannot alter the state of facts and evidence."

As I watched the streaming video (I wasn't able to get to the Schiff Auditorium on the day of the presentation) I kept wishing that every policy maker in the nation — heck, every citizen — could hear Rip and Cravens and their litany of stubborn facts.

* * *

Speaking of John Adams — and that seems like an appropriate thing to do on the Fourth of July — I had the opportunity just in the past couple of weeks to see on DVD the terrific HBO production *John Adams*. I'd highly recommend it, both for its insights and for the remarkable performances by the lead actors, Paul Giamatti as John and Laura Linney as Abigail. (I think the production should rightly have been called *John and Abigail*, so central was her role in the story and in his life as beloved companion, partner, and advisor.) The production was based on the popular biography by David McCullough. I haven't read the book, but I understand it is excellent. (Anything by David McCullough is excellent.)

* * *

One more thing about Adams — something that tells you a lot about the man. That quote I cited above? It was part of Adams' defense of British soldiers accused of murder in the 1770 Boston Massacre. Adams, a passionate believer in severing the colonies' ties to Britain, was even more passionate in seeing justice done, and he believed that a grave injustice was being done to those soldiers, Redcoats or not. In his defense of them, Adams demonstrated convincingly that the soldiers were acting in self-defense. He won the case.

* * *

We've been talking a lot about change around here lately. And that reminds me of a story I heard back when I was first starting out as a newspaper reporter in Bangor, Maine.

It seems there was a gentleman in a small town out in the boonies somewhere who was celebrating his 100th birthday. Well, that doesn't happen every day, so the local newspaper sent a cub reporter out to interview him. The reporter asked all the right questions: What's your secret to long life? Do you remember when there were no cars? How many great-great-grandchildren do you have? Stuff like that. And the old gentleman answered everything in the appropriate way. A shot of whiskey every day. Lots of chopping wood. And so on. Anyhow, the young reporter, feeling like he's established a real rapport with the old-timer, says, "Well, I guess you've seen lots of changes in your day?" And the old-timer suddenly goes ramrod stiff, grabs the youngster by the wrist, looks him in the eye, and says, "Changes? Yeah, I seen lots of changes. And I've been against every one of 'em."

See you next time.

— Bill Murphy (505-845-0845, MS0165, wtmurph@sandia.gov)

R&D 100

(Continued from page 1)

through the use of massively parallel computation, rather than resorting to accuracy-compromising simplifications used by other tools. Given the complexity of large-scale integrated circuits, trial-and-error circuit testing is prohibitive and lower-fidelity digital simulation fails to take effects like parasitic currents and electrical-interconnects into sufficient account. Existing analog simulators are limited to single processor workstations. Xyce, under development at Sandia since 1999, accurately simulates more than 10 million circuit elements on hundreds of processors, far exceeding any other simulation tool. Originally used to help certify integrated circuits in the presence of radiation and other hostile effects, today it also helps the electronics industry create simulations that cope accurately with decreasing feature size and the increasing number of integrated circuit components.

Calibrating production devices

To calibrate a device, an accurate calibration artifact is of primary importance. The Silicon Micromachined Dimensional Calibration Artifact for Mesoscale Measurement Machines has a long title but will help improve measurement accuracy for producing miniaturized devices such as fuel injectors, watch components, and inkjet printer parts as these high-volume parts are being manufactured. The Sandia MEMS-based three-dimensional physical artifact is 10 times more accurate and much less expensive than the former gold (so to speak) standard of patterned chrome on glass — a fundamentally two-dimensional device lacking the ability to be calibrated by high-accuracy methods. The Sandia artifacts, formed through the classic MEMS technology of anisotropic bulk micromachining, have nanometrically sharp, long-lasting crystalline edges that are macroscopically long. Such artifacts can be used to calibrate a variety of inspection systems.

A coating that really, really doesn't like water

A transparent coating that isn't just impermeable to water but actually makes it bounce off a surface has a number of potentially interesting applications. It could prevent corrosion, protect electronics and antiquities, or provide a new, more efficient surface to collect pure water. Modeled from nature — the lotus leaf's micro-craggy roughness and the hydrophobic regions of the Namib Sternocara Desert beetle — the Brinker group used sol-gel chemistry to make a patent-applied-for, simple-to-prepare coating solution that, upon simple drying, develops a nanoscopically rough silicon dioxide surface decorated with hydrophobic (water-hating) ligands. The coating can be applied by any standard method — including spin-coating, dip-coating, aerosol spraying, and ink-jet printing — to any surface regardless of composition, size, and shape. An additional benefit is its nearly perfect optical clarity, important for applications like self-cleaning, non-fogging displays, avoiding ice formation on optical elements, and protecting — in a transparent fashion — culturally important statuary from acid-rain corrosion. Importantly, the contact angle of the water droplet can be patterned with light to vary from a sphere to a pancake and to control whether and where a drop may roll. Competing hydrophobic products on the whole require very complex processing, are often opaque, and are generally substrate-specific. Furthermore, they do not provide optically defined spatial control of the coating's love-hate relationship with water.

Groups led by Brinker have won three R&D 100 awards.

The R&D 100 awards — occasionally referred to as "the Nobel Prizes of technology" — were first awarded in 1963 as the I-R 100s, in keeping with the original name of the magazine, *Industrial Research*.

Many entries over the ensuing years became household names, including Polacolor film (1963), the flashcube (1965), the automated teller machine (1973), the halogen lamp (1974), the fax machine (1975), the liquid crystal display (1980), the full color graphics printer (1986), the Kodak Photo CD (1991), the Nicoderm antismoking patch (1992), Taxol anticancer drug (1993), lab on a chip (1996), and HDTV (1998).

The sole criterion for winning, according to a description released by the magazine, is "demonstrable technological significance compared with competing products and technologies." Properties noted by judges include smaller size, faster speed, greater efficiency, and higher environmental consciousness.

Winners are presented plaques at a formal banquet in Chicago in early fall.

