WAR AND REMEMBRANCE — During a trip to the Washington, D.C., area in March, *Lab News* photographer Randy Montoya and his family visited Arlington National Cemetery, where more than 300,000 American service members are buried. During the visit, Randy's eye was drawn to a woman, alone in the field of the fallen, grieving for . . whom? A son? A daughter? A husband? A father? And how long has she grieved? Do these stones date from World War II? Or Korea? Vietnam? How long do grief and loss endure? On Memorial Day, we honor the memory of those who have fallen in battle defending the nation; we honor and move on. For some, there is no moving on, but only loss, experienced day after day after day.

Written on the wind

Jose Zayas (6120) and Dale Berg (6121) have been honored by *Windpower Engineering* magazine as two of the nation's innovators and influencers in wind energy. See story on **page 8**.

Sandia LabNews

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Sandia National Laboratories

Labs Director Paul Hommert, VP panel to introduce Sandia TotalComp on Tuesday

By Karyn Scott

Sandia President and Laboratories Director Paul Hommert and a panel of Sandia vice presidents will introduce Sandia TotalComp to the workforce at an all-hands meeting at 2 p.m. Tuesday, May 24.

TotalComp is the project to rebuild the Integrated Job Structure, which is now nearly 15 years old. It encompasses Sandia's compensation system, including job structure, as well as related policies and procedures.

"Sandia executives are reviewing the compensation system," says Sandia TotalComp project lead Jessica Pascual (3510). "This wide-ranging effort will create a system that is more equitable, market-based, consistently applied across the Labs, and able to respond to business and market conditions."

Other speakers at the meeting will include:

- Kim Sawyer, Deputy Laboratories Director and Executive Vice President for Mission Support
- John Slipke, Human Resources and Communications Div. 3000 VP
- Steve Rottler, Science and Technology and Research Foundations Div. 1000 VP
- Mike Hazen, Infrastructure Operations Div. 4000 VP
- Pat Smith, Enterprise Transformation Div. 9000 Acting VP
- Rick Stulen, California Laboratory Div. 8000 VP

* * *

The all-hands meeting will take place Tuesday, May 24, from 2-3:30 p.m. at the Steve Schiff Auditorium (with videoconferencing to Sandia/California).

The meeting will also be videostreamed live and made available for later viewing, from a link that will be available from the Techweb page on Sandia's internal web.

Overcoming adversity

Thunderbird Awards program honors bravest high school seniors

THUNDERBIRD AWARDS are given yearly by Sandia to graduating seniors from 12 Albuquerque public high schools, five alternative schools, and five outlying schools. The seniors have faced and overcome obstacles most of us can only imagine.

Inside . . .

See also . . .

Labs robots Smithsonian-bound

SEE PAGES 6-7

That's that

So he wasn't in a cave, after all. But he might as well have been. Would you want to spend five or six years in that supposed "million-dollar compound?" Didn't think so.

There's no way Osama bin Laden's final living arrangements haven't radically diminished his legend. Far from hunkering down in a warrior's redoubt deep in the wilds of the Northwest provinces, shoulder to shoulder with his fellow jihadi, facing down the hated Americans and facing down death every day, we find him comfortably, if somewhat shabbily, ensconced with several of his wives and a few trusted lieutenants in a virtual suburb of Islamabad. That photo of the sheikh huddled in a blanket, watching video replays of himself on TV, summons up images not of a heroic and defiant leader, but of an isolated and marginalized one. A weak horse. Just the thing he said he wasn't.

That's not to say he was totally cut off from The Base; the latest news accounts suggest that through his network of couriers, bin Laden retained — or at least thought he did — a grasp on the leadership of Al Qaeda. As he issued his orders and pronouncements from his fortress of solitude, he surely remained convinced until the very end that eventually his cause, being divinely ordained, would prevail. How confused he must have been, as the years went by, to find that the US kept coming at him, coming at him, coming at him. *We* were supposed to be the weak horse. *We* were supposed to cut and run. *We* were decadent, fat, and complacent. Very, very confusing, indeed.

Reportedly, a preliminary scan of his notebooks and computer files suggests that bin Laden was obsessed with hitting America again with a 9/11-scale attack. Only attacks that claimed casualties in the thousands, he surmised, would create the political environment in which America would disengage from the Middle East, leaving him a free hand to reshape that part of the world in his own image. How little he understood the US; how little he learned from our response to 9/11. Did he, even at the very end, when that Navy Seal burst into his room, understand us, understand that there was never a chance we would let him get away with 9/11, that more attacks would just make us more determined? Almost certainly not.

* * *

When President Obama made the dramatic announcement late in the evening of May 1 that Osama bin Laden had been killed by US Special Forces, Americans across the country spontaneously gathered in public places to celebrate, to chant "USA! USA!" I certainly understand the impulse to celebrate; for America's Millennial generation, bin Laden's death was the moral equivalent of the fall of the Berlin Wall. And I was certainly jubilant when the wall came down. So I understand the unrestrained joy with which the news of bin Laden's death was met by many, especially younger, Americans.

For me, though — and I hope this doesn't have the sniff of moral superiority about it, for I don't mean it to — the news, while welcomed, elicited no joy. I thought that night about the price we paid — specifically, the price paid by members of our Armed Forces and their families — to get to this point. More than 6,000 American service members — men and women — have died in Iraq and Afghanistan to, finally, get us to where we could get bin Laden.

Could we have done things differently, with fewer casualties? That will be debated forever, but the reality is, it cost us 6,000 lives, and thousands upon thousands of horrible injuries, to get here. It's been a terrible price, and the final bill has not yet come in. So when I heard Osama bin Laden was dead, was I glad? Yes. Good riddance. Was I exuberant? No. But I was proud of us as a nation, proud that we honored the lives of those who died on 9/11 and those who have died since, by staying the course, by bringing justice to a mass murderer.

* * *

How about something lighter? Have you ever run into this? I think of it as the endless email feedback loop. You begin an email exchange with someone, perhaps asking for a document or some other sort of help. They send you a note back saying they'll be glad to help, to which you send a thank-you note. They respond, "No problem." A while later they send you the document (or whatever) you requested. In gratitude, you send another "thanks a lot." They reply, again, "No problem, I was happy to do it." That could have ended the exchange, but your respondent adds, "You guys do great work." Now, with that compliment, courtesy seems to demand that you reply, "Thanks; that means a lot coming from you." You see where this can — and sometimes does — go. Maybe the best approach is the one dictated by the ergonomics of a BlackBerry: Thx.

See you next time.

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

Charline Wells receives ISPI Distinguished Service Award

By Iris Aboytes

Charline Wells (3520) received the Distinguished Service Award from the International Society for Performance Improvement (ISPI) during ceremonies held in Orlando, Fla., in April.

ISPI is the leading international association dedicated to improving productivity and performance in the workplace. Its mission is to develop and recognize the proficiency of members and advocate the use of Human Performance Technology (HPT), a systematic approach to improving productivity and competence using a strategy of methods and procedures related to the performance of people.

CHARLINE WELLS

Charline has been active in ISPI since 1982, serving as its president from 1997 to 1998. She has been a presenter at ISPI conferences and received more than 10 ISPI presidential and leadership citations.

"As I was developing my teaching skills, I discovered that one of my favorite areas of teaching was working with adults rather than children," says Charline, "although at one point in time I almost went back to school to become a kindergarten teacher. When I discovered that businesses and corporations actually have internal training programs, it provided the perfect opportunity for me. What could be better? I like designing, helping people develop their skills, and I like teaching adults."

Charline received her Bachelor of Science degree and vocational teaching credentials for secondary and adult education. Her master's degree was in educational psychological studies and organizational design.

"My interest in ISPI comes from my foundation in vocational education. The principles are similar," says Charline. "I especially enjoy teaching in areas that require specific skills that have a direct application to work requirements. During my employment as a management development trainer for the Bell System, I learned of ISPI. It is the only professional association in the field whose focus and mission is to improve the performance of individuals and organizations in systematic and reproducible ways."

