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Blowing bubbles to catch CO_2

Sandia, UNM develop bio-inspired liquid membrane that could make clean coal a reality

By Mollie Rappe

Sandia and the University of New Mexico have created a powerful new way to capture carbon dioxide from coal- and gas-fired electricity plants with a bubble-like membrane that harnesses the power of nature to reduce CO_2 emissions efficiently.

CO_2 is a primary greenhouse gas and about 600 coal-fired power plants belched out more than a quarter of total US CO_2 emissions in 2015. When you include emissions from natural gas plants, the figure goes up to almost 40 percent. Current commercial technologies to capture these emissions use vats of expensive, amine-based liquids to absorb CO_2. This method consumes about one third of the energy the plant generates and requires large, high-pressure facilities.

DOE has set a goal for a second-generation technology that captures 90 percent of CO_2 emissions at a cost-effective $40 per ton by 2025. Sandia and UNM's new CO_2 Memzyme is the first CO_2 capture technology that could actually meet these national clean energy goals. The researchers received a patent for their innovation earlier this year.

It's still early days for the CO_2 Memzyme, but based on laboratory-scale performance, "if we applied it to a single coal-fired power plant, then over one year we could avoid CO_2 emissions equivalent to planting 63 million trees and letting them grow for 10 years," says Susan Rempe (8635), a computational biophysicist and one of the principal developers.

Membranes usually have either high flow rates without discriminating among molecules or high selectivity for a particular molecule and slow flow rates. Susan, Ying-Bing Jiang, a chemical engineering research professor at UNM, and their teams joined forces to combine two recent, major technological advances to produce a membrane that is both 100 times faster in passing flue gas than any membrane on the market today and 10-100

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SANDIA RESEARCHER Susan Rempe peers through a bubble. The CO_2 Memzyme she helped develop captures carbon dioxide from coal-fired power plants and is 10 times thinner than a soap bubble. (Photo by Randy Montoya)

When hurricanes take aim

When a hurricane approaches landfall, local, state, and tribal governments must work together to decide if and how they want to evacuate large populations to save lives. Read how Sandia is helping in the decision-making process in a story on **page 3.**

Plasma science award

Sandia plasma physicist Christine Coverdale became the first woman to win the IEEE Plasma Science and Applications Committee Award in its 28-year history. Story on **page 5.**

Also inside . . .

While the unpredictability of severe storms can wreak havoc, Sandia's Stormwater Program is deliberate and constant as it works to develop strategies to prevent and reduce pollutants from entering the local ecosystem. Story on page 8.

X-ray vision

Bomb techs up their game with Sandia's XTK software

By Nancy Salem

In the chaos that followed the terrorist attack at the 2013 Boston Marathon, bomb squads scanned packages at the scene for explosive devices. Two homemade pressure cooker bombs had killed three and injured more than 250, and techs quickly had to determine if more were waiting to blow up.

They got help from X-Ray Toolkit (XTK), an image processing and analysis software developed at Sandia that has swept the ranks of the country's bomb squads. In fact, XTK has spread through the military and emergency response communities so rapidly that it's now in the hands of more than 20,000 users across the globe. It also was adopted by the FBI's Hazardous Devices School, which certifies all 467 recognized state and local bomb squads in the US, as its benchmark for all courses.

BOMB SQUAD TECHS learn the ins and outs of XTK software during a recent training session at Sandia. (Photo by Randy Montoya)

"XTK is the standard in the field not only nationally, but internationally. It made the average bomb tech a better bomb tech," says Craig Greene, a special agent and bomb technician at the Albuquerque FBI. "In the past 20 years, the bomb technician community has progressed from the Stone Age to the 21st Century in terms of equipment and procedures, and XTK is a major part of that progression."

The toolkit got to the people who needed it so quickly due to a thoroughly unconventional approach to technology transfer.

"It was not focused on generating revenue for Sandia," says Justin Garretson (6631), lead developer of the XTK software. "The objective was to get the technology out so it could be used to save lives."