Sandia LabNews

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Xyce™ 4.0.2

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Russo, Keith Santarelli, Richard Schiek, Heidi Thornquist

(all 1437), Nathan Golden (1031), Scott Hutchinson

(5349), Todd Coffey, and Roger Pawlowski (both 1414)

Retiree Deaths

Kathleen Wilson (age 97) March 29

Mildred A. Hooker (83) March 9

Wallace F. Boyes (86) April 3

Floyd C. Elder (76) April 3

Philip A. Gelt (85) April 5

James W. Hook (95) April 6

Ellera J. Corwin (90) April 8

Hugo R. Koski (82) April 9

Mary W. Davenport (88) April 9

Donald H. Emrick (87) April 12

Mary E. Ryan (78) April 12

Dorothy M. Bliss (80) April 15

Robert E. Perryman (81) April 16

Harry A. Gelwicks (96) April 21

William D. Huff (81) April 21

Olivia Viola Geffe (91) April 24

Barbara Walker dances her way to health

By Patti Koning

The audience at the California Site Diversity Talent Show last month was treated to a dazzling exhibition of ballroom dancing by Barbara Walker (8755) and her partner Sergei Shor. While the fancy footwork and grace of the pair was mesmerizing, the back story of how Barbara began dancing and where it has taken her is even more fascinating.

Eighteen months ago, she never would have imagined that she'd be dancing in front of a packed auditorium — or that she'd be in the best physical shape of her life.

"When I look back on it, it's really a miracle in a number of ways. For about five years I suffered from fibromyalgia. It got rather acute, to the point where I was in pain all the time," Barbara says.

According to the American College of Rheumatology, fibromyalgia is a clinical syndrome defined by chronic widespread muscular pain, fatigue, and tenderness. Barbara describes the disease as deep tissue muscle pain.

"When I first started having it I thought there was something wrong with my bones because it is that deep," she adds. "My body had accumulated a lot of inflammation. Just walking around was difficult."

In March 2007, she met with a dietitian who specialized in fibromyalgia. The dietitian recommended she try a gluten-free and limited-sugar diet. "Within a week's time, I felt a difference in my health," recalls Barbara. "I immediately started losing weight — something I'd struggled with for over 30 years."

The dietitian also instructed her to find exercise she would do regularly and enjoy. Barbara says she'd worked out in gyms for years and the thought of it bored her to tears. She'd enjoyed the dance lessons she'd taken as a child and had always wanted to learn ballroom dancing, so she enrolled in lessons at Livermore's It's All About Dancing.

Turns out, Barbara has a natural ability for ballroom dancing. Soon she was training for a dance competition



BARBARA WALKER and her dance partner Sergei Shor dazzle the audience at the California Site Diversity Talent Show.

with Shor, an instructor at It's All About Dancing and the son of owner Sasha Etchelecu. The pair won two first-place awards for the rumba and cha cha at the Hawaii Star Ball competition last October.

"Their performance was amazing," says Etchelecu. "Barbara definitely has a talent for dancing. She feels the music very well."

But the improvements in Barbara's health mean more to her than any award. "The real exciting part is that I used to be on medication to regulate my cholesterol and blood pressure and to control pain. I take none of that anymore. My cholesterol and blood pressure are back to normal. I do have to take the pain medication occasionally, but that's becoming less frequent," she says.

Barbara's health regime is not easy. She dances four nights most weeks and attends yoga classes twice a week at the Life Design Center at the California site. She also trains with fitness trainer Emily Thompson (8527) twice a week. "I'm in the best shape of my life," she says. "I can dance for three hours straight."

A gluten-free diet means no wheat, barley, rye, or related grains — essentially no bread, pasta, cookies, or anything else made with those ingredients. Gluten is frequently an ingredient in a wide variety of products, including salad dressing, soy sauce, sour cream, ice cream, cold cuts, and even some lipstick, postage stamps, medications, and vitamins.

Barbara eats mostly fruits, vegetables, dairy products, and meat. She also cut out all soda and limits sugar as much as possible, something she admits is a constant struggle. Between diet and exercise, she lost 45 pounds in about six months.

"I have been interacting with Barbara for a few years now and I have witnessed her steadily reclaim her health. She never gave up on herself, in spite of great obstacles and pain," says Morgan Edwinson (8527), preventative health educator and program coordinator for the California site. "She is now reaping the benefits of her courage and commitment. She looks great, feels great, and is free to enjoy activities like dancing and yoga. It is a beautiful thing to see."

Barbara's advice for anyone struggling with their health is that you can be surprised. "I would have never thought 18 months ago that I'd be doing today what I am doing. Life can bring surprises. I didn't have any clue that there were answers out there for me, but I kept looking," she says.

Sandia's Jim Handrock on special assignment to D.C. to work with NNSA

By Mike Janes

Special assignments to Washington, D.C., while not exactly a dime a dozen, are fairly common to Sandia. But there's nothing ordinary about Jim Handrock's special assignment to NNSA.

Jim (8230) was recently appointed deputy science advisor to Gen. Robert Smolen, who serves as deputy administrator for Defense Programs at NNSA's NA-10. NA-10 oversees all nuclear weapons complex activities for NNSA and funds the three weapons labs, four production facilities, and the Nevada Test Site. Jim's assignment marks the first time since the late 1990s that a Sandian has had the opportunity to play such a direct and influential role at NNSA's NA-10 D.C. office.

It was Jim's experience in the weapons program, says Div. 8000 VP Paul Hommert, that led to his selection. "The two decades Jim has spent in nuclear weapons made him a natural fit," says Paul.

Jim has been engaged in various weapons activities at Sandia's California site for some 20 years, including gas transfer systems, structural analysis, reliability, electrical modeling and simulations, and scientific computing. More recently he has served as a deputy director for Directed Stockpile Programs and senior manager of Stockpile Systems and Gas Transfer Systems. He also spent a year as the deputy to previous Div. 8000 VP Mim John.