Charline is the founding chair for the Management of Organization Performance Professional Community of Practice, an area of specialty within ISPI for members with a particular interest in resolving major organizational performance problems.

"As the senior manager of Corporate Learning & Development, I feel deepest about the contribution we make to the success of Sandia," says Charline. "Helping our employees grow, develop, and become strong contributors to our world is a high point. When I listen to the presentations by our employees who are seeking financial support to go to school and complete their PhD, wow! It reminds me of just how amazing our talented employees are. Of course, I can't leave out the fun I have designing programs and meeting the challenges of creating successful programs that help individuals learn."

Sandia LabNews

Sandia National Laboratories

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Fidel Gonzales (97) . . . . . Feb. 8
Victorino Lopez (82) . . . . . Feb. 23
Alfonso Lujan (85) . . . . . Feb. 25
Eileen D. Young (87) . . . . . Feb. 27
William R. Kampfe (75) . . . . . March 1
James L. Rogers (86) . . . . . March 1
Richard O. Johnson (72) . . . . . March 6
Maria L. Jesse (91) . . . . . March 6
Robert G. Tant (90) . . . . . March 8
John Wm. Hatcher (87) . . . . . March 8
William J. Meyer (80) . . . . . March 10
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Rodney V. Phillips (98) . . . . . March 14
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Wayne D. Olson (85) . . . . . April 22
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Sandia and Cray Inc. to tackle 'big data' in new supercomputing institute

By Neal Singer

Sandia and supercomputer manufacturer Cray Inc. have signed a cooperative research and development agreement (CRADA) to form an institute focused on

data-intensive supercomputers.

The Supercomputing Institute for Learning and Knowledge Systems (SILKS), to be located at Sandia/New Mexico, is expected to leverage the strengths of both Sandia and Cray by making software and hardware resources available to researchers who focus on a relatively new application of supercomputing. The task of such supercomputers is to make sense of huge collections of data rather than the traditional modeling and simulation of scientific problems.

"It's an unusual opportunity," says Bruce Hendrickson, Sandia senior manager of computational sciences and math (1440). "Cray has an exciting machine [the XMT] and we know how to use it well. This CRADA should help originate new technologies for efficiently analyzing large data sets. New capabilities will be applicable to Sandia's fundamental science and mission work."

Shoaib Mufti, director of knowledge management in Cray's custom engineering group, says, "Sandia is a leading national lab with strong expertise in areas of data analysis. The concept of big data in the HPC [high-performing computing] environment is an important area of focus for Cray, and we are excited about the prospect of new solutions that may result from this collaborative effort with Sandia."

Says Rob Leland, director of computing research (1400), "This is a great example of how Sandia engages our industrial partners. The XMT was originally developed at Sandia's suggestion. It combined an older processor technology Cray had developed with the Red Storm infrastructure we jointly designed, giving birth to a new class of machines. That's now come full circle. The institute will help leverage this technology to help us in our national security mission work, benefiting the Labs and the nation as well as our partner."

> *"Traditional machines are pretty good for many science applications, but the XMT's latency tolerance is a superior approach for lots of complex data applications."*
>
> **— Bruce Hendrickson**

The XMT has a different mode of operation from conventional parallel-processing systems.

Says Bruce, "Think about your desktop: The memory system's main job is to keep the processor fed. It achieves this through a complex hierarchy of intermediate memory caches that stage data that might be needed soon. The XMT does away with this hierarchy. Though its memory accesses are distant and time-consuming to reach, the processor keeps busy by finding something else to do in the meantime."

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In a desktop machine or ordinary supercomputer, Bruce says, high performance can only be achieved if the memory hierarchy is successful at getting data to the processor fast enough. But for many important applications, this isn't possible and so processors are idle for most of the time. Said another way, traditional machines try to avoid latency (waiting for data) though the use of complex memory hierarchies.

XMT embraces latency

The XMT doesn't avoid latency; instead, it embraces it. By supporting many fine-grained snippets of a program called "threads," the processor switches to a new thread when a memory access would otherwise make it wait for data.

"Traditional machines are pretty good for many science applications, but the XMT's latency tolerance is a superior approach for lots of complex data applications," Bruce says. "For example, following a chain of data links to draw some inference totally trashes memory locality because the data may be anywhere." More broadly, he says, the XMT is very good at working with large data collections that can be represented as graphs.

Such computations appear in biology, law enforcement, business intelligence, and in various national security applications. Instead of a single answer, results are often best viewed as graphs.

Sandia and other labs have already built software to run graph algorithms, though "the software is still pretty immature," Bruce says. "That's one reason for the institute. As semantic database technology grows in popularity, these kinds of applications may become ubiquitous."

Among its other virtues, the XMT saves power because it runs at slower speeds.

SILKS' primary objectives, as described in the CRADA, are to accelerate the development of high-performance computing, overcome barriers to implementation, and apply new technologies to enable discovery and innovation in science, engineering, and for homeland security.

The CRADA's main technical categories include software, hardware, services, outreach, education, and training.

University students and faculty, as well as scientists and engineers from industry and government, are expected to be invited to take part in and benefit from the institute's research.

CRADAs are written agreements between a private company and a government agency to work together on a project.

A CRADA allows the federal government and non-federal partners to optimize their resources, share technical expertise in a protected environment, share intellectual property emerging from the effort, and speed the commercialization of federally developed technology.

Tom Hunter recounts oil spill disaster effort

One year to the day after the oil spill in the Gulf of Mexico that became the largest single environmental catastrophe in the nation's history, former Sandia President Tom Hunter described to an attentive audience in the Steve Schiff Auditorium the events that shocked the nation. In his Truman Distinguished Lecture Series remarks, Tom said, "Things that were deemed not possible, happened." Tom, who headed the government scientific team at the gulf for DOE Secretary Steven Chu, described the dramatic attempts that ultimately sealed the blown-out Macondo Prospect well off the coast of Louisiana. "Things that usually might take eight months were done in eight days," he said. Tom himself worked 140 consecutive days without breaks for weekends or holidays. An estimated 48,000 people, more than 7,000 sea vessels, 150 airplanes, and six deepwater drilling rigs were involved in cleaning up the coastline and capping the well. Researchers from Sandia and the two other NNSA labs "came together as a seamless team that worked tirelessly and without regard for their lab affiliation to support the killing of the well. It was my distinct pleasure to serve alongside them," Tom said. The total response, he added, "was the most massive ever, outside of war." — *Neal Singer* (Photo by Randy Montoya)

Z researcher Dan Sinars awarded $2.5 million Early Career Research Program grant by DOE

By Neal Singer

Following up a particularly fruitful line of research, Dan Sinars (1648) has been awarded a DOE Office of Science Early Career Research Program award of $2.5 million over a five-year period for measuring fundamental instabilities in magnetically driven Z-pinch explosions.

Dan's team was the first to capture, in a series of 3-D images separated by nanoseconds, the undesirable but apparently unavoidable appearance of a damaging instability (called Magneto-Rayleigh-Taylor, or MRT) in Z-pinch magnetic fields otherwise known to create conditions that fuse atoms for possible electrical energy generation.

Dan's application proposed to continue his earlier investigations, published last year in *Physical Review Letters*, with a two-pronged approach.

One prong would study nonlinear MRT growth through the generation of well-controlled initial perturbations combined with high-resolution observations. The second prong proposed study of conditions that might actually mitigate the bugbear of MRT growth. Because these problems have never been systematically studied at the level of experimental accuracy required to validate relevant computer codes, the scientific merit of the proposed project was considered very high by reviewers.

Specifically, according to one DOE reviewer, "The proposed research directly addresses an important and poorly understood phenomenon relevant to the evolution of rapidly compressed matter. The results of this research would significantly impact high energy density plasmas, inertial confinement fusion, and related fields. It would provide significant opportunity for comparison and improvement of at least three important simulation codes."

