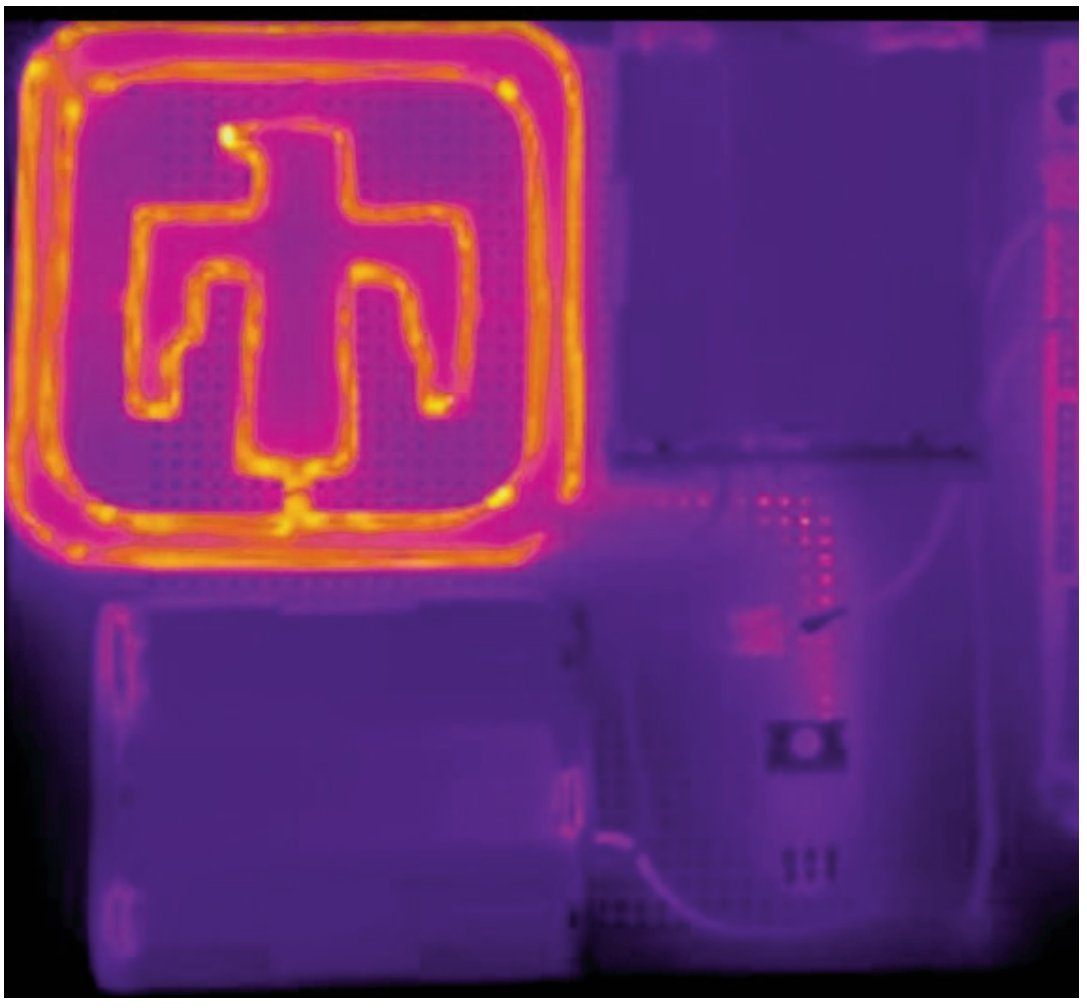

CAN YOU TAKE THE HEAT? — An image from the infrared camera of a resistance-heated thunderbird. (Photo courtesy of the Climatic lab)

Can you take the heat?

Climatic lab welcomes new method to monitor thermal stress

By Mollie Rappe

Though Duracell batteries are "Trusted Everywhere," nothing quite compares to the diverse environments in which Sandia's nuclear weapons systems and components must survive. Testing these components and ensuring their reliability in the harshest environments is the job of the people and tools at the non-destructive environmental testing lab.

Late last year, one of those facilities, the climatic lab, welcomed a new tool that should give them a clearer idea of what is happening during testing. Their new infrared camera and movable, magnetic IR-transparent window can provide a more complete data set than by a few strategically placed thermocouples. The combination is particularly useful for monitoring live electrical components during climatic testing.

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Inside . . .

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Exascale

Earth-modeling system to make high-fidelity predictions for energy

By Neal Singer

An Earth modeling system developed over the last four years and unveiled two weeks ago is expected to have one of the finest resolution ever achieved by supercomputers simulating aspects of the planet's climate, said Sandia researcher Mark Taylor, the project's chief computational scientist.

The Energy Exascale Earth System Model, or E3SM, is the work of eight Department of Energy labs and several universities working under the aegis of the DOE's Office of Science. More than 100 researchers worked to enable program users to be able to anticipate long-term changes that will critically impact the U.S. energy sector in coming years and eventually uncover other aspects of climate's changing effects.

Simulations of the Earth's climate, with its myriad interactions of atmosphere, oceans, land and ice components, present an extraordinarily complex system for investigation. Simulations at this grand scale must

(Continued on page 6)

Sandia/California hosts Lisa E. Gordon-Hagerty

Undersecretary of Energy for Nuclear Security and NNSA Administrator Lisa E. Gordon-Hagerty recently visited Sandia/California, where she received an overview of Sandia/California's contributions to the nation's security mission.