The specific job he'll be performing, says Jim, is evolving but will include at least two major areas. He, along with lead Science Advisor Greg Simonson (Lawrence Livermore National Laboratory) and Deputy Science Advisor Jeff Paisner (Los Alamos National Laboratory) will be developing a long-term science, technol-



JIM HANDROCK

ogy, and engineering road map that gazes into the future of NNSA. Though still in its very early stages, the plan is a top priority and will engage Jim and other members of the NA-10 leadership team.

Jim has also been asked by Gen. Smolen to serve on a team that will closely examine the NNSA complex and look at the ways in which sensitive, classified weapon parts are monitored and managed. "Jim has visited nearly all NNSA complex sites during his career," Paul points out, "so his experience will prove valuable in that regard."

Corey Knapp, director of National Security Engineering Center 8200, agrees. "Jim brings a breadth of engineering experience, which includes component design, computational simulation, and program management, which gives him a perfect background to perform this important assignment," Corey says.

It's highly likely, Jim says, that he'll be asked to be a part of other NA-10 activities during his special assignment, such as those involving Complex Transformation. In addition, the NA-10 "Innovator Team" — which provides insights into key NNSA initiatives and changes — has already invited Jim to serve as an ad hoc member.

Though Jim says he's experiencing a bit of "separation anxiety" from leaving Center 8200, he feels the new assignment will help round out his Sandia career. "An assignment to D.C. is one thing I've missed out on, and this will fill that void," says Jim. "Even more important, having laboratory representatives working directly for NA-10 should be a huge benefit to the complex." Jim says his family, too, is looking forward to the move, especially his wife, a teacher who has never been to the nation's capital.

Jim's new assignment has technically already begun, but he's looking forward to finding a permanent place to live and getting settled. "It's not much fun living out of a suitcase," he says.

For more information on gluten sensitivity and intolerance:

Gluten Intolerance Group
<http://www.gluten.net/>

For more information on fibromyalgia:
<http://www.fmaware.org/>

Gluten intolerance

Gluten is the name given to the proteins found in wheat, barley, and rye that are responsible for giving bread structure. Although oats do not contain gluten, the milling process often exposes them to it. Gluten intolerance (celiac disease, which affects one in 133 Americans) is an intestinal disorder in which the body's immune response to gluten damages the walls of the small intestine. The resulting malabsorption of nutrients leads to diarrhea and/or constipation, gas, bloating, vomiting, weight loss, anemia, chronic fatigue, weakness, bone pain, and muscle cramps. Complete restriction of gluten is necessary to treat and control gluten intolerance; deciphering nutrition labels becomes extremely important. In addition to wheat, barley, rye, and possibly oats, foods that contain gluten include:

- Emulsifiers (most commercial salad dressings and mayonnaise)
- Stabilizers (chocolate milk)
- Thickeners (meatloaf, hotdogs, soups, sausages)
- Flour
- Food starch
- Hydrolyzed vegetable protein
- Malt
- MSG

If you suspect you have gluten intolerance, see your doctor. Screening includes blood tests and biopsies of the small intestine.

Sandia California News

Everyone's reading about JBEI

Two articles on the Joint BioEnergy Institute (JBEI), published in *ACS Chemical Biology* and written by members of the DOE JBEI leadership team, are among the most-accessed *ACS Chemical Biology* articles for the first quarter of 2008. "Synthetic Biology for Synthetic Chemistry" heads the list of most-accessed articles, while "Addressing the Need for Alternative Transportation Fuels: The Joint BioEnergy Institute" is fifth on the list.

"Synthetic Biology for Synthetic Chemistry" was written by Jay Keasling, JBEI's chief executive officer and the director of the Physical Biosciences Division at Lawrence Berkeley National Laboratory (Berkeley Lab). The article discusses the intersection of synthetic biology and synthetic chemistry in creating new energy sources, producing new drugs, and remediating polluted sites. The article reviews some of the most important tools for engineering bacterial metabolism and the use of these tools to produce artemisinin, an antimalarial drug, at a low cost.

Sandia's Blake Simmons (8755) is a coauthor of "Addressing the Need for Alternative Transportation Fuels: The Joint BioEnergy Institute." The other authors are Harvey Blanch (University of California, Berkeley), Paul Adams (Berkeley Lab), Katherine Andrews-Cramer (ChemGenuity), Wolf Frommer (Stanford University), and Keasling. This article examines the potential of biomass as a renewable resource for high-energy-content transportation fuel and the possibility that this fuel may be carbon neutral over its complete life cycle.

Blake, who serves as vice president of JBEI's Deconstruction Division and heads up the Energy Systems department at Sandia/California, describes this accomplishment as "more good news on JBEI, indicating that interest is very high in the ongoing research programs at this DOE-funded institute."

For more information on JBEI, see the article "Sandia to play key role in Bay Area-based DOE bioscience center" in the July 6, 2007, issue of *Sandia Lab News*, or visit www.jbei.org. To see the full list of most-accessed articles, go to <http://pubs.acs.org/journals/promo/most>, and choose "ACS Chemical Biology."

Nano, bio research contributions by Labs' 2008 Truman Fellows will boost Sandia, nation

By Bill Murphy

After a nationwide search, researchers Patrick Hopkins and Bryan Kaehr have been selected as Sandia's 2008 Truman Fellows. They join eight other researchers who have been appointed since the President Harry S. Truman Fellowship in National Security Science and Engineering was established in 2004.

Patrick earned his PhD in mechanical and aerospace engineering at the University of Virginia in May 2008. His dissertation title was "Scattering processes affecting thermal boundary conductance solid-solid interfaces in nanomaterial systems."

During his Truman fellowship, Patrick will examine "Interfacial electron and phonon scattering processes in high-powered nanoscale applications"

(the title of his research proposal). Patrick will conduct his research in Microscale Science and Technology Dept. 1513. Patrick was a graduate student intern at Sandia in 2007.

Bryan earned his PhD in biochemistry at the University of Texas-Austin in August 2007. His dissertation title was "Defining cellular microenvironments using multiphoton lithography."