Another DOE reviewer wrote, " . . . [T]he data available for the experimental validation of the MHD code simulations and theoretical predictions is very scarce. Actually, it consists mostly of the results obtained by Dr. Sinars and his collaborators from SNL in their experiments on Z dedicated to accurately measuring the MRT…."

HE'S Z MAN — Dan Sinars has been awarded a prestigious DOE Office of Science Early Career Research Program award for his work with Z-pinch phenomena. (Photo by Randy Montoya)

Dan emailed his group, "I am obviously very excited by this award. It would certainly not have been possible without the personal mentorship of Mike Cuneo (1643), John Porter (1670), and Mark Herrmann (1640), as well as the excellent opportunities for great science afforded by the Z and Z-Beamlet laser facilities."

Z-machine senior manager John Porter wrote, "You've far exceeded all my expectations. I am very proud of your accomplishment and to have been able to help. Congratulations!"

DOE defines "early career" as a principal investigator who is within 10 years of receiving a doctorate, and is a full-time, nonpostdoctoral, permanent DOE national laboratory employee.

According to DOE's website, out of 1,150 applications, only 65 will receive awards. Dan is the sole Sandian to win this year of those that were announced.

Dan earlier received the 2007 IEEE Nuclear Plasma Sciences Society Early Achievement Award "for contributions to radiographic measurements of high energy density physics experiments on the [Sandia]20 MA Z pulsed-power generator, including wire-array z-pinches, ICF capsules, and complex hydrodynamics targets," and the 2007 NNSA Defense Programs Award of Excellence for "Z-pinch predictive simulation capability."

New Oracle implementation boosts usability, integration

Oracle E-Business Suite R12 goes 'live' in mid-June, offers significant enhancements

By Tracy Jones

Oracle E-Business Suite R12, the newest version of Sandia's primary business management tool, is scheduled to be implemented at Sandia on Saturday, June 11, through Tuesday, June 14. Oracle R12 delivers notable improvements in usability and integration and promises to provide a consistent user experience across all applications and accelerate user productivity.

"The goal is that users will move through their tasks faster, and new users will require less training," says Ramona Gauna (9542), Oracle upgrade project manager. "Most of these improvements are for superusers of the system but there are many that help all users."

Significant enhancements, Ramona notes, include :

- a new main menu design for Oracle R12 that touches everyone who uses Oracle;
- improvements for iProcurement, which is used by 1,700 Sandians
- improvements to accounts receivable used by many Sandians and their Work For Others (WFO) customers;
- improvements for projects as they relates to expense vouchers; and
- improvements for fixed assets used by 700 property coordinators.

The new main menu for Oracle R12 allows rapid navigation across responsibilities and applications. It also reduces the need to navigate back to the home page. In addition, a redesigned navigator eliminates server-side requests to render the full page, saving time for the user. A new favorites menu provides easy shortcuts with one-click access to a user's favorite pages.

Oracle R12 incorporates many new accessibility features to assist customers in achieving compliance with the Americans with Disabilities Act (ADA). One of these features is a redesign of the function keys for Oracle Forms in support of ADA. The Oracle E-Business Suite R12 Forms common keyboard shortcuts is available at http://upgrade.sandia.gov/faqa.html.

Additionally, the applications have simpler interfaces across business flows that provide many benefits, including consolidated information dashboards, simplified user setup screens, more activity-based tabs, a reduction in the number of steps to perform key tasks, reduced pop-ups, reduced duplicate screens, and a consistent overall look and feel.

"In the iProcurement module, the R12 upgrade provides a new approvals feature that allows a purchase requestor to add approvers, modify their management approvers, and add viewers of a requisition prior to going to a buyer," says Louise Britton (10241), Supply Chain team lead. "This will allow the requestor to have purchases reviewed by their management or team members as they purchase specific items that need additional approval or notification of purchase. If a requestor knows their immediate supervisor will be away and unable to approve, the requisition can be routed to another manager so that the purchase is not delayed."

Accounts receivable, too, gets new capabilities. "There is a new invoice capability in the accounts receivable module that will allow users to print Adobe PDF versions of the Standard Form 1080 forms (aka OFA invoices) to their desktop computers," says Sharon Chino (10549), Budget & Work For Others team lead. "In addition, users will be able to review invoice summary information as well as export the information to Excel files. These features replace iReceivables, which will not be available after the upgrade."

"In the accounts payable module, there is a new capability to allocate expense report lines at the organization level," notes Mike Widmer, Projects team lead. "This will allow team celebrations to be split between departments through the Expense Report application."

The fixed assets module supports the automatic preparation of mass additions, a feature that allows users to copy asset information from other modules such as accounts payable.

Additional information can be found on the Oracle E-Business R12 upgrade home page at http://upgrade.sandia.gov.

Take Our Daughters and Sons to Work Day 2011

By Patti Koning • Photos by Dino Vournas

On April 28, there was something different about Sandia/California — children! Nearly 200 daughters, sons, and family friends spent the morning on campus with their parents, getting a look at where mom and dad work and engaging in activities around the site.

"Our event is much more than a career day — it is an enriching experience designed to show our children the value of their education, how the important adults in their lives balance work and family life, and to inspire them to dream for their own professional futures," says Div. 8000 VP Rick Stulen.

The children and parents created "nano" spaghetti, went for rides on a hydrogen-powered bus, practiced lifting fingerprints from household objects, cooked s'mores under the sun, played with windbags, beat up the unlucky security guard in the Red Man Suit, tested their skills in the Firearms Training Simulator, and learned about computer programming using a Lego Mindstorm robot, among other fun activities.

For this year's special challenge, the "puff-mobile," kids created a car using just 11 items — three nonbending straws, four candy lifesavers, one piece of paper, two paper clips, and 20 inches of tape. They raced their cars using only their own "breath power."

CHRISTOPHER AND ZOE MEDLIN, children of Doug Medlin (8656), are fascinated with the plasma ball.

Sandia California

The Sandia Women's Connection offered the middle and high school students the chance to meet science, engineering, and technology professionals and learn about their careers, with an emphasis on workforce diversity. At each session, four Sandians spoke about their backgrounds, work, and balance of work with other life priorities and then took questions from the students.

"More than 20 students attended and asked a lot of great questions about school and career choices," says Susanna Gordon (8958), one of the organizers and speakers. Thanks go out to the rest of the speakers — Lara Bauman (8954), Janine Bennett (8953), Debra Post (8248), Isaac Ekoto (8367), Lindsay Erickson (8365), Tricia Gharagozloo (8365), Jane Ann Lamph (8243), Nicole Lemaster (8961), Ajith Mascarenhas (8351), Nerayo Teclemariam (8125), and Lynn Yang (8114).

Additional thanks to Kristi Miller (8965) and Rachael Gupta (8120) for organizing Take Our Daughters and Sons to Work Day. Of course, they didn't do it alone.

"We want to thank all of the demonstration volunteers. It's only because of their willingness to donate their time and energy to this site-wide special day that we can even have this event." says Kristi. "Without them, it would just be a job-shadowing day with no fun science stuff."

Rachael adds, "We can plan and organize to our hearts' content, but without the participation and dedication of our demonstration volunteers, that would still get us nowhere. Just yesterday a parent said he believed this year's event was 'the best ever.' We know this is due in large part to the wonderful enthusiasm of our demo volunteers."

AYVA SAVOY (daughter of Ashley Wilkins, 8237), Mia Strmiska (a friend of Avya's), and Alexa Mendonca (daughter of Holly Mendonca, 8244) create "nano spaghetti" from CTAB, a surfactant, and sodium salicylate. This activity demonstrated how self-organizing materials can change structure with the simple addition of a salt in solution.

MONICA HALL, daughter of Gary Hall (8243), waits patiently for her solar collector to melt chocolate and marshmallows to create a "solar s'more."