Labs Director Steve Younger provided Lisa E. Gordon-Hagerty, DOE undersecretary for Nuclear Security and NNSA administrator, with an overview of Sandia. After a nuclear weapons update, participants checked out a B83 modern strategic bomb display unit. From left to right, Jeffrey Harrell, manager of NNSA's Sandia Field Office; Dori Ellis, Integrated Security Solutions associate labs director; Lisa E. Gordon-Hagerty, Steve Younger, and Steve Girrens, Nuclear Deterrence associate labs director and chief engineer for Nuclear Weapons. (Photo by Dino Vournas)

Labs Director Steve Younger, right, led Lisa E. Gordon-Hagerty, DOE undersecretary for Nuclear Security and NNSA administrator, on a tour of Sandia's California campus, along with Andy McIlroy, left, deputy to the Integrated Security Solutions associate labs director, and Jeffrey Harrell, manager of NNSA's Sandia Field Office. (Photo by Dino Vournas)

Lab News Notes

By Jan Williams

Editor's Note: *Lab News seeks guest columnists with observations on life at the Labs or on science and technology in the news and in contemporary life. If you have a column (500-750 words) or an idea to submit, please contact Jim Danneskiold, the acting editor.*

I've been active in the Society of Women Engineers for decades. The reason the society exists is to encourage more women to enter the profession, but we are more generally devoted to getting young people to consider careers in engineering and other STEM, or Science, Technology, Engineering and Math fields. Members of SWE do this in three ways: outreach activities, mentoring and advocacy.

Many of us who advocate for STEM education are often asked: Why is it so important to promote STEM education and STEM careers? Let me address this question from my perspective as a woman engineer, a Sandian and a U.S. citizen.

For a long time, the U.S. has considered itself pre-eminent in technological innovation. But technologies are emerging and developing more rapidly than ever before, and our global partners and competitors are making giant strides, even surpassing the U.S. in some areas. For example, leaders in high-performance computing from several nations frequently trade the honor of having the fastest computer in the world, as next-generation supercomputers are fielded every few months.

Advances in technology and global competition are accelerating the need for more workers with STEM education and technical training. Furthermore, the rapid emergence of innovative technologies will demand a STEM-educated workforce in fields we can't even imagine yet. Already, personnel in support and administration positions must have a lot of tech savvy, and they will need more to operate in the workplaces of the future. This makes core education in STEM fields more universal and more critical.

Global competitiveness aside, without an adequate cadre of citizen STEM professionals, the U.S. won't be able to fill critical national security positions. For the last few decades, about half of all advanced degrees in science and engineering granted in the US have gone to non-US citizens, many of whom aren't eligible to work in national security jobs.

As a long-time recruiter for Sandia at SWE conferences, I have seen how difficult it is to find qualified candidates — especially females — who hold advanced degrees in the areas of the greatest interest to Sandia and who are eligible to perform national security work. I read an article recently that asserted the U.S. has all the STEM professionals graduating that we need to fill current STEM job openings. Even if that is accurate today, it won't be true tomorrow, and it won't be true for national security positions. Many STEM professionals in the "baby boomer" generation are retiring, taking decades of experience with them. Are we training enough STEM professionals to take their places over the next decade? And will the limited number of advanced engineering degrees granted to U.S. citizens result in a shortfall of qualified candidates for future national security jobs?

The availability of a qualified STEM workforce starts with a solid elementary education that incorporates STEM and continues through high school classes and focused counseling that ensure college readiness for STEM majors. We must offer integrated curricula that include strong STEM foundations, taught by teachers who are comfortable with STEM topics. And those teachers need training and tools to offer creative activities that make STEM learning the fun, fascinating and rewarding experience we Sandians know it to be. Role modeling is crucial, especially for women and minorities. The outreach and mentoring activities in which many of us participate help convey the wonder of scientific inquiry and the rewards of a STEM career. Educational excellence and solid role modeling can foster an early, and sustained, affinity for STEM subjects that may inspire students to consider STEM careers when they might otherwise have looked elsewhere.

My message is simple: pay it forward. It is up to those of us already in STEM to show the next generation the stimulation, excitement and rewards of a STEM career.

A recent study commissioned by Microsoft Corp. showed that outreach activities have a profound effect on kids, particularly girls, who may be considering science and engineering courses and careers in STEM. The surprising reality is that just showing up to an outreach event can make a big difference in whether someone considers a career in STEM. The next time you read about outreach and mentoring volunteer opportunities in the Sandia Daily News, I hope you will strongly consider volunteering to make a difference and shape the future.

KIDS DAY SWAN PANEL — Panelists, from left to right, Marcy Litvak, Michelle Williams, moderator Anju Shah, Lisa Deibler, Whitney Ingram and Olivia Underwood. Litvak is a professor in the biology department at the University of New Mexico.

KIDS DAY SWAN PANEL Q&A — Material scientist Olivia Underwood answers a question from one of the girls in the audience during the all-woman panel hosted by SWAN.

Panel discusses challenges, opportunities for women in STEM

By Lindsey Kibler

The Sandia Women's Action Network (SWAN) recently hosted an all-woman panel aimed at giving girls more information on pursuing educational and career paths in science, technology, engineering and math.

Panelists from various professions and levels of leadership discussed their STEM career paths while answering questions from girls in the audience for Sandia's Kids Day. Through each story ran a common thread: believe in yourself. The group discussed how the challenges of sometimes being the only females in their laboratories or jobs led them to question, at times, if that job was actually something they wanted.

"When someone counts you out, make sure you so believe in yourself. Dig deep, push yourself and give them a reason to count you in," said panelist and SWAN outreach co-chair Olivia Underwood. "You have to advocate for yourself because no one will do that better than you."

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Sandia National Laboratories

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Jim Danneskiold, Acting Editor 505/844-0587
Darrick Hurst, Managing Editor 505/844-8009
Michael Lanigan, Production 505/844-2297
Randy Montoya, Photographer 505/844-5605
Patti Koning, California site contact 925/294-4911

Contributors: Michelle Fleming (Ads, Milepost photos, 844-4902), Neal Singer (845-7078), Stephanie Holinka (284-9227), Michael Baker (284-1085), Troy Rummler (284-1056), Valerie Larkin (284-7879), Lindsey Kibler (844-7988), Tim Deshler (844-2502), Mollie Rappe (844-8220), Kristen Meub (845-7215), Michael Padilla (925-294-2447), Julia Bernstein (925-294-3609), Jim Danneskiold, manager (844-0587)

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Sandia's special appointments announcement in the April 27 issue of the *Lab News* incorrectly identified Mark Anderson's Distinguished appointment.
The correction appears here.