Sandia recently won the 2016 national Federal Laboratory Consortium Award for Excellence in Technology Transfer for its XTK effort. Licensing specialist Bob Westervelt (1932) says the Labs did three things:

- Offered it to military and law enforcement bomb squads to download free from the XTK website
- Offered no-cost test and evaluation licenses to X-ray scanner manufacturers so they could make sure XTK worked with their hardware
- Offered low-cost licenses to companies willing to give high-quality training to end users

"Those were foundational elements of the XTK licensing. It was a unique approach," Bob says. "We hadn't done anything like it on that scale before."

A specialized visualization tool

Explosive Ordnance Disposal (EOD) technicians use portable X-ray scanners with image processing software to

(Continued on page 5)

That's that

By Nancy Salem

I had a job once where, after six weeks, I was promoted to boss, of the whole place. And it wasn't rinky-dink. The company was part of a national chain and had lots of employees and business pursuits. I was not chosen for my skill. In fact, I had no training or experience in the boss's line of work. It was a different profession in the same office. I likened it to being told one morning I was going to be a dentist, and my first patient was in the waiting room.

I'm not sure why I was picked. It seemed as simple as the previous boss was fired and they threw a dart, hitting me. How crazy is that?

The story makes me smile as I approach the five-year mark at Sandia, the great divide between newbies and veterans. But even after five years I feel I've only touched the tip of the iceberg here. Five years at most companies and you know it all and then some. Five years at Sandia and, while technically not, you are still a newbie.

I'm part of one of the bigger waves of new people to join the Labs in its history. Thousands of new hires walked in the door the past five years as thousands of others wrapped up their Sandia careers. We're a diverse group with wildly different backgrounds and talents. We're young and not-so-young, local and out-of-towners, scientists and business people.

What we share are many embarrassing stories of what it's like to be a Sandia newbie. A common theme for me is getting lost — on the base, in the tech areas, in maze-like buildings worthy of "The Shining." There are one-way streets, dead-ends, chain-link fences, hidden building numbers, and random loading docks and physical plants to stumble into.

I asked some colleagues to share their favorite newbie stories.

Lab News editor Bill Murphy didn't hesitate: "A few weeks after being hired, I got my clearance and my official badge. Now I was a *real* Sandian. I walked around with a little strut in my step; I was The Man. The next day I wasn't so cool. I forgot my badge and had to get a temporary one, clearly marked as such with blinking neon lights, I think. They called those one-time IDs 'dummy badges,' and at a meeting in the Tech Area, the first thing the guy I was interviewing said was 'Forgot your badge, did you?' He laughed and I flushed. 'Hey, it happens to everyone once,' he added kindly. And he was right. In 21 years, I haven't forgotten it since."

Valerie Smith, the Internal, Digital and Executive Communications manager, says learning the staff's countless departmental numbers has been a hurdle. "I studied an org chart daily, hoping somehow if I stared at the numbers long enough they'd embed themselves into my DNA." Then there were building numbers. "'Meet me in the lobby of 898' or 'Can you stop by 823' led to a maps search. My most embarrassing numbers moment was looking up a meeting location in the maps system only to learn it was my office." And this: "Being an uncleared newbie led to stressful moments, like getting to a meeting only to realize I needed to go to the bathroom. The handoff from a male escort to a woman who can assume escorting duties for a bathroom visit is an oddly formal process and a wee bit embarrassing, pun intended."

Don't get Sue Holmes started on acronyms. "It's hard to remember all the TLAs (Three Letter Acronyms) endemic to Sandia. How many times have you been at a meeting where the acronyms were flying around, dive bombing you really, and you had to figure out which ones were important enough to ask about? WEC, ROI, PPE, AFP, OAA, PVD, NDE, MDL, TRC, AML, CVD, TSR, HBE, CMOS, MEMS, HRBP, ES&H, R&A. Every organization has its own. Maybe the same letters even mean different things in different groups. No wonder Sandians keep acronym lists. No wonder I have trouble remembering the correct order of the alphabet. There will be a quiz on Friday."