Bryan's research interests encompass nonlinear photochemistry, biocompatible microfabrication, smart materials, engineered cellular networks and populations, biohybrid nanomaterials, and microdevices. During his Truman fellowship at Sandia, Bryan will focus on "Development and characterization of 3-D, nano-confined multicellular constructs for advanced biohybrid devices" (the title

of his research proposal). He will conduct his research in Ceramic Processing & Inorganic Materials Dept. 1815.

Chief Technology Officer and VP in charge of the Truman Fellowship Program Rick Stulen (1000), says he expects Patrick and Bryan will make important contributions to Sandia's mission — and ultimately to the national interest.

According to the selection committee, Patrick's proposed research will address crucial issues in the continued reduction in feature size and growth in performance of integrated electronics. The results of his research could have significant impact at Sandia and in US industry on the continued development of innovative nanoscale devices and unique materials.

Bryan will arrive at Sandia with a new and unique technology for building almost any structure with proteins. As the proteins are functionalized the possibilities seem almost endless for making new technology of value to Sandia. His research has been picked up by the widely read science literature and appeared in *Scientific American*, *C&E News*, and *Biophotonics*. This work has brought wide acclaim to him and Jason Shear, his advisor at UT-Austin.

Here are brief descriptions provided by Patrick and Bryan of the work they hope to accomplish during their three-year fellowship at Sandia:

Patrick Hopkins

"The goal of my research is to study how thermal transport in nanostructures is affected by the resistances of interfaces and junctions between two nanomaterials. The large heat fluxes generated from novel nanoelectronic applications are a significant limiting factor in next-generation devices. As



PATRICK HOPKINS

(Continued on next page)

The Truman Fellowship

The Truman fellowships are three-year appointments. Candidates are expected to have solved a major scientific or engineering problem in their thesis work or have provided a new approach or insight to a major problem, as evidenced by a recognized impact in their field. The program fosters creativity and stimulates exploration of forefront science and technology and high-risk, potentially high-value R&D. A panel of eight senior scientists and engineers reviews and ranks each application. This year's members were Anita Renlund, chair (2550), Ron Loehman (1815), Patrick V. Brady (6310), David Chandler (8350), Lyndon Pierson (5629), Mel Baer (1500), Bob Benner (1422), and Al Watts (5400).

Sandia's University Research Office (1012) and Human Resources/University Partnerships (3555) teamed more than five years ago to create the Truman Fellowship Program and develop the processes necessary to implement the prestigious position.

Chief Technology Officer Rick Stulen says the Truman Fellowship Program offers Sandia unique opportunities to take giant steps in critical research areas.

"The Truman Fellows bring high-risk, novel ideas to the laboratory that we might not have identified from



our current R&D or mission technology base," says Rick. "This in turn stimulates exploration that can help us connect the science and technology dots and innovate in the future.

"For example, we have a current Truman Fellow developing chameleon-like reconfigurable metal/dielectric surfaces that could enable future synthetic-aperture radar advances, another who is bridging our systems engineering and renewable energy expertise to elucidate the complicated trade-offs among alternative energy solutions for the nation, and a third who has developed a novel electron microscopy tomography technique that is being used to unlock the secrets of 3-D nanoparticles in order to exploit their properties. All of the Truman Fellows are opening R&D doors that might not otherwise have occurred to us.

"Not only is the Truman Fellowship Program living up to all the expectations we had when we launched it in 2004, it is far exceeding them."

Previous Truman fellowship recipients: Youssef Marzouk, Gregory Nielson, Ilke Arslan, David Scrymgeour, Jacques Loui, Whitney Colella, Anatole von Lilienfeld, and Darin Desilets.

NNSA vision

(Continued from page 1)

National Security Technologies, LLC, which manages the Nevada Test Site, and developed in communication with partner agencies.

In a statement released last week, D'Agostino said NNSA's national security laboratories and the Nevada Test Site "have world-class scientists, engineers and capabilities that are national assets. To respond to the

NNSA, its national security laboratories, and the test site have reached a consensus that their future mission . . . is one encompassing the full spectrum of national security interests.

evolving 21st century global security threats, NNSA will bring our science, technology, and engineering enterprise to bear on solving large, urgent national security challenges."

According to a June 26 news release, NNSA, its national security laboratories, and the test site have reached a consensus that their future mission is not limited solely to the historic nuclear weapons core mission, but rather is one encompassing the full spectrum of national security interests.

The broad range of research and development activities at the NNSA laboratories, which include sensor and detection technology, high-performance computing, microsystems, chemical and biological technology, and explosives science, will continue to ensure that the nation is equipped to deal with technological surprises and anticipate new national security threats.

Some examples of this type of national security work already being done include:

- Supporting war fighter needs in Iraq with IED modeling and analysis;
- Assisting in the safe recovery and securing of a

A future vision for NNSA's national security laboratories

Transforming the nuclear weapons complex into a national security enterprise

Note: This is the vision document crafted collaboratively by the leadership of DOE, NNSA, the three NNSA national laboratories, and the Nevada Test Site. DOE Secretary Samuel Bodman signed the document on June 19.

The Department of Energy's (DOE) National Nuclear Security Administration (NNSA) laboratories employ world-class scientists and engineers and maintain truly unique national assets. These laboratories have led science, technology, and engineering (ST&E) efforts that enabled major changes in the US national security posture. As the nation faces a changed world in which monolithic threats no longer dominate, the means to disrupt an increasingly technology-based society are rapidly multiplying. As a consequence, NNSA and its national security laboratories have been called upon even more than before to devote their immense capabilities to responsibilities that are not limited solely to the historic nuclear weapons core mission, but are more expansive and encompass a spectrum of national security missions.

Commitment

The Department of Energy is committed to invest in the people and the nation's scientific

infrastructure in order to enhance essential capabilities used by the nation to solve defense, energy, and other critical security issues. To contribute its unique capabilities, NNSA will partner with other segments of DOE and other agencies with national security responsibilities to direct and enhance the underlying ST&E capabilities available to the nation.