ISABEL MARIANO, daughter of Rob Mariano (8135) and Jennifer Robles (8245), takes on the Red Man Suit.

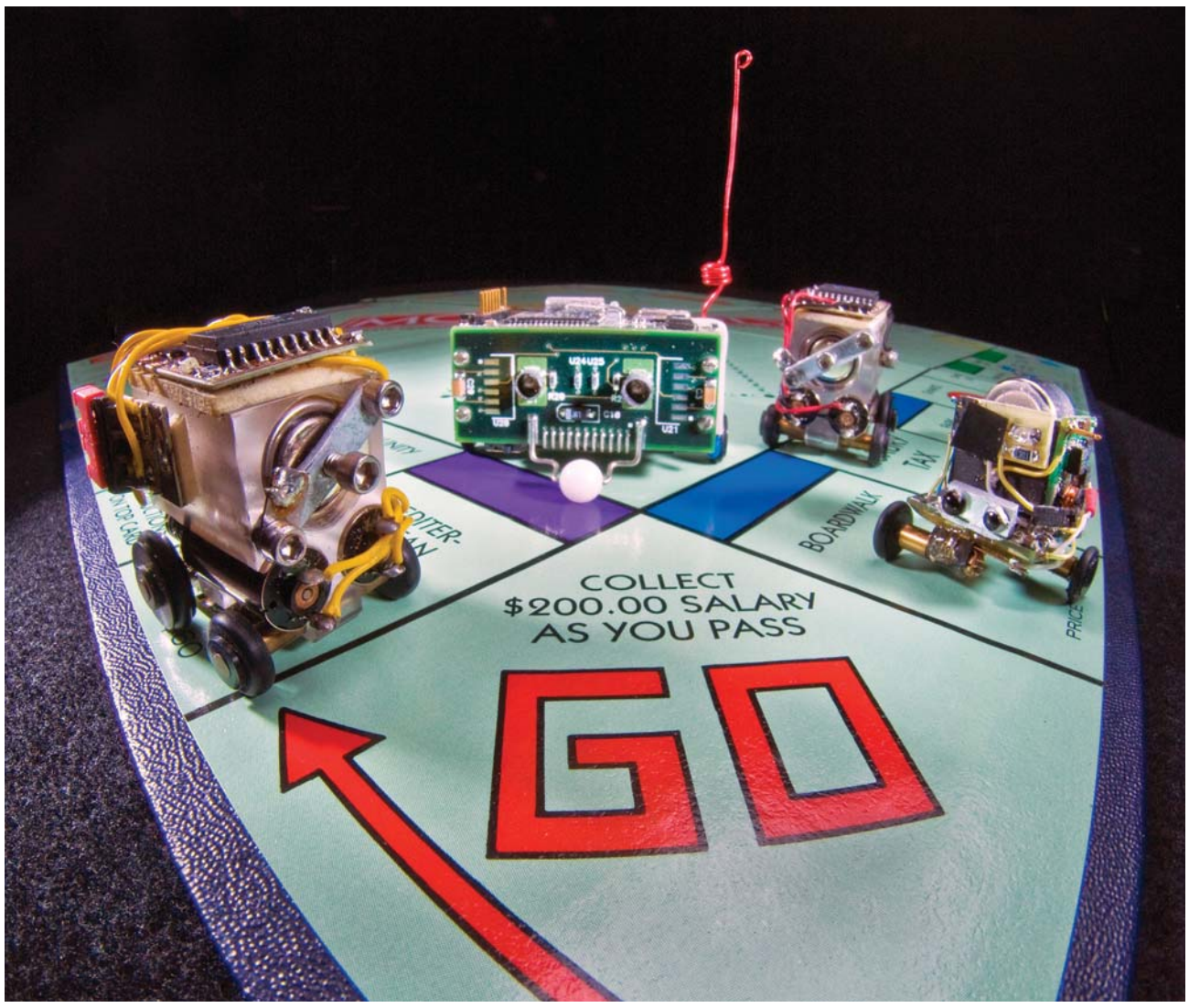
MORGAN MENDONCA (daughter of Holly Mendonca, 8244) takes a close look at her nano spaghetti.

CAROL LEWIS (8522) and her son, Alec, enjoy a walk across campus with Jessica Gowin (8522) and her children, Trevor and Kylee.

BOBBY SMITH (85131) gets an eyeful of his son, Tanner Ellis,' nano spaghetti.

A little piece of Sandia goes to America's attic

Labs' robots Smithsonian-bound



MINIATURE AUTONOMOUS ROBOTIC VEHICLES were developed in the mid-1990s and led to the creation of superminiature robots in 2001, which were selected by *Time* magazine as the invention of the year in robotics in 2001. (Photo by Randy Montoya)

By Stephanie Hobby

With more than 137 million artifacts, the Smithsonian Institution is the world's largest museum and research complex. It comprises a mind-boggling scope of treasures, representing America's rich heritage, art from around the globe, and the immense diversity of the natural and cultural world. This month, nine historically significant robots from Sandia are joining the collection, where they will be permanently housed in the National Museum of American History, home of more than 3.3 million pieces of US history, including the wool and cotton flag that inspired the Star Spangled Banner, Kermit the Frog, and the desk Thomas Jefferson used to draft the Declaration of Independence.

"For the Smithsonian to request Sandia technology to be in their collections is an external recognition of the significance of Sandia National Laboratories' contributions to the nation," says Philip Heermann (6530) senior manager of Intelligent Systems, Robotics and Cybernetics and participant in the signing ceremony at the museum. "These robots will be in the same collections as some of Thomas Edison's first electric light bulbs and Samuel Morse's original experimental telegraph. The Smithsonian selected Sandia robots for inclusion after they researched the history of robotics and they found worldwide references, all pointing back to Sandia Robotics as early pioneers. The Sandia robots are similar to Edison's electric light bulb in that both are first steps and testaments to American innovation."

MARV, the tiny marvel

A Smithsonian curator contacted Sandian and former robotics engineer Ray Byrne (5535) earlier this year about obtaining some of the MARV, or Miniature Autonomous Robotic Vehicles, that made headlines in the mid-1990s as one of the first miniature robots developed in the US. Taking up no more than one cubic inch of space, MARV housed all necessary power, sensors, computers, and controls on board. Such an accomplishment held promise for exciting future developments and applications for medicine and the military.

Retired Sandia robotic senior scientist Barry Spletzer, who was instrumental in creating MARV and the Hopper, spoke at the transfer ceremony about the significance of the robots.

"Nothing like MARV had ever been built before," Spletzer says. "We never expected recognition and certainly never thought we'd end up in the Smithsonian. This is certainly a career achievement."

As the Smithsonian soon found out, MARV was just the tip of the iceberg of Sandia's contributions to the advancement of the robotics field.

"The curator said they were looking for anything of historical significance. We have a lot that fit that requirement, so I started mentioning all of these older robots, and she was very interested," Ray says. "So far, we've donated Dixie, the first battlefield scout robot, SIR, one of the first truly autonomous interior robots, the hopping robots, the NETBOTS, MARV, and the descendants of MARV, the super-miniature robots."

The Sandia Interior Robot, or SIR, made a lasting impression on the nation when it was introduced in 1985 as the first truly autonomous interior robot. At the time, SIR was the only robot able to navigate a building without a preprogrammed pathway or floor wiring to find its way. It could run in manual or autonomous modes using navigational software, also developed at Sandia. SIR could perform dangerous work, such as disposing of radioactive waste or reconnaissance in a hostile environment.

In 1987, Sandia unveiled Dixie, the first battlefield scout robot. The all-terrain vehicle could perform reconnaissance work and exploration missions in a variety of landscapes. Dixie uses teleoperation with advanced navigation aides to enhance a remote operator's understanding of surrounding terrain.