Division 6000

Mark Anderson
Materials Science

Jeff Brinker elected fellow of American Academy of Arts and Sciences

By Neal Singer

Jeff Brinker, Sandia fellow and University of New Mexico regents' professor, has been elected fellow of the American Academy of Arts and Sciences, the oldest learned society and independent policy research center in the United States.

The academy's 1780 charter states its purpose is "to cultivate every art and science, which may tend to advance the interest, honor, dignity and happiness of a free, independent, and virtuous people." The academy's broad-based membership — currently 4,900 fellows and 600 foreign honorary members — allows it to conduct a wide range of interdisciplinary studies and public policy research. The membership includes more than 250 Nobel laureates and Pulitzer Prize winners.

JEFF BRINKER, SANDIA FELLOW AND UNIVERSITY OF NEW MEXICO REGENTS' PROFESSOR, has been elected fellow of the American Academy of Arts and Sciences, the oldest learned society and independent policy research center in the United States. (Photo by Randy Montoya)

Jeff is among 177 new fellows and 36 new foreign honorary members.

"I am thrilled to have been elected to America's oldest academy whose members include some of my personal heroes," he said, "including Martin Luther King Jr., Jonas Salk, Georgia O'Keefe, Albert Einstein, Charles Darwin and Benjamin Franklin.

"My election into AAAS would not have been possible without continued support from Sandia's Laboratory Directed Research and Development program, the Department of Energy's Office of Basic Energy Sciences, the Air Force Office of Scientific Research, the National Cancer Institute, the Defense Threat Reduction Agency, the National Science Foundation, and the University of New Mexico.

"I hope to participate in the academy's activities in the advancement and study of the key societal, scientific and intellectual issues," Jeff said.

Jeff has made pioneering contributions to the processing and characterization of porous and composite nanostructured materials. He was one of the first to champion the need for multidisciplinary materials research.

Later he led the creation of aerogels, the world's lightest solids, by a method that eliminated the need for supercritical processing. In 1997, his group published pioneering work on evaporation-induced self-assembly of ordered mesoporous silica films, the first combination of controlled sol-gel chemistry with molecular self-assembly. Most recently, Jeff has worked with a revolutionary class of nanocarriers that deliver diverse cargos directly to biological cells.

He is currently distinguished professor of chemical and biological engineering and molecular genetics and microbiology at UNM, and a distinguished affiliate scientist at the Center for Integrated Nanotechnologies, a DOE Office of Science nanoscale science research center led by Sandia and Los Alamos National Laboratory.

Jeff has authored or coauthored more than 400 papers, patents and books that have been cited more than 49,000 times, according to the web search engine Google Scholar. Among Jeff's honors over his 35-year career have been the Ernest O. Lawrence Memorial Award from the Department of Energy (2002), the Materials Research Society MRS Medal (2003), five R&D100 awards (1996, 2007, 2008, 2011 and 2015) and a UNM Presidential Medal of Distinction (2015).

Jeff was elected into the National Academy of Engineering in 2002 and the National Academy of Inventors in 2015. He has supervised more than one hundred post-doctoral researchers, doctoral candidates, undergraduates and high school students.

The academy's annual formal induction ceremony will be Oct. 6 at its headquarters in Cambridge, Massachusetts.

Six environmental initiatives receive excellence awards

By Lindsey Kibler

A total of 58 members of the workforce were honored recently with Sandia's annual Environmental Management System awards for their contributions to environmental stewardship.

"This year, we received a broad range of impressive nominations from teams that both enhance sustainability across Sandia, and whose efforts saved, and will continue to save, hundreds of thousands of dollars, eliminate waste and save millions of gallons of water a year," said Environmental Management System Program Coordinator Chris Catechis.

The awards have been part of Sandia's Environment, Safety & Health program for more than a decade, and demonstrate continuous environmental excellence and improvement throughout the Labs, he said.

Denise Tibbetts received the Greenie Award for creating a comprehensive recycling program in building 840-South — the first time recycling has been made available there. It was dubbed an "against all odds" program.

Adhering closely to the building's requirements, Denise looked to other members of the workforce to help her foster a culture of recycling. The program reduced the amount of solid waste leaving the building, which, in turn, reduces Sandia's cost of solid waste disposal.

Francis Bouchier and Chad Twitchell created the Sandia Bike Commuters Group, which earned the Grassroots Award. Chris said an often-overlooked environmental impact of Sandia's daily operations is fossil fuel consumption and associated Scope 3 Greenhouse Gas emissions due to daily commuting.

What started as a small group of Sandians has grown to one of the largest bike commuting populations in Albuquerque. Over the last year, the group avoided more than 8 million miles of driving, based on the average round-trip commute, and prevented the emission of approximately 1,200 metric tons of carbon dioxide equivalents, helping Sandia move toward its reduction goals.

Jeff Zirzow received the Resource Conservation Award for improvements that led to massive savings of water and power at a temperature chamber used for Sandia's renewable energy and elecric grid programs. Last year, when long-term accelerated lifetime tests of microinverters and photovoltaic modules began in the walk-in chamber at the Distributed Energy Technologies Laboratory, the estimated tap water usage of about 3.7 million gallons a year rose to about 5 million gallons, as ambient outside temperature increased. Jeff worked with the chamber vendor and came up with his own creative ideas to modify chamber operation, eliminating the need for any water use. In addition, power usage dropped from about 35 kilowatts continuous to around 5kW continuous. Altogether, these operational changes translated to a savings of up to 5 million gallons of water per year and more than 172 megawatt-hours of electricity so far over an eight-month run, for an estimated annual savings of more than $16,500.

(Continued on page 4)

The first building that will be certified under the campus umbrella is the Bldg. 725 Data Center addition. It will be Sandia's first LEED certified data center. (Photo by Randy Montoya)

Sandia LEEDs the way with New Mexico campus certification

By Stephanie Holinka

The U.S. Green Building Council has awarded the Sandia/New Mexico site a LEED v.4 for Campus Certification, the first such certification at a Department of Energy lab. The Sandia/New Mexico award is the largest LEED Campus Certification in the history of the program, as well as the first Version 4 certification in New Mexico.

LEED quantifies building performance in terms of energy and water use. The performance measures look at site selection, green power, recycling and indoor air quality, as well as opportunities for capitalizing on daylight.