National security laboratory centers of excellence

Enhancing this broadened national security role requires leadership and support from NNSA and the other elements of the Department as well as investments by the broader national security community. Each laboratory and the Nevada Test Site will maintain a broad multidisciplinary portfolio of competencies and may develop centers of excellence in specific technical areas to more effectively contribute to the nation's current requirements. This broadened current national security role for NNSA and its laboratories will require continuity and stability for their core nuclear-deterrent mission as they continue to evolve to provide the nation a critical advantage in meeting security challenges in the 21st century.

potential radiological device or a lost or stolen US nuclear weapon;

- Helping identify, among other things, the source of a nuclear device, its effects, and the persons or groups responsible using technical nuclear forensics;
- Developing and deploying integrated systems for

countering aerosolized bioterrorist releases and bio-decontamination technologies; and

- Developing and deploying portal detector technology to prevent smuggling of illicit nuclear materials.
- NNSA will be looking to establish longer-term partnerships with other federal agencies on national security related R&D.

Does nuclear energy hold the 'power to save the world?'

Author Gwyneth Cravens shared a journey — or perhaps two journeys — with a Sandia audience at her May 20 Technology Symposium lecture in the Steve Schiff Auditorium.

Cravens was invited to speak about her book, *Power to Save the World: The Truth About Nuclear Energy*, and its main theme: the promise that nuclear energy holds to break the nation's reliance on fossil fuels and reduce greenhouse gases.

Cravens spoke of her journey through the nation's nuclear energy infrastructure to get a firsthand, inside perspective on every aspect of the industry, from the mining and refining of the uranium fuel to the operation of power plants to the final disposition of spent fuel. On that "Nuclear America Tour" (as she called it) she was accompanied by retired Sandia scientist Rip Anderson, who built an international reputation at the Labs for his work in the fields of probabilistic risk assessment and nuclear and environmental health and safety. Rip systematically exposed Cravens to the facts about nuclear energy, many of which ran counter to Cravens' own notions.

The gradual removal of prejudice

It was Rip, with his patient tutelage, who also guided Cravens on another journey, an internal one, a journey through her own preconceived ideas about nuclear energy and her slowly evolving sense that many of those ideas had been distorted — or plain wrong.

Cravens cited a dictum formulated by Nobel laureate and physics titan Niels Bohr: that the common aim of all science is "the gradual removal of prejudices."

"I had my beliefs; they were unsupported by evidence, but I didn't know that," Cravens said. Over several years, she added wryly, Rip remedied that.

Rip, who joined Cravens at the Tech Symposium, said the nation's energy stakes are huge. "Burning anthropogenic carbon is, I think, probably the biggest problem we have," he said, "as big, in the end — slow though it may be — as a large meteor hitting the Earth somewhere."

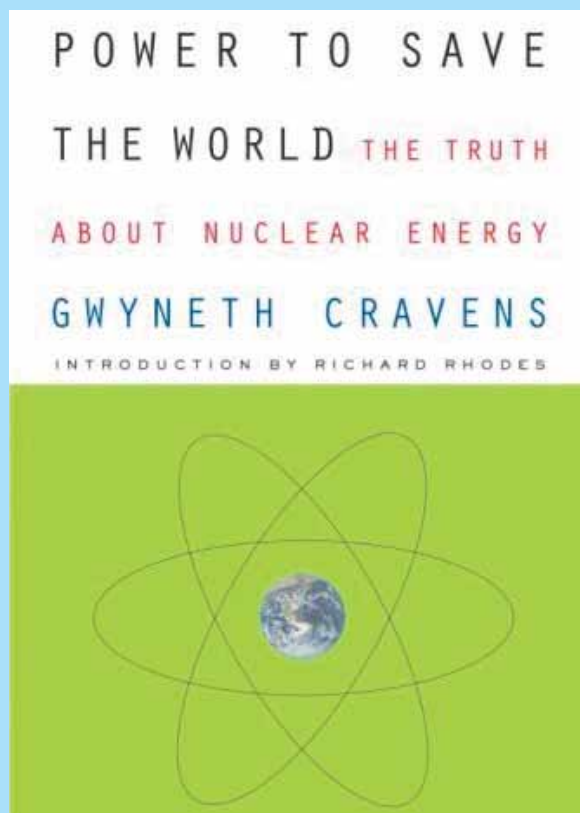
Cravens, who described herself as "a tree-hugger," said that as she embarked on her two-pronged journey with Rip, she was faced with a pretty tough dilemma, one that the larger environmental community has had to come to grips with in recent years.

"What Rip presented to me was a kind of conflict between being antinuclear and being worried about global warming and the environment."

A chance conversation

It was a chance conversation at a party about a decade ago between Rip and author Cravens, who grew up in Albuquerque and now lives in New York, that set her on the path to learn everything she could about nuclear energy. As her interest deepened, her vision expanded. Her initial intent had been to write a magazine article; she ended up writing *Power to Save the World*, which has enjoyed notable success: Months after its publication, *Power to Save the World: The Truth About Nuclear Energy* has been through several printings and is still the top-selling book at Amazon.com in its particular subject category (nuclear energy).

In her Tech Symposium lecture, Cravens recounted how at each stop on the Nuclear America Tour she learned things that surprised her, things that didn't



conform to her preconceived ideas about nuclear power and its dangers.

One of the real eye-openers for her, Cravens said, was becoming aware of the consequences of burning fossil fuel. She knew about greenhouse gases, of course, but hadn't been aware of other impacts of coal-burning. For example, a coal plant emits far more radiation — as much as 400 times more — than a nuclear plant. That's because there are radioactive elements in coal that get released during the burning process. "We're talking low-dose radiation here, of course," she noted.

People who are worried primarily about the radiation impacts of energy production should put coal-fired plants at the top of their list, Cravens said. "They're far dirtier than nuclear plants."

Cost of burning coal

What are the costs of burning fossil fuels in terms of public health and the environment? Displaying a set of charts comparing coal-burning vs. nuclear powered plants, Cravens said, "You can see that it's not a pretty picture on the coal side."