Sue and I started in media relations at Sandia on the same day nearly five years ago, veterans of our profession but wet behind the ears in our new jobs. Now we're ready to shed that mantle and take our rightful place among the Sandia old-timers. Or are we? We probably won't be running anything anytime soon. Luckily we're surrounded by thousands of people with decades of Labs experience who can truly claim to be Sandia veterans, and who have our backs. They remind us every day by their very presence that we have a long way to go.

— Nancy Salem (MS 1468, 505-844-2739, mnsalem@sandia.gov)

Pension offer to former employees doesn't affect current participants

By Lucy Long

While Sandia's defined benefit plan has healthy assets supporting its pension payments, the Pension Benefit Guaranty Corporation (PBGC) adds another measure of security by insuring the plan. But that support does not come free of charge. PBGC operations are financed partly by insurance premiums set by Congress and paid by plan sponsors like Sandia.

Recent law changes have significantly increased the PBGC premiums. As a result of this premium increase and other changes increasing costs and administrative burdens, the Sandia Corporation Retirement Income Plan is offering eligible former employees a voluntary one-time opportunity to receive a lump sum payment or begin immediate monthly reduced pension payments.

PBGC
Protecting America's Pensions

This action does not impact employees or retirees currently receiving benefits from the plan. Regulations do not allow a lump sum offer to participants already receiving monthly pension payments. Current employees are not eligible because they continue to accrue additional benefit in the Retirement Income Plan.

The lump sum offer applies to about 2,200 former employees who terminated employment before May 1, 2016, and who are not yet receiving monthly payments from the Sandia pension plan.

This offer is beneficial to both Sandia and the former employees who choose to take this opportunity. Sandia will be able to reduce administration costs associated with the plan's benefits for participants who are neither employees nor retirees — many of whom have small balances — while giving those former employees more control over their retirement benefits. They will have the option to choose a payment method now, rather than at normal retirement age, if it is right for their circumstances. Giving former employees options for retirement benefits is estimated to help Sandia save $6 million over the next 10 years in PBGC premiums alone.

The Sandia Lump Sum Window Center at 855-550-9048 is available to eligible former employees Monday through Friday from 8 a.m.-4 p.m. Mountain Time, except on certain US holidays.

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LOCKHEED MARTIN

Heinrich hosts 2016 Energy Summit

THE FUTURE OF ENERGY STORAGE — Industry leaders from across the US came to Albuquerque on Aug. 23 to participate in US Sen. Martin Heinrich's 2016 Energy Summit. Sandia Labs Director Jill Hruby opened the event, themed Storage Strategies for Industry & National Security. Jill discussed Sandia's role in advancing renewables and energy storage technologies, remarking, "With two national laboratories, New Mexico is in a great position to lead the nation toward a sustainable energy future." Sandia/California site VP Marianne Walck, who heads the Labs' energy and climate programs, particpated in a panel discussion titled Energy Storage Resiliency for National Security and Emergency Preparedness.

(Photo by Lonnie Anderson)

When hurricanes take aim

Officials can soon turn to Sandia's guidance for fast, critical evacuation decisions

By Michael Padilla

When a hurricane approaches landfall, local, state, and tribal governments must work together to decide if and how they want to evacuate large populations to save lives. During this time, emergency managers must make quick and effective decisions, often with outdated information and models.

To ensure that emergency officials are better prepared in making effective decisions, Sandia researchers are coordinating and compiling insights from the National Hurricane Program Technology Modernization working group on hurricane emergency management into an updated guidance document. The goal of the working group is to facilitate the insertion of new technologies into the National Hurricane Program.

Nerayo Teclemariam (8112), who oversees the project for Sandia, says team members have been leveraging Sandia capabilities such as the Standard Unified Modeling and Mapping Integration Toolkit (SUMMIT) for the work and have been able to tap into various groups throughout the Labs including Division 6000, and Centers 8100 and 8900.

"The work is built on our deep history of modeling and simulation at Sandia that began as a part of our nuclear weapons mission and has evolved over time to support a broader set of national security missions," Nerayo says. "We are making significant contributions to the program including developing general guidance for local and state emergency officials who make critical decisions during hurricane evacuations."