The Leadership in Energy and Environmental Design v.4 for Campus Certification is a framework for quantifying sustainability measures that contribute to LEED certification on a campus-wide basis. Sandia/New Mexico received its certification for areas in which new projects are antici- pated in 5-7 years, so the certification includes Tech Areas 1, 2 and 4.

"LEED for Campus helps Sandia plan for and achieve a healthier and more sustainable campus," says Sandia project lead Alicia Brown. "It simplifies the building and infrastructure site selection process by putting all of the information in one location, and helps make environmental considerations an extremely important measure in new building and infrastructure site selection."

"The campus certification allows Sandia to take credit for the many existing environmental initiatives, mandates and amenities that contribute credits towards LEED for Campus certification. This allows us to cite and document all of the efforts in one location," Alicia says.

LEED for Campus also provides a reference guide for project managers so future projects are proposed within the LEED for Campus framework, allowing Sandia to retain the certification through new building projects and to avoid costly change orders.

The first building that will be certified under the campus umbrella is the Bldg. 725 Data Center addition. It will be Sandia's first LEED certified data center.

Alicia says data centers are hard to certify as green buildings because they require more water and power than a typical office building.

The team spearheading the LEED v.4 for Campus also won Sandia's Environmental Management Services Sequoia Award.

The federal government requires that all new buildings that cost more than $5 million must achieve LEED Gold certification.

A green scene at California's Earth Day 2018

The spirit of the original Earth Day, which marked the birth of the modern environmental movement in 1970, was alive and well last week at Sandia/California. John Garcia, Environmental Safety and Health senior manager kicked off the Labs' Earth Day event by challenging those assembled to take action toward a healthier planet.

Action options at the event included an electronic waste recycler who collected 673 pounds of personal electronics onsite, composting education at the Livermore Sanitation and StopWaste booths, and a nature walk led by wildlife expert Robert Holland of environmental management for a deeper appreciation of local birds.

The official 2018 Earth Day theme was "putting an end to plastic pollution," and John spoke proudly of the Labs' support for that campaign along with others complementary to Earth Day, such as saving endangered species, promoting green schools, reforestation, climate change and more.

John encouraged attendees to spend time talking with the environmental solutions agencies and companies assembled for the day. Many of the participating companies provide the technology that enables Sandia's environmental management practices, all of which have a net positive impact on the planet, he said.

Though Earth Day may have come and gone, suggestions are on the official Earth Day website for actions that can ensure Sandia staff live in maximum possible harmony with their natural suroundings.

— Jules Bernstein

David Hopman left, and Meghan Castro pose with the rocks they painted at the Human Resources table. Part of HR's stress reduction initiative, this helps the painters decompress from their busy days. Stones with the words "Sandia rocks" on the underside will be hidden on site. Those who find one of these treasures are encouraged either to hide it again or keep it, paint their own and pass it on in a random act of kindness. (California photo by Michael Padilla)

Earth Day in New Mexico

THE WATER RUNS DOWNHILL — At the Earth Day event in New Mexico, John Kay from Sandia's Stormwater Team showed both young and old how runoff generated by rainfall can carry harmful chemicals and waste to the waterways, and offered ideas to help solve the problem. The Kids Day attendees joined numerous representatives from Sandia and its partner organizations for a variety of activities at the Earth Day information booths in the Steve Schiff Auditorium lobby. (New Mexico photos by Norman Johnson)

GROW BIG — As part of the New Mexico Earth Day celebration, ES&H and Facilities worked together to plant a *Pinus nigra* or Austrian Pine Tree, which can grow up to 60 feet tall at maturity and can withstand drought conditions and poor soil. Jaime Moya, director of ES&H, center left, and Chris Catechis of ES&H got some help from Kids Day participants and Facilities personnel, and thanked participants after the tree planting.

EMS excellence awards

(Continued from page 3)

MESA FAB Operations 2 — Gary Patrizi, Carlos Sanchez, Shawn Felter, Barbara McGuire, Andrew Gough and Jose Martinez Jr. — received the Above and Beyond Award. The department routinely performs operations involving semiconductor wafer-dicing and wafer-thinning processes, but encountered a problem when it relocated a laboratory that required control methods for hazardous waste, such as gallium arsenide. The team introduced an arsenic filtration and a de-ionized water closed-loop system.

The system allowed work to continue, eliminated waste and significantly reduced de-ionized water usage. By not replumbing an old system to a new location, the Labs saved an estimated $320,000, along with an additional annual savings of about $60,000 in de-ionized water purchases.

The Sequoia Award went to a group working across the Labs to establish the New Mexico site as a Leadership in Energy and Environmental Design Campus. This is the first LEED Campus certification at a DOE lab and the first in New Mexico.

LEED Campus certification team members are Ayorinde Akinnikawe, Thomas Armijo, Christopher Catechis, James Corcoran, Kathie Deal, Jeffrey Fleming, Gerald Gallegos, Jude Garcia, Henry Guan, Ann Koepp, Barbara Larsen, Freeman Leaming, Samuel McCord, Carol Meincke, Sam Nuzzo, Timothy Peterson, Jon Pier, Jasent Quintana, Camille Reyes, Michael Rocco, Patsy Rowland, Scott Rowland, Ryan Sarhan, Paul Schlavin, Christian Sholtis, Jessica Small, Susan Spencer, Lisa Teves, Robert Thoesen, Douglas Vetter, Jennifer Reisz Westlund and Timothy Wilcox.

The Kaizen Award, given only when a group has shown outstanding achievements in continual improvement upon a process that impacts the environment, was presented to members of the Z Machine team for their efforts to reduce emissions of the potent greenhouse gas sulfur hexafluoride (SF6), putting Sandia in a considerably better position to meet or exceed its 2025 greenhouse gas reduction goals. The team's multi-faceted approach to reduce SF6 use at the Z Machine included:

- routine system leak identification and repair
- removal of unused systems and processing hardware
- implementation of innovative solutions for improved leak detection and isolation of components
- purchase and use of a portable SF6 reclamation system for components that can't use the existing recovery system.