She rattled off the numbers: 24,000 deaths a year can be attributed to the particulate matter released into the atmosphere by coal-burning plants, along with hundreds of thousands of cases of heart and lung disease. (The data, she noted, are from a study done for the US Environmental Protection Agency.) On the nuclear side, she said, there have been zero deaths in 40 years.

Coal combustion releases two gigatons of CO₂ into the atmosphere each year; nuclear does not emit carbon dioxide.

Coal combustion results in 120 million tons per year of solid waste; the nation's 103 nuclear plants produce 2,000 tons of spent fuel per year. In fact, in

the past 40 years, the US nuclear power industry has generated 55,000 tons of spent fuel. "You could fit all of it in one Wal-Mart," she said.

"People say we don't know what to do about nuclear waste," Cravens said. "In fact, we do; this is not some eternally perplexing problem at all."

And don't call it waste; it's spent nuclear fuel, a distinction that is important, Cravens explains, because spent fuel retains well over 90 percent of its potential energy and can be recycled and reused continually.

Those are hard facts; there's also an aesthetic impact (which is associated with health and environmental implications). Cravens recounted that in the 1960s she visited Paris and found it to be "a smoggy, sooty place." Years later she returned. In the meantime, France had converted its base-load electricity production from coal to nearly 80 percent nuclear. "It was like going to the Emerald City," Cravens said.

The obstacles to wider adoption of nuclear energy in the US are political, Cravens said, noting that the nuclear industry has sometimes been slow to acknowledge issues such as even small, innocuous leaks. "The more transparency, the better," Cravens said. "There is a knowledge vacuum out there [among lay people] and cover-ups just feed into that general supposition about the dastardly aspects of nuclear power."

With energy prices rising, nuclear power plants are becoming an increasingly attractive option for investors, Cravens said, adding that if the nation enacts carbon tax legislation, "that puts nuclear energy way ahead of the pack" in terms of economic viability.

Cravens said that in carrying the cause of nuclear power forward, advocates need to get past the "us vs. them" mindset. People under 30, she added, already favor nuclear power, "so it's going to happen."

Rip's principles

So, how to communicate the issue effectively? "To me," Cravens said, "Rip's method gets down to creating better communication among scientists and with the community." Rip's principles, she explained are:

- Listen and explain. Always include social and political factors in probabilistic risk assessment. We're all stakeholders now.

- Focus on the problem. See it whole at all times while keeping details in mind. Take an interdisciplinary, multidisciplinary approach.

- Create a small group of people whose job it is to invalidate the idea itself. If the group fails, the project has passed the toughest test. If the group succeeds, you've been spared a lot of future pain.

Rip, whose career was built on analyzing risk, said, "When we don't understand the problem, we concentrate most on the consequences and forget about probability altogether."

"What I hope," Cravens said, "is that my book — because it starts out with someone who does not trust nuclear power and was skeptical, but who gets the facts — I'm hoping that people will read it and change their minds the way I did." — Bill Murphy



If you have access to Sandia's internal web, you can see Gwyneth Cravens and Rip Anderson talk about the promise of nuclear energy at the Tech Symposium website at www-irn.sandia.gov/organization/div2000/ctr2900/techsym.

Truman Fellows

(Continued from preceding page)

such, a greater understanding of the causes of this thermal interface resistance is imperative for design and development of high-powered sensor, signal processing, and energy conversion systems.

"During my Truman fellowship, I will examine heat transfer processes around structurally imperfect regions at interfaces involving both traditional and novel nanostructures. Nanomaterials and structures will be fabricated subject to different deposition and processing conditions to induce various degrees of structural variants around the nanomaterial interfaces. The electronic and phononic interfacial processes will then be measured with various electrical and optical techniques. The experimental data will be supplemented with theoretical quantum transport models.

"The Truman fellowship gives me the necessary means to accelerate my research in nanoscale heat transfer and significantly advance the current physics involved with high-flux device design. This multidisciplinary research project will allow me to interact with the world-class scientists at Sandia and give me

the opportunity to conduct experiments in state-of-the-art laboratory environments. I am extremely pumped to be given this opportunity and work with fellow Sandians to study this critical aspect of high-powered nanosystems."

Bryan Kaehr

"This fellowship provides the opportunity to explore an exciting frontier at the cutting edge of materials science and bioengineering. Cells and microorganisms employ nanomachinery of enormous variety and sophistication to sense, navigate, communicate, and adapt to the environment. The ability to control and manipulate cellular machinery in artificial systems may hasten the development of smaller, more responsive sensors and actuators, and those are important goals for nanotechnology.



BRYAN KAEHR

"A promising avenue for research in this area is to integrate whole cells into devices and materials, an approach that confers a number of advantages over other approaches that have been tried with only limited success. In order to develop a new platform for the fabrication and manipulation of robust, whole-cell biohybrid materials, I will take advantage of recent breakthroughs accomplished at Sandia that enable cells to direct the assembly of functional interfaces to solid-state nanomaterials.

"My efforts at Sandia will focus on incorporating complex cellular functions — such as replication, differentiation and intercellular communication — into solid-state platforms. The development of this technology will permit the design of solid-state cell-based circuitry to be explored across a broad spectrum of applications including environmental sensing, biocomputation, bioenergy conversion, and artificial tissue fabrication.

"This fellowship is a great honor and tremendous opportunity for learning and interacting with some of the best scientists and engineers working today. I plan to take advantage of the wide range of expertise at Sandia and am confident that this research will result in valuable insights, tools, and technologies important for Sandia's missions."