Funded by Department of Homeland Security Science and Technology and the Federal Emergency Management Agency (FEMA), Sandia has been working on four areas of the project including developing a guidance document; creating a hurricane evacuation study (HES) tool; establishing metrics for evaluating the hurricane planning and response processes; and evaluating infrastructure modeling to support vulnerability analysis in the HES tool and to extend the scope of infrastructure considerations for hurricane planning.

"What we've been doing over the past couple of years is helping the overall program figure out how to improve the technology they use in deciding when to evacuate in the event of a hurricane," says Trisha Miller (8112), who helped lead the project. "We are adding a lot of efficiency to their planning process and that in turn makes their decision more up to date, more accurate, and more relevant to the actual storm that they're facing."

Developing guidance

Before the guidance document was created, Sandia conducted a gap analysis based on more than 50 interviews with emergency managers, regional planners, federal stakeholders, tool developers, and individuals with a role in the program. Out of this analysis, researchers were able to get a sense of the roles of emergency planners, the challenges they faced, and what has worked and what hasn't worked before and during evacuations.

HURRICANE REVIEWERS — Patricia Pacheco (8114) and Lynne Burks (8116) review Sandia's ongoing hurricane project activities. (Photo by Dino Vournas)

Sandia CaliforniaNews

"Out of that gap analysis we came up with seven high-level directions or areas where the program could improve their process by inserting new technologies," Trisha says. "We then worked to further identify the technology needs and define the technology requirements. What has evolved is the new methods and technologies we've delivered to the program."

The guidance document provides a framework for emergency planners across the program to help them develop localized hurricane response plans, hurricane evacuation studies, and post-storm assessments.

"The guidance document provides a huge benefit to the program because it enables emergency managers across jurisdictions impacted by hurricanes, from New York to Florida to Texas and even Hawaii, to share best practices and lessons learned for evacuation decision-making," Trisha says.

Hurricane evacuation study tool improves efficiency, lowers costs

The main focus of the HES is to help determine evacuation zones and clearance times — the time it takes the population to evacuate from the zone — for a given area that may be impacted by hurricanes. The HES tool software model that utilizes information or roads systems, population distribution, and potential storm conditions.

"Through the Technology Modernization effort Sandia was able to develop the HES tool to improve the efficiency and cost-effectiveness of the HES process," says Trisha. "This means that jurisdictions will be able to update their HES much more frequently, resulting in better decision-making and ultimately lives and dollars saved."

This information is critical to the evacuation decision that emergency managers make during a real storm. The current process for conducting an HES is very lengthy and resource intensive. As a result, some jurisdictions don't update their plans for 10 to 15 years.

"We wanted to increase that frequency of how often the plan is updated," says Nerayo. "We need to take into account the latest developments in states including changes in populations, changes critical infrastructure, new roads, and traffic patterns."

By updating the technology, the Sandia team estimates there will be a 70 percent reduction in time and about a two-thirds reduction in cost in evacuation planning.

Validating the HES tool

Sandia led two pilot studies with working group members from North Carolina and New York City to validate the HES Tool process.

"Both North Carolina and New York City were in the process of updating their HES using the existing process during the pilots," Trisha says.

The Sandia team met with pilot partners in their respective locations to compare their HES undertaking with the process being developed in the HES Tool. The pilot studies led to the development of additional capabilities in the HES Tool and feedback on the diverse needs of different regions impacted by hurricanes.

"We have built something that can offer a lot of benefit, and so being able to follow through and see that come to fruition will be really nice," Trisha says. "We are very encouraged with what has been built to date and the interactions that we have had."

Sandia will be handing off the work to partners at the Massachusetts Institute of Technology Lincoln Lab where the planning tool will be integrated with the response tool developed there.

The integration of the tools will greatly benefit the National Hurricane Program, says Trisha.

"The key thing that we're bringing to the project, and hopefully that the end users really see as a benefit, is that they can update their plans and understanding of when to make that evacuation decision on a much more regular basis," she says.

Encouraging STEM success for women of color

By Mollie Rappe

While women make up a quarter of the science, technology, engineering, and math (STEM) workforce, African American women make up less than 2 percent.