The team's efforts at Z Machine have resulted in sustained reductions of SF6 emissions from 50 pounds per shot to 34 pounds since 2013 — per-shot savings equivalent to eliminating the CO2 emissions from a passenger car driven 400,000 miles or from a railcar full of coal. Putting the reclaimer into service is expected to recover approximately 500 pounds of SF6 annually. That's equivalent to more than 5,100 metric tons of carbon dioxide every year, or to the CO2 emissions from a passenger vehicle driven more than 12.5 million miles.

The Z Machine team included Michael Jones, David Justus, Aaron Lombrozo, Donald Petmecky, Thomas Schweitzer, Kathryn Seals and Decker Spencer.

Neutron generator researchers Ryan Anderson, Tina Falling and Bertha Montoya received an honorable mention for their oil-free vacuum pump conversion initiative. They replaced six oil vacuum pumps in the research lab with a model that did not require oil, resulting in an annual savings of $720, and eliminating maintenance fees and waste disposal requirements. The new pumps use less electricity, as they cycle down rather than run continuously like the old pumps.

The Tech Area III clean-up campaign netted an honorable mention for Ernesto Baca Jr., Janise Baldo, Deven Codding, Thomas Faturos, Philip Rivera and Randall Watkins. The team used a systematic approach to clean up nearly 480,000 pounds of waste from seven major test sites. The team was able to recycle about 440,000 pounds, or 92 percent, of the total waste collected.

KIDS DAY at Sandia

Sandia/New Mexico hosted more than 1,800 students across the Labs on April 26 for a combined celebration of Kids Day (formerly Take Our Daughters and Sons to Work Day) and Earth Day. Students in grades 5-12 came with parents, friends, and relatives to learn more about their hosts' work and Sandia's mission. Students enjoyed more than 50 energizing activities around the Sandia campus with the goal of inspiring the next generation of leaders in science, technology, engineering, and math careers. The range of STEM events for the students included hands-on tours of laboratories, panel discussions, a tree planting for Earth Day and cookie baking using solar ovens at the Solar Tower.

(Photos by Randy Montoya)

Climatic lab

(Continued from page 1)

The window is made of a new commercially available polymer that is mostly transparent to IR radiation. Five years ago, IR-transparent windows were made of crystals such as sapphire or zinc selenide, which can be incredibly expensive for a six-inch diameter window, says Eric Hicks, a climatic lab technician who led the development of the capability.

Climatic lab simulates many 'normal' environments in Tech Area 1

The climatic lab specializes in subjecting components to the kind of environments expected during a normal lifetime — long-term storage in a humid and corrosive locale, transportation through freezing outer space or broiling weather and the environment of intended use.

The climatic lab has more than 20 environmental chambers. The IR window and camera can be used on nearly all of them. Miguel Atencio, climatic test engineer says, "That's the beauty of what Eric came up with. It's very adaptable and can be set up almost anywhere in the lab."

The climatic lab can expose parts temperatures from -106 to 350 degrees Fahrenheit for days or months at a time. They can also simulate temperature shock by subjecting components from -106 to 350 degrees, or vice versa, in only eight seconds, simulating re-entry or other abrupt temperature changes. The team can conduct numerous standardized corrosion tests as well as subject parts to low pressure environments, mimicking heights above the stratosphere. Though most of their testing chambers are close to oven sized to accommodate components or subsystems, the lab does have one walk-in chamber that can test a full system or other objects weighing several thousand pounds. It is 16 feet deep, 9 feet wide and 8 feet tall.

IR camera and window provides more data

"Many of our customers will bring us a circuit board and want to know how a tiny electrical component responds to a certain environment while the device is being tested. The problem is, a thermocouple is about the same size as the component and can act like a heatsink to perturb our measurements," says Eric.

A CLOSER LOOK — Sandia climate lab technician Eric Hicks positions a new infrared camera outside one of more than 20 environmental testing chambers at the climate lab. (Photo by Randy Montoya)

As an alternative, the IR camera can provide pixel-by-pixel tracking of how the part responds to the environment, without introducing these effects. Miguel says, "This capability allows us to give the customer a better idea of what is happening during a test. Our goal is to use thermal imaging to compliment thermocouple data so that they can better understand how their product is responding."

Eric's first use of the IR camera and IR-transparent window, which took place when he was a summer intern, involved testing the thermal response of a gadget he made in college. At about 200 degrees Fahrenheit, the commercial battery that powered the gadget started to ooze and put off a lot of heat. Eric says, "We could actually watch it heat up and identify the area that was starting to cause the issue. We could see the battery failing, which we never would have caught with just a thermocouple."

Such comprehensive monitoring also has a role in safety. Miguel adds, "We're definitely going to start using this capability in ways that will allow us to determine if a product is starting to misbehave. We'll be able to shut a test down before it gets dangerous." Even without a catastrophic failure, the information provided by the IR system can help engineers identify problem areas or components that might need to be redesigned so they don't fail in the field.

Hitting a 'moving target' by adding new capabilities

The big challenge for adding this new system to the climatic lab's capabilities was combining two commercial, off-the-shelf devices to best meet the needs of their customers, said Miguel. However, he adds, it's not useful for every test. The surfaces of some components may emit or reflect IR light, which will influence the camera's readings. Other components composed of a homogeneous material can easily be measured with thermocouples alone.

In addition, Eric says, the IR camera can aid the team by quickly determining hotspots on a component, which would help them determine the best places for thermocouple location.

Miguel says, "We've made a dedicated effort to modernize the climatic lab and increase our capabilities. We've been working to better understand our customers' needs, but it's a moving target. We are doing our best to stay ahead of the curve and anticipate the needs ten years out. It is an ongoing challenge we enjoy."

Exascale

(Continued from page 1)

employ approximations of physical, chemical and biological governing equations on spatial grids at resolutions as fine in scale as computing resources will allow.

National labs joining Sandia in solving this problem are Lawrence Livermore, Pacific Northwest, Lawrence Berkeley, Los Alamos, Oak Ridge, Argonne and Brookhaven. The teams at these labs cover all the technical areas needed to assemble E3SM, with expertise in water-cycle science, atmosphere physics, atmosphere dynamics, aerosol modeling, land modeling, ocean and ice modeling, computational performance and software engineering.