The Hopper made news when it debuted in 2000 for its unique ability to navigate over walls and other obstacles by hopping 20 feet in the air over them. With applications for planetary exploration, gathering war-fighting intelligence, and assisting police during standoffs or surveillance operations, the Hopper was the first robot powered by a combustion cylinder and a piston foot, and the wheeled Hopper was the first hybrid hopping/wheeled mobility system.

Sandia continued to wow the robotics field with the introduction of "superminature robots" in 2001. These tiny robots descended from MARV and were built small enough to be able to scramble through pipes or buildings to look for human movement or chemical plumes. Less than a quarter-cubic-inch in size, these robots could "turn on a dime and park on a nickel" and could include such enhancements as a miniature camera, microphone, communication device, and chemical microsensor. They had the ability to communicate with one another and work together, much like insects in a swarm. The superminiature robots were selected by *Time* as the invention of the year in robotics in 2001.

The related NETBOTS are roughly the size of a remote-controlled toy car, and in fact, built on the same platform. With more than 20 vehicles in the group, at the time they comprised the largest team of cooperating small robots ever developed. They could communicate and localize with respect to one another. NETBOTS operated on a network that allowed vehicles to pass messages and camera images to other vehicles out of the line of sight, and had applications for military and explosive ordinance removal.

Ray took all of the robots on the plane, either in carry-on or checked luggage, to Washington, D.C., for a transfer ceremony to kick off the museum's festivities for National Robotics Week. "These are historically significant," Ray says. "I am pleased that the Smithsonian has chosen to recognize Sandia's contribution to robotics."

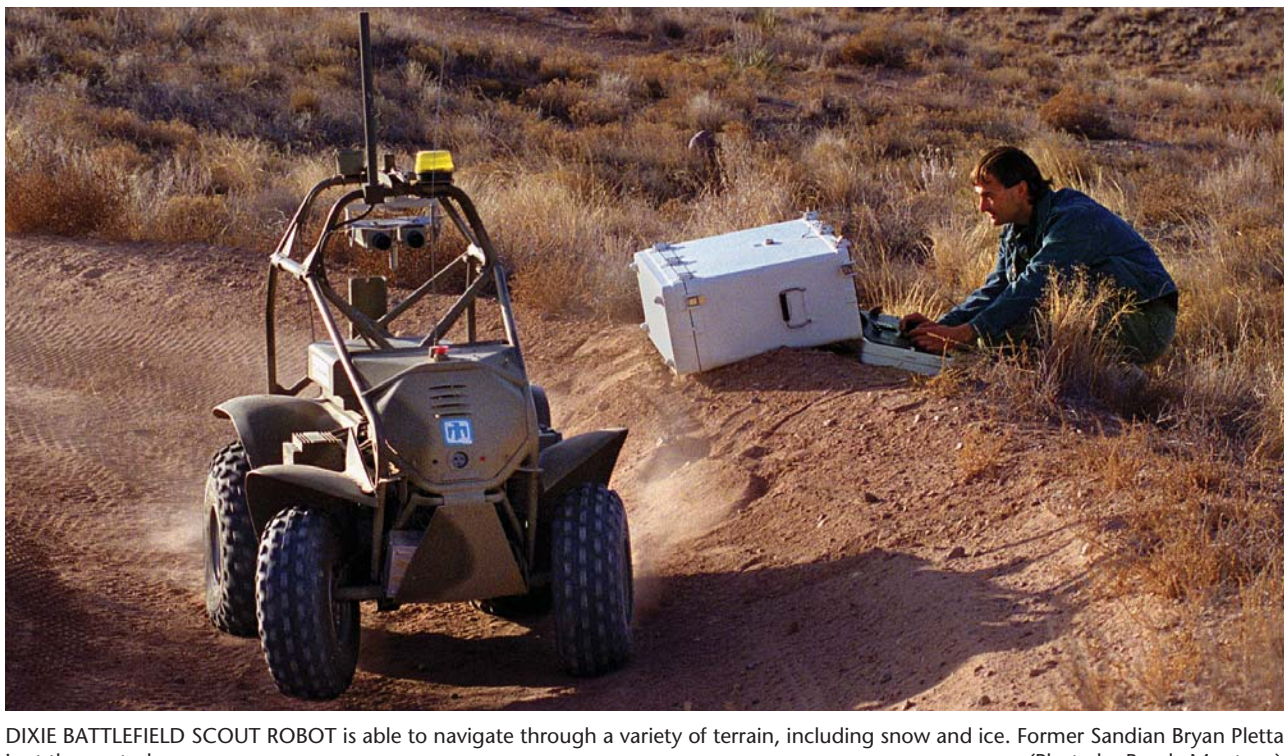
THE ICONIC SMITHSONIAN INSTITUTION BUILDING, or "The Castle," was completed in 1855 to house the nation's growing collection of art and scientific specimens. When English chemist and mineralogist James Smithson died in 1829, he left more than half a million dollars to the US to found an institution "for the increase and diffusion of knowledge," despite never having been to America. Sandia's robots will join the permanent collection of the Smithsonian's National Museum of American History, located across the Mall from the Castle.

SANDIAN DOUG ADKINS examines superminiature robots, which are ¼ cubic inch and weigh less than an ounce, debuted in 2001. At the time, they were possibly the world's smallest autonomous untethered robots ever created. (Photo by Randy Montoya)

SANDIA NETBOTS were, at the time, the largest team of cooperating small robots ever developed. (Photo by Randy Montoya)

SANDIA INTERIOR ROBOT, or SIR, (left) was developed in 1985 and was one of the first truly autonomous interior robots; Dixie (upper right) was created in 1987 as one of the earliest battlefield scout robots; and Hopping Robots (lower right) are able to navigate autonomously onto or over obstacles. (Photo by Randy Montoya)

BARRY SPLETZER (now retired) shows how high the Hopper can go. (Photo by Randy Montoya)



DIXIE BATTLEFIELD SCOUT ROBOT is able to navigate through a variety of terrain, including snow and ice. Former Sandian Bryan Pletta is at the controls. (Photo by Randy Montoya)

GARY FISCHER holds one of the combustion-powered hopping robots developed at Sandia. (Photo by Randy Montoya)

The wind beneath their wings

By Stephanie Holinka

Jose Zayas (6120) and Dale Berg (6121) have been honored by *Windpower Engineering* magazine as two of the nation's innovators and influencers in wind energy.

Jose, senior manager of the Renewable Energy Technologies group, was named an influencer on wind energy. The magazine also named Berg, principal member of the technical staff at Sandia, an innovator of wind energy technology.

JOSE ZAYAS, wind energy influencer.

Jose sets priorities for Sandia's Renewable Energy Technologies group at Sandia, and wind is an important part of that portfolio. With more than 14 years of experience in wind energy, Jose seeks ways to expand and accelerate Sandia's role in the innovation, development, and use of all renewable energy technologies.

Jose recently led development of advanced water power systems, focusing on the emerging clean energy portfolio of wave, current, tide, and conventional hydro energy sources. He also leads a federal interagency research effort to overcome barriers to the continued deployment and acceptance of wind energy systems nationwide.

Jose joined Sandia in 1996 as a senior member of the technical staff. He holds a bachelor's degree in mechanical engineering from the University of New Mexico and a master's degree in mechanical and aeronautical engineering from the University of California.

Dale has worked throughout his career on key innovations that make wind systems reliable and competitive sources of energy. In the early 1980s, he helped develop the first airfoils designed specifically for wind turbine applications. Up to that time, blade airfoils were the same as those used on aircraft and sailplanes.