Mileposts

New Mexico photos by Michelle Fleming



Karl Wiegandt
40 9530



Sandra Evans
30 10513



Paul Morrison
30 2712



Randy Creighton
25 1126



James Lloyd
25 6752



Cynthia Myers
25 9335



Gregory Wickstrom
25 2125



Diane Behar
20 2029

Recent Retirees



David Like
26 2625



Anita Denton
25 10513



Rita Simon
17 9300



Kate Sauer
15 4232



50 years ago . . . When Sandia Corporation's new computer — the **IBM 705 Electronic Data Processing Machine** — arrives next week, it will be installed in most unusual quarters in Bldg 880. Rigid specifications for the physical environment of the big computer gave Plant Engineering some problems in air conditioning, heating, electrical facilities, and power supplies. Ingenious solutions assure the 705 a dust-free atmosphere, a relative humidity of between 40 and 60 percent, constant temperature of 75 degrees and a separate power substation free from fluctuations of voltage. **Sandia engineers joined scientists from the University of California Radiation Laboratory (UCRL-Livermore)** in an advisory capacity in the first field study to determine feasibility of using nuclear explosives to create a harbor in northern Alaska. The study is part of Project Plowshare, the non-military use of nuclear explosives. The Alaska harbor site, located near Cape Thompson, was selected for the project as an aid in developing fishing and mineral deposits in the area. The lack of a suitable port has impeded exploitation of these resources.



NEARING COMPLETION — The special 705 computer room in Bldg. 880 receives final touches from a construction worker. Removable floor panels allow access to the electrical connections.

40 years ago . . . **Hermes-II**, a giant machine being constructed in Area V to simulate the flash of gamma rays from nuclear weapons, has been test fired. The high-voltage generator of the machine has been charged to 70,000 volts to store 500,000 joules of electrical energy and has been triggered to discharge the energy into a load in a single 0.09-microsecond, 10 million volt pulse.



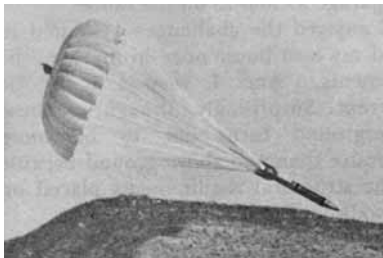
HERMES II capacitors will store a maximum of one million joules to provide the basic energy of the machine. The interior of the steel tank will be filled with 150,000 gallons of mineral oil.

30 years ago . . . **At the Nevada Test Site in the old G-tunnel complex**, familiar to many Sandians as the site of a number of underground nuclear events, is another kind of laboratory. Called a Geophysical Laboratory, the site is currently being used for experiments in hydraulic fracturing and explosives containment. The results are applicable to both the oil and gas industries and to underground nuclear weapons testing. Hydraulic fracturing — pumping fluids under high pressure into oil or gas wells to fracture rock formations to increase pro-

duction is a common technique in use for more than 30 years. **Deep sea sediments from the Atlantic** will be recovered this summer as part of a program to determine the feasibility of disposal of high-level radioactive waste or spent fuel in ocean floors. Seabed disposal is being considered as a possible complementary option to underground disposal. **The new B61-3, 4 parachute** underwent a successful sled test at Mach 1.3 in Area III. Kevlar material used in the chute has twice the tensile strength of steel. Some 40 development tests have been completed. Several more tests are planned on the Sandia sled track and at Tonopah Test Range with drops from aircraft. **20 years ago . . .** **The first drop test of the TRUPACT II waste canister** at Sandia's New Cable Site on July 22 attracted representatives from the local media. If it and its twin pass the required series of tests (drop,



FROM THE OCEAN DEEP — A core sample taken from beneath 20,000 feet of North Pacific Ocean is examined as part of a program to determine feasibility of radioactive waste disposal in deep sea sediment.



NEW B-61-3, 4 PARACHUTE undergoes a successful sled track test.

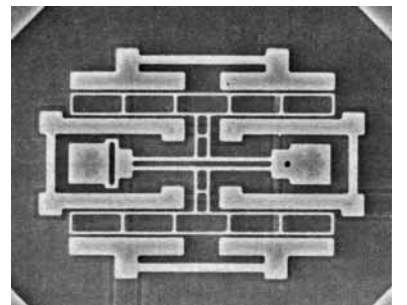


FIRST DROP TEST of the TRUPACT II waste container at Sandia's New Cable Site.

puncture, and fire), the Nuclear Regulatory Commission will certify the design, and such canisters will be ready for use in transporting transuranic wastes to the WIPP (Waste Isolation Pilot Plant) site near Carlsbad. During a severe rainstorm, **the Hermes II electron beam accelerator in Tech Area V** was fired for the 30,000th time. It was 6:30 p.m. on July 5. Now 20 years old, HERMES II had an original design life of 1,000 shots, but is still going strong.

10 years ago . . . Within the next few years, your

watch, television, and computer may all contain **microelectromechanical systems (MEMS)**, micron-size machines being developed at Sandia. This MEMS prototype functions as a clock source. The minuscule machines with moving parts the size of a pollen grain perform the same job as quartz crystals, the traditional technology used in timing devices in all digital electronics. **President Bill Clinton has tapped his UN Ambassador, Bill Richardson, to head the Department of Energy.** Richardson, the former US representative from New Mexico's Third Congressional District — which includes Los Alamos National Laboratory — takes over as Secretary of Energy from Federico Peña, who left the post on June 30 to return to the private sector and to spend more time with his family. A "computer cluster," known as **Cplant**, is being assembled from commodity computers instead of being grown from the ground up as a monolithic supercomputer. The Cplant (computational plant) is a prototype system demonstrating and emerging "distributed" approach to high-capacity computing that will augment supercomputers being developed as part of DOE's Accelerated Strategic Computing Initiative.



A **TUNING FORK**-shaped MEMS, like the one shown here, may one day replace quartz crystals used in electronic timing devices. Ten of the fine strings or tines would fit on a pinhead.



CPLANT PATCH — Rolf Riesen (standing) and Ron Brightwell monitor computations being performed on Sandia's Cplant. (Photo by Randy Montoya)

'Farewell and Godspeed'

After 36 years in US Senate, Pete Domenici says goodbye

Story by Darrick Hurst • Photos by Randy Montoya

After 36 years, Sen. Pete Domenici's career of service to New Mexico is drawing to a close, and at a sold-out event Saturday evening, community leaders and noteworthy figures from across the nation gathered to pay him homage.