MARK TAYLOR, chief computational scientist for the Energy Exascale Earth System Model project. (Photo by Randy Montoya)

Sandia's work focuses on making the model run faster on today's supercomputers and being ready to transition to the still-faster exascale computers currently under development.

"We are also making the model code easier to configure and test," Mark said of the 30-person group he leads. "Our computer science improvements make it possible for the climate science groups to get more climate science done."

Sandia manager Andrew Salinger leads a 10-person group working on model infrastructure, testing and development. "Sandia researchers have played vital leadership and technical roles in the development of E3SM," Andrew said. "Our technical expertise has been critical to the development of E3SM capabilities in global atmospheric dynamics and transport, software engineering, uncertainty quantification, computational performance, land ice dynamics and unstructured-grid technologies."

Limitations in previous computing technologies had made it impossible to develop a reliable Earth system model that would examine problems resulting from changing regional air and water temperatures, water availability and extreme water-cycle events like floods, droughts and sea-level rise. It was clear that a new model would require advances on three frontiers: increased model resolution and enhanced computational performance; more realistic rendering of the two-way interactions between human activities and natural processes, especially those affecting U.S. energy needs; and ensemble modeling to quantify uncertainty of model simulations and projections where multiple areas and factors are involved.

Technical challenges are varied. In the near term, simulating atmospheric and oceanic fluid dynamics with fine spatial resolution will be especially challenging, said Taylor. It also is important that E3SM can be effectively used by the diverse computer architectures procured by the DOE Advanced Scientific Computing Research Office.

A long-term aim of the E3SM project is to effectively use the exascale machines when they come online during the next five years, but since these don't yet exist, there's clearly a potential programming problem. But the development of E3SM is proceeding in tandem with the Exascale Computing Initiative, making it possible for each to influence the other. An exascale machine refers to a computing system capable of carrying out a billion billion ($10^9 \times 10^9 = 10^{18}$) calculations per second. This represents a thousand-fold increase in performance over that of the most advanced computers of a decade ago.

In E3SM, a big plus is that all model components (atmosphere, ocean, land, ice) can achieve variable resolution in focusing computing power on fine-scale processes in regions of interest. This is implemented using advanced mesh designs that smoothly taper the grid-scale from the coarser outer region to the more refined region.

"This model adds a much more complete representation between interactions of the energy system and the Earth system," said Lawrence Livermore National Laboratory's Dave Bader, the principal investigator of the E3SM project. "The increase in computing power allows us to add more detail to processes and interactions that results in more accurate and useful simulations than previous models."

To address the diverse critical factors impacting the U.S. energy sector, E3SM strives to answer three questions:

- How does the hydrological cycle interact with the human-Earth system on local to global scales to determine water availability and water-cycle extremes?
- How do biogeochemical cycles interact with other Earth system components to influence the energy sector?
- How do rapid changes in cryosphere (continental and ocean ice) systems evolve and contribute to sea-level rise and increased coastal vulnerability?

The E3SM project benefits from DOE programmatic collaborations including the Exascale Computing Project and programs in Climate Model Development and Validation, Scientific Discovery Through Advanced Computing and Atmospheric Radiation Measurement.

E3SM
Energy Exascale Earth System Model

Sandia staff working on E3SM come from computing research, geosciences research, and reacting flow organizations. Among them are:

Jim Foucar: software engineer who works on the infrastructure used to configure, build, test and run the model.

Michael Deakin: simulation workflow and provenance capturing.

Erika Roesler: mesh generation, research on variable resolution capability.

Wade Burgess: runs testing system.

Khachik Sargsyan: land component model developing using Uncertainty Quantification methods.

SANDIA CLASSIFIED ADS

MISCELLANEOUS

SHOWER BENCH, 27" x 16" x 24", adjustable, $65. Ayers, 505-349-1793.

NM SCIENCE FIESTA, fun activities for kids & adults, May 19, 11 a.m.-3 p.m., Tiguex Park, Albuquerque, free. Surbey, 505-823-2843.

HALF BUCKET SWING SEAT, red, w/40-in. coated & chain length 8'6", photos available, $50 OBO. Weagley, 505-385-4059.

SPEAKERS, ADS L1290, floor standing, HiFi, $350; tech area bike, Giant, $150. Crain, 505-239-9405.

BUFFET CABINET, w/shelves, lined drawers, large, Cherrywood, used in home office, great condition, $300. Valdez, 505-550-1993.

DINING SET, w/4 chairs, $65; Papasan chair, w/footrest, $120; photos available. Black, 505-331-9147.

WOMEN'S SILVERADO JACKETS, 4, sizes large/X-large, excellent condition, photos available, $50 ea. OBO. Knief, 505-821-3868.

WEDDING RING, Zei, 2K, white gold, diamond, used; Zales 1/2K earrings, white gold, diamond, new, $1,800. Livengood, 505-974-8070, ask for Sammie.

GARAGE SALE, business suits, accessories, home décor, furniture, 7103 Eagle Canyon Rd. NE, May 18-19, 8 a.m.-1 p.m. Rajan, 505-553-4141.

WEED EATER GRASS TRIMMER, gas-powered, light weight, almost new, $25. Holmes, 505-873-5255.

BEER/ICE-WATER GLASSES, Ouverture, 4, 17-5/8 oz., Riedel of Germany, never used, in original box, $25. Wagner, 505-504-8783.

BARSTOOLS, 4, vintage, wooden, from downtown Marriott, some wear, wood good condition, photos available, $125 OBO. Rivers, 505-720-4701.

TWIN MATTRESS/FOUNDATION, sheet sets, metal frame, used ~6 times, always w/protective cover, $125. Kral, 505-410-9599, send text.

DVD MOVIES, large selection, all genres, call for more info, $.50 ea. Vrooman, 505-249-5592.

TWIN BED, w/drawers, white, IKE, 3-drawer chest, bookcase, table/desk, adjustable desk chair, good condition. Porter, 505-400-0185.

SAFE, 4-number combination, 1.3-cu. ft., $10. Drotning, 505-821-9598.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.