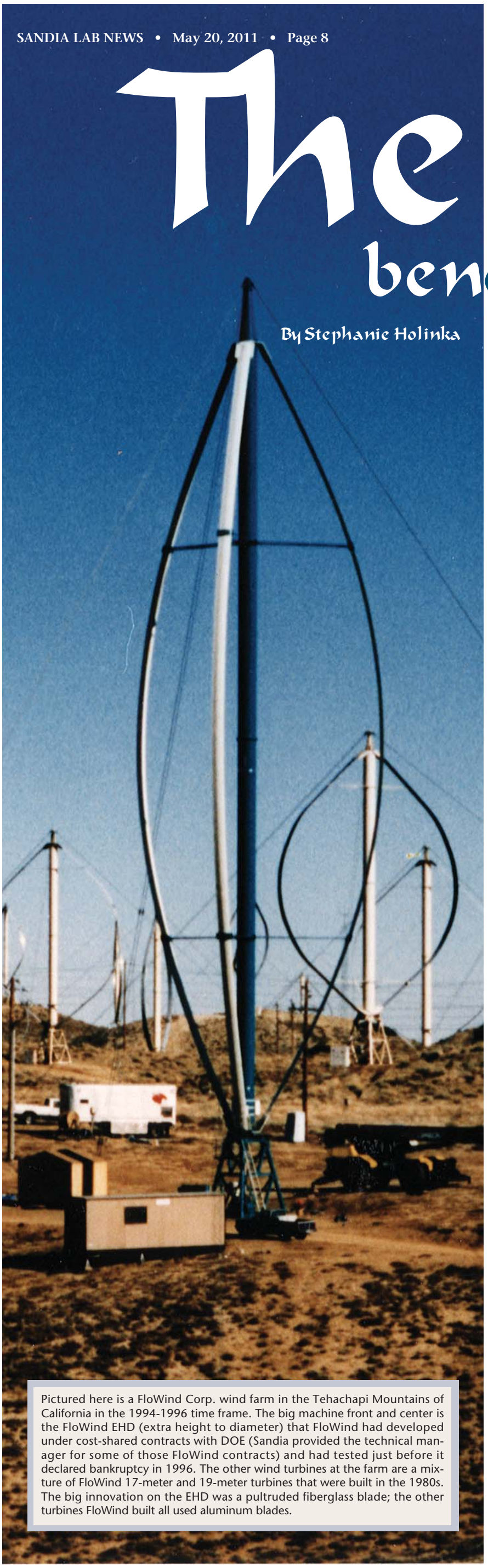
DALE BERG, wind energy innovator.
(Photo by Randy Montoya)

In the late 1980s, Dale contributed to the aerodynamic and structural design of the technologically innovative variable-speed Sandia 34-meter Testbed Vertical Axis wind turbine.

More recently, Dale worked on turbine aerodynamics and the development of systems for aeroacoustics testing, analysis, and data acquisition. Aeroacoustics testing pinpoints the sources of noise generated by turbine blades with the aim of developing quieter blades.

Dale leads a multidisciplinary team of Sandia employees and contractors developing a turbine rotor that will reduce turbine damage due to frequent wind variations. The rotor integrates blade-mounted load and flow sensors, small, fast-response blade control surfaces, and embedded intelligent control systems, which are frequently referred to as "smart" rotors.

Dale has worked in wind energy at Sandia since 1981. He holds a bachelor's degree from Michigan State University, a master's in mechanical engineering from the University of New Mexico, and a doctorate in aeronautics from the California Institute of Technology.



Pictured here is a FloWind Corp. wind farm in the Tehachapi Mountains of California in the 1994-1996 time frame. The big machine front and center is the FloWind EHD (extra height to diameter) that FloWind had developed under cost-shared contracts with DOE (Sandia provided the technical manager for some of those FloWind contracts) and had tested just before it declared bankruptcy in 1996. The other wind turbines at the farm are a mixture of FloWind 17-meter and 19-meter turbines that were built in the 1980s. The big innovation on the EHD was a pultruded fiberglass blade; the other turbines FloWind built all used aluminum blades.

'Wind weenies' and 'egg beaters'

Sandia's early days in wind power

Sandia got involved in the wind industry during the 1979 oil embargo. Dixie Lee Ray, head of the Atomic Energy Commission, challenged the national laboratories to examine alternative energy sources to decrease the nation's dependence on foreign oil.

In the early days, wind energy researchers at Sandia were referred to as "wind weenies." The industry was young and full of long-haired engineers/inventors working on designs in their back yards and garages, says Dale Berg (6121)

Berg says then-manager Randy Maydew made contacts in Canada with other researchers working on so-called Darrieus vertical axis wind turbines, which were often referred to as "egg beaters." Randy took a staff member with him to the Natural Resources Council. He returned intending to investigate vertical axis wind turbines (VAWTs).

AN EARLY vertical axis wind turbine test bed.

His group mounted a small turbine on the roof of 802 with great fanfare, but quickly realized that the dynamics of the blades meant that a less-traveled location would be safer. They then established a test bed southeast of the current Tech Area 1 off Poleline Road in the mid-1970s, and VAWTs remained there until the early 1990s. The largest units were 17 meters in diameter.

The vertical axis designs eventually gave way to the horizontal turbine designs common today, in part because forces were easier to understand, and market decisions eventually led to the end of research on vertical axis turbines. Since then, the horizontal axis turbines have taken over and research has largely concentrated in that area.

But old ideas find their way back in science; researchers are re-examining those vertical-axis designs for very large turbines, in part because gravitational loads on the blades are constant on the vertical axis machines, in contrast to the oscillating gravitation loads on the blades on the horizontal axis machines. The "egg beaters" may rise again to power our future. — *Stephanie Holinka*

MORE THAN NUMBERS

Internal auditors partner with organizations to help them achieve goals

By Heather Clark

Some people break out in a cold sweat when an auditor calls. But not Pamela McKeever (4870) and Ed Williams (4871); in fact, they were the ones who called Independent Audit & Advisory Services Center 800. The two wanted Sandia's audit team to review processes and tools in the Facilities Management and Operations Center (4800) and help implement a new facilities management system.

After years of collecting data from multiple sources, Pam and Ed say they were concerned about their information's accuracy before they merged it into the new system and they wanted to have the right processes in place to ensure their customers were being charged correctly for space.

Enter Laura Lang (857) and her co-workers, who dug right in to learn how facilities managers do their jobs, even down to how they measure a room's square footage, Ed says.

"They really wanted to learn about what we did as an organization," he says. "That was pretty impressive."

"We were like one team working together," Pam adds

Jennifer Plummer, director of Independent Audit & Advisory Services Center 800, says the Facilities Management special management review is just one example of how working with the audit center can be a positive experience for the organization involved.

"We don't only audit for compliance, we also want to understand what an organization is trying to achieve and help identify any roadblocks and how it can operate more effectively and reach its goals."

— Jennifer Plummer, Audit Center director

"We want to partner with organizations to help them achieve their objectives. We don't only audit for compliance, we also want to understand what an organization is trying to achieve and help it identify any roadblocks and how it can operate more effectively and reach its goals," Jennifer says.

The audit center is celebrating International Internal Audit Awareness Month in May.

The audit center has about 40 employees, including around 30 auditors. About 15 auditors work on subcontract audits and the other 15 conduct internal audits.

While independent in the sense that they don't report to the organizations they audit, the audit center is a part of Sandia. The audit center reports to Executive VP Kim Sawyer and to the Sandia Corp. Board of Directors Audit & Ethics Committee, Jennifer says.

When most people think about audits, they think numbers, but that's just a part of what Sandia's auditors cover. The auditors perform risk-based, objective, and professional audits and reviews that are aligned with the Labs' strategic management objectives. They look at financial and business operations, safety, security, and information technology operations (just to name a few areas).

Manager Gordon Smith (857) says most audits take 90 days from start to finish.

Sandia's auditors communicate with their "clients" throughout the process, giving them input at entrance and exit conferences about the audit and informing them if a potential problem is found, Gordon says.

"We have a policy of no surprises. No one should be surprised by audit results when they become formal," he says.

Getting results

In the Facilities Management review, Ed and Pam say they got confirmation that their data didn't have any significant flaws, giving them confidence to move ahead with improvements. They also learned that they needed to have processes in place rather than relying on one person to do things, Ed says.