"Years ago, I had friends tell me, 'Run for office or stop complaining,'" Domenici said. "Later, I was warned that if I went into politics I'd make more enemies than friends, that I wouldn't get things done, but I can look around this evening and see the fruits of the work I've been privileged to do. I can certainly say this was a great life — it *is* a great life."

Veteran reporter and ABC political analyst Sam Donaldson emceed the event, held at the Roy E. Disney Center for the Performing Arts at the National Hispanic Cultural Center. An estimated crowd of more than 700 people attended the presentations and tributes from friends and colleagues who had worked with Domenici during his career.

"I see so many people here tonight, hundreds of friends and family, and I don't have a bad memory of any of them," Domenici said. "I have wonderful memories of every face I recognize."

Labs Director Tom Hunter was among the throng gathered to honor the retiring senator. Tom recounted stories in his presentation of the various times his career path had intersected with Domenici's, and described the senator's lasting impact on the role of the laboratory.

"Pete Domenici's leadership and vision around nuclear technology changed the future of the country and of the world," Tom said. "He's made a big difference in where the country has gone, and where it will go."

Domenici earned a reputation during his tenure in the Senate as an outspoken supporter of research in areas of nuclear power, energy, and related causes, having advocated investment in the facilities and mission of the state's national labs.

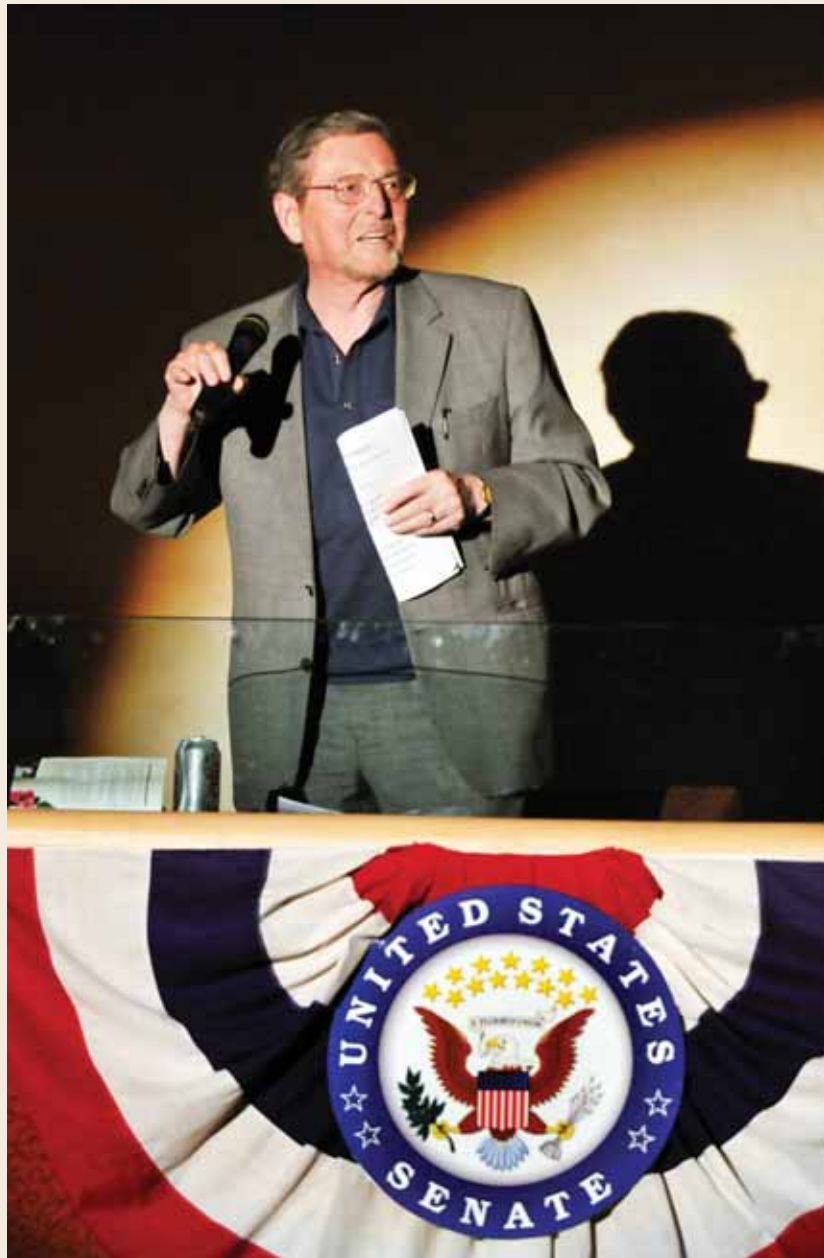
"The labs are so very important to me, they always have been and always will be," Domenici said as he moved through the crowd shaking the hands of those who had come to pay tribute Saturday evening. "The labs' valuable work holds a special place with me.

"The energy work and research they do will be more important than ever as this is a hard time for our country — not just the state, but the country. The role of oil in our economy and how we're being impacted by that resource is becoming an important matter."

Arizona Gov. Janet Napolitano, N.M. Gov. Bill Richardson, and Sen. Jeff Bingaman were just a few of the many who shared memories of working with Domenici and offered their best wishes to the longest-serving senator in the state's history.

As the night's festivities drew to a close, Donaldson said goodbye on behalf of those who had been touched by Domenici during his career.

"Tonight we reflect on all you've done for New Mexico," Donaldson said, "We'll miss you Pete . . . we wish you farewell and Godspeed."



A DAY FOR SEN. DOMENICI — Sen. Pete Domenici, who is retiring after six terms in the US Senate, offers warm words for friends and colleagues (photo at top right) during remarks at a function in his honor organized by New Mexico First. In other photos (clockwise starting at right) emcee Sam Donaldson greets Arizona Gov. Janet

Napolitano; friends and family toast Domenici and his wife Nancy; school children say thank you in song and dance; and Sandia Labs Director Tom Hunter, Sen. Domenici, and Los Alamos National Laboratory Director Michael Anastasio in the reception hall at the Roy E. Disney Center at the National Hispanic Cultural Center.