Submit by one of these methods:

- **EMAIL: Michelle Fleming (classads@sandia.gov)**
- **FAX: 844-0645**
- **MAIL: MS 1468 (Dept. 3651)**
- **INTERNAL WEB: From Techweb search for 'NewsCenter', at the bottom of that page choose to submit an ad under, 'Submit an article'. If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.**

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

TRANSPORTATION

'15 FORD FIESTA ST TURBO, 6-spd., loaded, 23K miles, excellent condition, fun & economical, $15,000 OBO. Montoya, 505-610-5296.

RECREATION

'95 JAYCO POP-UP, Eagle 8SD tent trailer, sleeps 6, garaged, very good condition, $1,200. Knapp, 505-323-9975.

'05 HONDA GOLDWING, Titanium, 33K miles, w/XM satellite radio, excellent condition, $8,500. Young, 505-280-5843.

'96 YAMAHA ROYAL STAR, 1300cc, leather bags, windshield, 24K miles, $2,500. Martinez, 505-249-5220.

STARCRAFT TRUCK POP-UP CAMPER, heater, refrigerator, gas or electric, AC, gas cook top, fits 7-ft. truck bed, $4,000. Hibray, 505-620-1572 or 505-821-3455.

COLEMAN SEDONA PIONEER POP-UP CAMPER, sleeps 5, heater, $900 OBO. Martin, 505-280-6924.

FISHING BOAT, 14-ft., aluminum, on trailer, w/9.8 hp Mercury motor, excellent condition, $800 OBO. Green, 505-228-7015.

'98 BMW R1200C, 5-spd., new tires, ws/sb, recently serviced, road ready, manual, photos, 22K miles, excellent condition, $4,500 OBO. Rizkalla, 505-286-9278.

'14 SANIBEL 5TH WHEEL, sleeps 4, fireplace, TV, heater, refrigerator, king-sized master bed, washer/dryer, more, used 4 times, photos available, $55,000 assumable loan. Hunter, 505-459-9443.

REAL ESTATE

3-BDR. TOWNHOME, 2 baths, 1,900-sq. ft., 2-car garage, Pueblo-style, great mountain views, photos t bit.ly/3712rp, $280,000. Abbott, 720-583-5487.

4-BDR. HOME, 3 baths, 2,700-sq. ft., w/loft, Cabezon/Rio Rancho, near schools, parks, restaurants, mall, movie theaters. Ramos, 505-220-5201.

4-BDR. HOME, 2 baths, 1,610-sq. ft., move-in ready, 7304 San Francisco, $239,000. Jilek, 505-306-0632.

WANTED

HOST FOR INTERNATIONAL HIGH SCHOOL STUDENT, w/AFS. Hiebert-Dodd, 505-296-1158.

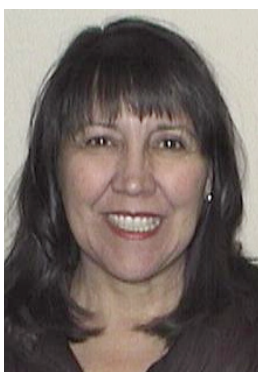
Mileposts

New Mexico photos by Michelle Fleming
California photos by Randy Wong


Mae Lambert 35


Harold Clay 30


Matt Burger 25


Carol Jones 25


Jeremy Plake 20


Karen Tafoya 20

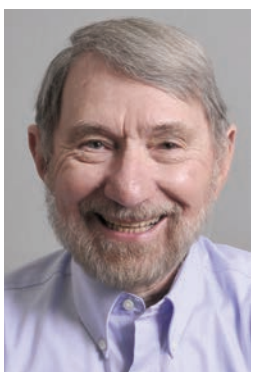

William Vance 20

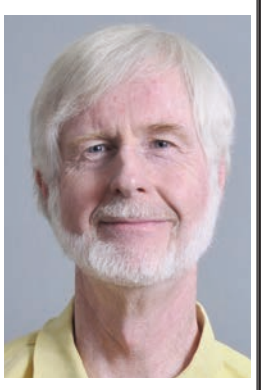

Allen Hurst 15


Carlyn Romero 15

Recent Retirees


Paul R. Smith 36


Paul Demmie 34


Michael Furnish 30


Joseph Hurtado 20


Toby Garcia 19

40 Under Forty honorees serve Sandia's mission

Honored Sandians have much in common

By Michael J. Baker

Ask Jake Sena and Valerie Peyton what motivates or inspires them, and both will turn quickly to family. Valerie throws out a quick "#momfirst." Jake jokes that his father, trying to save money for his children and grandchildren, buys himself just one pair of new shoes — always off-brand — every few years.

"I never hear him complain about having to work hard," Jake says about his dad. "He's done really well, and he and my mother have always put family first. Both my parents have been great inspirations to me and my sisters."

Valerie also speaks of her parents' work ethic; how her mother returned to school and earned an occupational therapy degree after raising five children as a stay-at-home mom. Valerie also talks about her first son, born when she was a college junior, and the challenges and rewards of finishing school and starting a career while raising him.

"It provided me with a greater purpose in life and has pushed me and inspired me to be who I am today," she says.

Albuquerque Business First recently named Valerie and Jake to its 40 Under Forty list for 2018, based on their professional achievement, community contributions and leadership. Jake and Valerie have much in common: 40 Under Forty, motivational family, Sandia Mission Services, community service and baseball.

Jake Sena, 36, procurement manager

Jake played baseball through high school in Los Alamos and for about three months at a junior college before burning out and deciding to focus more on academics.

He transferred to Eastern New Mexico University and earned his bachelor's in marketing before taking a job in Florida to be near the woman who would become his wife. While working in Florida, Jake earned his MBA and got married.

Jake's uncle, Pat Sena, worked for Sandia as a senior manager and senior engineer for 37 years — "One of those really smart PhD guys," Jake says. His uncle had always talked up Sandia, which helped motivate Jake to return to New Mexico.

"He was a big advocate for me coming to Sandia," Jake says.

Jake moved from the Sunshine State to the Land of Enchantment and began his Sandia career in June 2010 in the information technology purchasing group.