Laura says the review provided Facilities Management staff with a prioritized list of workable solutions to improve their processes, and provided them with information from other sources to help them better implement the improvements.

"Organizations in our environment may not have the time or the resources to really look at their processes. We can come in, they can keep working, and we can assess how their processes work," Laura says.

Pam says the outcome helped her center.

"We really embraced the idea of getting their expertise to help us with this because we wanted an independent view," Pam says. "We were very thankful to them for the input that they gave us. It wasn't adversarial at all; it was very helpful."

Communicating trends

The audit center has improved its services to help managers strengthen their assurance activities. Since March, the center has communicated Labs-wide trends and areas of concern. They also inform and advise managers, the board of directors, and critical stakeholders about risks that affect Sandia, Jennifer says.

"When we talk about the strategic objective of being a leader in the 21st century for the government-owned, contractor-operated model, that's where we fit in to make sure that Sandia has a management assurance system that's effective. It's providing our leaders with that assurance that they will meet their goals," Jennifer says.

Based on audits over the past two years and input from center managers, the audit center's current concerns include: the self-assessment process, the corrective action process, hiring and retention, workforce planning, knowledge transfer, recapitalization, stress and workloads, materials control, and the pressure to reduce costs. Some recent trends they have identified include issues in records management, consistent implementation of policy, and cost estimating.

Steve Rottler, VP of S&T & Research Foundations Div. 1000, says of the audit process: "I view independent assessments as something we do for ourselves because it improves our ability to manage the Labs. It should not be viewed as something done to us by others. Independent assessments are most meaningful when they go beyond compliance and advise management on the effectiveness of an operation."

Each internal audit department also holds audit discussion group meetings with representatives of audited organizations. The purpose of the meetings is to discuss upcoming audits and ways to reduce overlap of audits and improve efficiencies, Jennifer says.

Audit requests

The audit center's positive attitude is working. So far this fiscal year, Sandia's management has made nine requests for the audit center's services, compared to about four such requests in the previous fiscal year, Jennifer says.

Matt Riley (10547), a manager in the International Homeland and Nuclear Security Strategic Management Unit, recently wrote about his experience with a cost estimation audit completed in March.

The auditor's "approach was always set within the context of helping make the cost-estimation process better, not within the context of catching us doing something wrong. It was never 'us against them,' but was 'How is the process not optimal and what can be done to change this?'" Matt writes.

Over in Facilities Management, Ed says they'll continue their relationship with the audit center.

"Probably the best reinforcement about how happy we are is that we've asked them for another one," Ed says, explaining that they've asked for help with identifying lessons learned on certain projects.

City of Albuquerque, Sandia to cooperate on mutually beneficial initiatives

ALBUQUERQUE MAYOR RICHARD BERRY, left, and Sandia President and Labs Director Paul Hommert shake hands on April 19 after signing a memorandum of understanding (MOU) between the City of Albuquerque and Sandia. The MOU, similar to others that have previously been in place with the city, allows for the two entities to work together in areas of mutual benefit and interest, and signifies a continued solid and productive relationship between the city and the Labs. Past MOUs have: enhanced the quality of emergency management collaboration and preparation; promoted outreach activities to assist those in need and improve the overall quality of life in the community; and assisted local law enforcement efforts with video enhancement from crime scenes, to name just a few. (Photo by Randy Montoya)

Mileposts

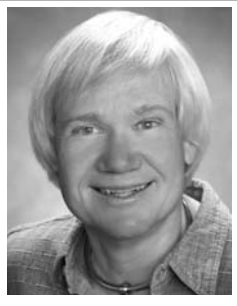
New Mexico *photos by Michelle Fleming*
California *photos by Randy Wong*


Norman Kolb
40 2622


Dahwey Chu
35 1718


Ronald Hartwig
35 2100

Recent Retirees


James Ringland
30 8245


Finis Long
35 1678


Wilbur Martin
35 2991


Richard Meyer
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Bill Richard
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George Baldwin
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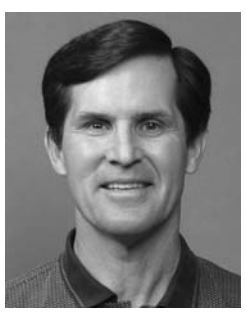
Judy Hurtz
16 8522


Carole Farnan
10 8238


Jim Chavez
30 5900


Martin Fuentes
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David Jones
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Terry Keim
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Suzanne Kelly
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Neil Lapetina
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Paul Taylor
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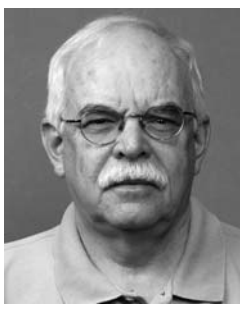
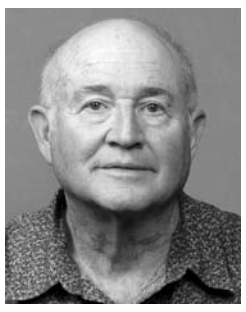

Walter Wolfe
30 1515


Ted Wolff
30 857


Douglas Bickel
25 5344

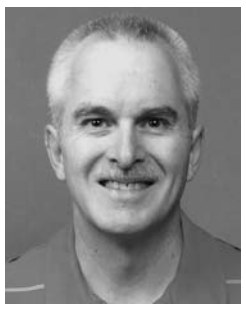

Teresa Bottomly
25 5562


Thomas Dickman
25 2717


Deborah Jensen
25 2622


Rosalie Lopez-Spinello
25 2734


Louis Weichman
25 2127


John Williams
25 5353


Ronald Farmer
20 426


Mark Olona
20 3653


Roman Martinez
15 5353


David Moran
15 10545

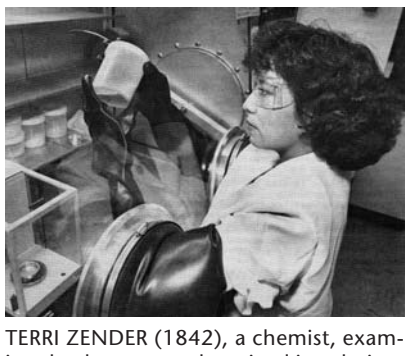

Charles Mueller
15 8362

50 years ago . . . Experiments under near-perfect vacuum conditions can now be conducted by Advanced Development Division 1413 through use of a helium refrigerator which was recently installed in Bldg. 855. Certain properties of materials cannot be accurately analyzed in the presence of air. By conducting tests in an ultra-high vacuum, the specimen is not contaminated by the atmosphere, and precise analyses can be made. This ultra-high vacuum is achieved by a technique called cryopumping (cold pumping), which makes use of the fact that the common atmospheric gases have extremely low vapor pressures at temperatures near that of liquid helium. **Sandia Labs is developing a theory for a billion component ultra microcircuitry.** This circuitry is being developed for information handling and processing for advanced instrumentation. The microscopic components being developed can only carry extremely limited amounts of power because of their size. The system would be a mesh of ultra microcircuits containing electronic components packed to a density of as much as 109 per cubic inch. This approaches the neuron density of the human brain.

40 years ago . . . In mid-April a team of **Sandians successfully conducted a series of ice penetrometer tests near Thule, Greenland, and Alert, Canada.** Instrumented projectiles were dropped in various types of sea and freshwater ice. Data radioed to the drop aircraft from the Sandia Ice Penetrometers (SIPs) reveals ice thickness as well as whether it has formed in one year (annual ice) or over a period of several years (pack ice). Twenty-three instrumented penetrometers were dropped. Initial analysis of data shows close correlation with measurements of actual ice samples core-drilled at the impact sites.