Many factors contribute to this deficit, but Leyte Winfield, chair of the chemistry department at Spelman College, stressed that to ensure the persistence and success of African American women in STEM, the emphasis should be placed on empowering and supporting them to stay in what she called the "leaky pipeline."

LEYTE WINFIELD offered concrete strategies to help African American women succeed in STEM careers. (Photo by Mollie Rappe)

The evening of July 27 at the National Museum of Nuclear Science and History, Winfield and Kimberly Jackson, an associate chemistry professor at Spelman, presented their case studies and offered concrete strategies to support women of color. The talk was sponsored by Sandia's Women's Action Network (SWAN), Sandia's Black Leadership Committee (BLC), and the Women's International Study Center.

With effective mentoring and a focus on staying in touch with their alumnae, Winfield and Jackson have established a sustainable system where their students embrace their identity to cultivate success at Spelman and in their subsequent careers.

Beyond important, yet general, tools for success such as conducting undergraduate research, engaging global learning, and honing writing skills, Jackson highlighted the importance of living-learning communities to form a cohort. The support of peers with similar life experiences creates an environment where it is safe for the students to ask for help, which leads to persistence and ultimately equity in STEM fields.

Jackson and Winfield's work was supported by a six-month planning grant from the National Institutes of Health. They were also Women's International Study Center Fellows-in-Residence in Santa Fe.

Clean leap

By Nancy Salem

Small Business Vouchers Pilot
U.S. DEPARTMENT OF ENERGY

5 energy companies get technology-to-market help from Sandia

DOE has announced that five more small, clean-energy businesses were chosen to work with Sandia to bring next-generation technologies to market faster.

"These are innovative companies working to build the clean-energy economy," says Mary Monson, senior manager of Industrial Partnerships Dept. 1930. "Many of these companies have not had access to national laboratory resources. Now they do, and Sandia is happy to bring entrepreneurs together with our scientists and engineers to solve challenges and break new ground in the clean-energy marketplace."

The Small Business Vouchers Pilot, or SBV, was launched last September and companies were encouraged to apply for technical help from DOE labs. In March 2016, 33 companies were selected to receive $6.7 million in funding through the pilot. Seven of them are working with Sandia with vouchers totaling $1.62 million.

In the Aug. 18 announcement of second-round awards, the DOE Office of Energy Efficiency and Renewable Energy (EERE) named 43 applicants that will receive $8 million in vouchers. The five that will work with Sandia are Group NIRE of Lubbock, Texas; Oscilla Power Inc. of Seattle; HelioBioSys Inc. of Woodside, California; SkySpecs of Ann Arbor, Michigan; and Nishati Inc. of McLean, Virginia. The vouchers total $983,000 and range in value from $100,000 to $300,000.

"Through SBV, Sandia is collaborating with small businesses throughout the country," says Jackie Kerby Moore, manager of Technology and Economic Development Dept. 1933. "This collaboration is creating jobs along with products that can change our world."

The pilot, part of EERE's National Laboratory Impact Initiative, aims to help small businesses by giving them access to world-class expertise and tools at the labs. The pilot will fund projects in the areas of solar, geothermal, wind, water, fuel cells, advanced manufacturing, bioenergy, buildings, and vehicles. The types of projects include prototyping, materials characterization, high performance computing, modeling and simulation, scaling to generate customer samples, performance validation, and regulatory compliance.

Last year, DOE chose Sandia as one of five leads in the $20 million pilot, along with the National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory. Sandia was named the lead lab in the sectors of solar energy, wind energy, and geothermal technologies.

Wide variety of clean-energy efforts

The latest companies selected to collaborate with Sandia are working on a wide variety of clean-energy efforts:

- **Group NIRE's** technologies advance wind energy on the grid and microgrid to improve stability and performance.
- **Oscilla Power** is harnessing the power of the ocean through commercialization of low-cost, utility-scale wave energy converters.
- **HelioBioSys** puts cyanobacteria to work converting photons to sugars, reducing the cost to produce a broad suite of biofuels and bio-based chemicals.
- **SkySpecs** is developing drones to inspect wind turbine blades to increase speed, accuracy, and safety, and lower costs.
- **Nishati** offers portable solar energy systems for military outposts, disaster relief, isolated encampments, and other off-grid power needs.