"This was like coming back home," Jake says. "I pretty much loved it from day one. It just felt like the right place to be."

Jake has spent time as a buyer in radiation sciences and as a procurement policy analyst. Now he is a manager supporting purchasing for the nuclear weapons programs.

"There's something rewarding out of every day when you come to work here," he says. "One of the most rewarding things is when I see my staff members be successful. When I really see them grow and succeed and overcome obstacles, and I can see them growing professionally as individuals but also see them contributing to the broader mission of Sandia."

It's that mission that excites Jake about working at Sandia.

"Now that I'm supporting the nuclear weapons program, it's awe-inspiring," he says. "When you think about what your daily job is contributing to and impacting — national and global security — that's incredible."

Outside work, Jake keeps busy helping to raise two young children, volunteering at local charities and coaching youth basketball, soccer and baseball.

Valerie Peyton, 37, financial operations manager

Valerie's first job was in junior high when she worked at a youth baseball concession stand in her hometown of Artesia, New Mexico. Possibly the beginning of her love of baseball, she learned to be on time, provide quality customer service and recognize the importance of teamwork, she says.

Those traits flourished as Valerie earned her bachelor's in accounting and finance and then her MBA from the University of New Mexico. In graduate school, she worked as an accountant at UNM and began her Sandia career as a graduate intern in contract audit in February 2006.

She was hired full time as an auditor after obtaining her MBA. From there, she became a financial analyst and business office program lead for the nuclear weapons mission area and is now the financial operations manager for Treasury and Travel Services. Valerie has participated in the Executive Diversity Council, Mission Services Talent Acquisition Team, Hispanic Leadership Outreach Committee and Lead From Where You Are.

"I'm inspired by many talented individuals, working to support a common mission and am honored to pay it forward: to help others find their purpose and have an impact," she says.

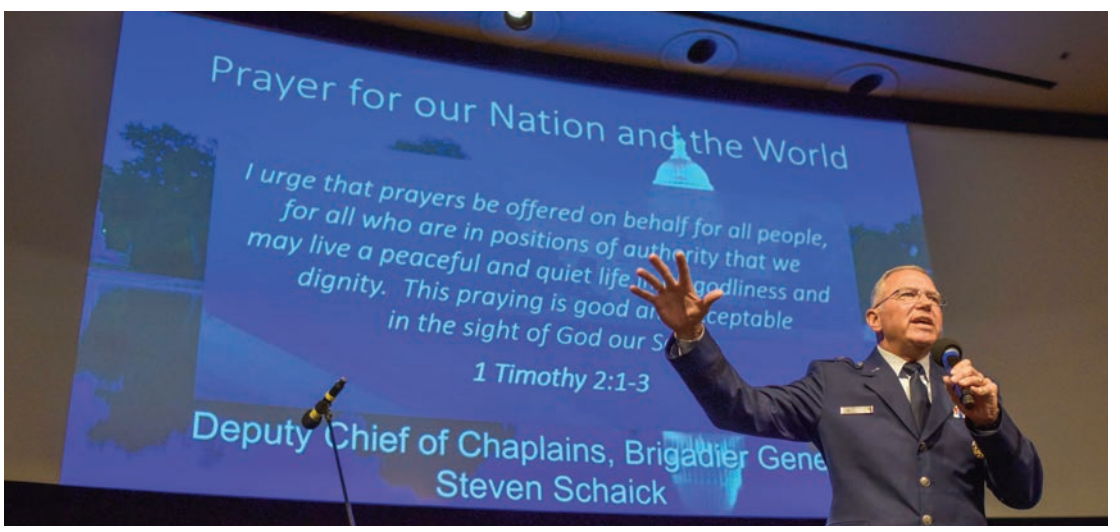
Paralleling her success at Sandia has been her work with the Association of Latino Professionals for America, whose purpose is to connect Latino leaders in homes, communities and workplaces. Valerie's first experience with the organization was winning an undergraduate scholarship. Over the next 14 years she served as a board member of the UNM student chapter, president of the Albuquerque professional chapter and now is a member of the national Women of ALPFA's Strategy Development Committee.

"Nothing I've achieved would I ever say that I did it myself," Valerie says. "I have always desired to learn more, do more, be more, and fortunately for me I have an amazing husband and have had phenomenal mentors, coaches and friends throughout my academic and professional careers that have supported this aspiration. It's been a fun and rewarding ride."

Outside of work, Valerie volunteers her time with various charities and her church. She and her husband raise three children and are involved in their sports — including baseball — and other extracurricular activities.

Jake Sena and Valerie Peyton say their families have inspired them in their work and life. *Albuquerque Business First* recently named both Sandia National Laboratories Mission Services managers to its 40 Under Forty list for 2018. (Photo by Randy Montoya)

Associate Labs Director for Infrastructure Operations John Clymo joins in a prayer at the National Day of Prayer event. (Photo by Randy Montoya)



(Photo by Randy Montoya)

Sandians observe National Day of Prayer

Sandians and others from across Kirtland Air Force Base participated in the 2018 National Day of Prayer gathering at the Steve Schiff Auditorium on May 3. The event was sponsored by Sandia's Christians in the Workplace Networking Group in partnership with the Kirtland Air Force Base Chaplain Corps.

Prayer leaders for the day included guest speaker Deputy Chief of Chaplains Brig. Gen. Steven Schaick from the Pentagon, Senior Manager John Bowers of neutron generators, Executive Pastor David Eiffert from the Believers' Center of Albuquerque and Jeff Martin, the master of ceremonies. The Sandia Singers performed the national anthem and the Air Force Song, and God's House Choir also participated.

Other attendees included Deputy Labs Director David Douglass; two associate labs directors — John Clymo of Infrastructure Operations and Mark Sellers of Mission Assurance; John Myers, senior director, Human Resources and Communications; 377th Base Commander Col. Richard Gibbs and Wing Chaplain Lt. Col. Darren Duncan; and Michael Duvall, Sandia Field Office.

Chaplain Schaick discussed this year's theme of unity. John Clymo added, "I am grateful to have a workplace like Sandia that supports our freedom to gather."

Information about the group is available at cwng.sandia.gov.