20 years ago . . . Ferroelectric thin films — high-tech ceramic materials are now being developed at Sandia for a variety of new applications. The materials most commonly used to make ferroelectric thin films are a family of ceramics called PZT. The letters refer to lead oxide, zirconium oxide, and titanium oxide, respectively. These materials, and sometimes lanthanum oxide (PLZT), are combined in varying proportions to get different properties. These new films may be used in further development of optical modulators, optical computing, and pyroelectric infrared detectors.

10 years ago . . . Using the latest in computational structural dynamics modeling and "smart structures" capabilities, **Sandia examined how machine tool "chatter" happens, then helped a consortium design a vibration control system** that actively suppresses chatter as the tool spins at thousands of rpm. ("Smart structures" refers to the use of sensors, actuators, computers, and control algorithms to produce a response in a structure that makes that structure more effective.) The new Smart Spindle Unit (SSU) allows the milling machine to cut deeper and faster, removing metal at more than five times its original rate. The SSU could enable machinists to operate their machines closer to their design capabilities, possibly shaving minutes or hours off the milling of each metal part and dollars off production costs.


TERRI ZENDER (1842), a chemist, examines lead acetate to be mixed in solution, part of the procedure for producing ferroelectric thin films.

Celebrating Asian Pacific American Heritage Month . . .

With desire and perseverance, many things are possible

By Iris Aboytes

Tammy Strickland, manager of Technical Project Management Dept. 9512 and chair of the Asian Leadership & Outreach Committee, traveled a long and difficult road to get here.

She grew up in Hong Kong with four sisters and one brother. Her father initially had his own business and earned enough money for his family to live comfortably. Unfortunately the business took a downturn, and he was forced to close it. Though Tammy was still very young, this would mark the beginning of a period of struggle and hardship for her and her family.

THE SUEN FAMILY — Tammy poses with her parents and siblings for a formal portrait. Tammy stands on the far right, next to her father.

Her dad worked in a factory while her mother worked at home as a seamstress. "My oldest sisters helped my mom with the sewing," says Tammy. "My younger sister and I were responsible for the cooking and household chores. I did not like to sew."

Their family of eight earned just enough money to afford a tiny apartment without heating or air conditioning. In the summer they sometimes took three showers a day to stay cool. In the winter, they boiled water to bathe.

At that time in Hong Kong, public schooling ended in sixth grade. After that, children either went to trade school, or if their families had the financial means, they went on to high school. Tammy's family couldn't afford high school, so if the children wanted to stay in school, they would have to earn scholarships.

"What will I do?" Tammy asked her mom. "I really don't like to sew. Maybe I could take a bookkeeping class at trade school."

At the end of sixth grade all students took a mandatory exam on the core competencies. If Tammy wanted to go on to high school, she had to do well on this exam to be accepted. But if she were accepted, how would she pay for it? She didn't know.

"It was a grueling full-day exam," says Tammy. "I wanted to go on to high school so I studied and tried hard." Tammy did so well she received a full scholarship.

Tammy had saved money during high school, but the only two colleges in Hong Kong were very exclusive. Only the wealthiest families could afford them. Now what? Though she desperately wanted to attend college, she had to enter into the workforce and put any ideas of further education on the back burner. She worked as a secretary and then a merchandiser for more than six years. Part of her salary would go to her family, the other part she saved for her college fund.

TAMMY STRICKLAND

Where could she afford to go? At the time, she had a friend attending Texas Tech in Lubbock. When he told her about the tuition and fees there, she was both shocked and relieved. It was within her budget. She applied immediately and was accepted into the school's computer science program.

"Our parents taught us to work hard and do the best we could. They told us we had to believe in ourselves. We all did."

— Tammy Strickland

She worked 36 hours a week holding two jobs on campus, and went to school full time. Again she sent money home occasionally to help pay for tutors for her brother in hopes that he could attend college, too.

At Texas Tech she met Steve (6614). "He is brilliant," she says. She and Steve were married her senior year.

After receiving her degree she went to work at Texas Tech as an entry-level programmer and soon became project leader. She worked at the university for eight years before her husband got a job offer to come to New Mexico.

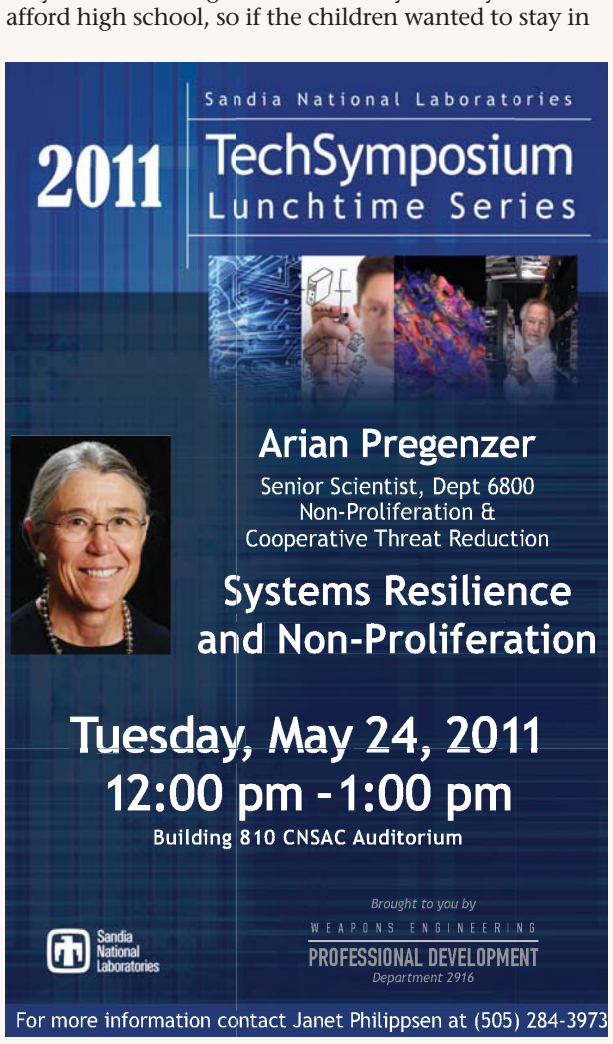
With their two children in tow they arrived in the Land of Enchantment. Her husband went to work and she began working part-time for the same company. Tammy met a person at work who told her about Sandia being the best employer in the state. Tammy applied and was offered a position as a programmer/analyst.

"In the 18 years I have worked here, I have worked with many intelligent, hardworking, and talented people," says Tammy.

Her two children have their college degrees. Her daughter, Stephanie, works for Pixar Animation Studios. Stephanie determined early in her college career where she wanted to work, so, like her mother, she made it happen. Tammy's son, Tate, is an interactive designer in Austin, Texas, where he designs websites, mobile applications, and motion graphics.

Tammy's brother had five sisters looking out for him and making sure he finished school. With their help, he went to college and became a civil engineer in Canada. One of her sisters is a certified public accountant, one of them is a software engineer, and one of them is a partner in an export business in Hong Kong. The oldest sister retired from a supervisory position at a boutique and lives in Australia.

"Our parents taught us to work hard and do the best we could," says Tammy. "They told us we had to believe in ourselves. We all did. We all worked together to make it happen — for all of us. Besides, there is no way I could have made a living sewing. I don't like to sew."



Sandia, University of Arizona sign MOU

Sandia and the University of Arizona have signed a new memorandum of understanding to promote collaborations in energy, water, sustainability, and materials research. Signing the agreement during a visit by a UA delegation to Sandia are, left, Duane Dimos, director of Engineering Sciences Center 1500 and Sandia's campus executive for the University of Arizona, and Jeff Goldberg, dean of the University of Arizona College of Engineering. Glenn Schrader, standing, associate dean for research at the UA College of Engineering, also played a significant role in developing the agreement. In addition to technical collaborations, the new partnership will focus on student programs, recruiting, and faculty/staff exchanges. "This partnership," says Duane, "is one element of our technical strategy to team with the best universities in the nation to address the most challenging technical problems facing the US."

THE UNIVERSITY OF ARIZONA