"We are excited to partner with Sandia Labs," says Rahul Shendure of Oscilla Power. "Sandia has world-class expertise, and our company is looking forward to working with a research community of that caliber on the road to commercialization."

David Smernoff of HelioBioSys says Sandia will help the company with essential work. "This collaboration is needed to scale up our system and evaluate performance from photons to fuel," he says.

Companies can continue to apply for vouchers

The SBV pilot will offer one more round of competition to small businesses in 2016. To be eligible, businesses must be US-based and -owned with no more than 500 full-time employees worldwide.

The pilot is part of EERE's Technology-to-Market program. Companies can apply to Sandia through the SBV website for vouchers valued from $50,000 to $300,000 that can be used for a variety of technical services. Successful companies will be required to provide a 20 percent cost share or in-kind services.

The seven companies chosen in March to work with Sandia were iBeam Materials Inc. of Santa Fe; Altergy Systems of Folsom, California; FastCAP Systems Corp. of Boston, Massachusetts; Renewable Power Conversion Inc. of San Luis Obispo, California; Skysun LLC of Bay Village, Ohio; Columbia Power Technologies Inc. of Corvallis, Oregon; and Micron Optics Inc. of Atlanta, Georgia. The vouchers ranged in value from $150,000 to $300,000.

"Sandia has been doing cutting-edge work in clean energy technology for decades," says Juan Torres, chief of operations for Sandia's Energy and Climate programs. "From solar, wind, and water power to bioenergy, we can give these companies the support they need to be successful."

Bubbles

(Continued from page 1)

times more selective for CO_2 over nitrogen, the main component of flue gas.

Stabilized, bubble-like liquid membrane

One day Jiang was monitoring the capture of CO_2 by a ceramic-based membrane using a soap bubble flow meter when he had a revolutionary thought: What if he could use a thin, watery membrane, like a soap bubble, to separate CO_2 from flue gas that contains other molecules such as nitrogen and oxygen?

Thinner is faster when you're separating gases. Polymer-based CO_2 capture membranes, which can be made of material similar to diapers, are like a row of tollbooths, or the checkpoints at the Eubank gate: they slow everything down to ensure only the right molecules get though. Then the molecules must travel long distances through the membrane say, at the Truman gate or the next row of tollbooths. A membrane half as thick means the molecules travel half the distance, which speeds up the separation process.

CO_2 moves, or diffuses, from an area with a lot of it, say flue gas from a plant which can be up to 15 percent CO_2, to an area with very little. Diffusion is fastest in air, hence the rapid spread of popcorn aroma, and slowest through solids, which is why helium slowly diffuses through the solid walls of a balloon, causing it to deflate. Thus, diffusion through a liquid membrane would be 100 times faster than diffusion through a conventional solid membrane.

Soap bubbles are very thin — 200 times thinner than a human hair — but are fragile. Even the lightest touch can make them pop. Jiang and his postdoc associate Yaqin Fu knew they would need to come up with a way to stabilize an ultra-thin membrane.

10 times thinner than a soap bubble

Luckily, his colleague Jeff Brinker (1000), another principal developer who is a Fellow at Sandia and Regent's Professor at UNM, studies porous silica. By modifying Jeff's material, Jiang's team was able to produce a silica-based membrane support that stabilized a watery layer 10 times thinner than a soap bubble. By combining a relatively thick hydrophobic (water-fearing) layer and a thin hydrophilic (water-loving) layer, they made tiny nanopores that protect the watery membrane so it doesn't "pop" or leak out.

Enzymes (the –zyme part of Memzyme; the mem– comes from membrane) are biological catalysts that speed up chemical reactions. Even the process of CO_2 dissolving in water can be sped up by carbonic anhydrase, an enzyme that combines CO_2 with water (H_2O) to make super soluble bicarbonate (HCO_3.) at an astounding rate of a million reactions per second. This enzyme can be found in our muscles, blood, and lungs to help us get rid of CO_2.

Susan and her former postdoctoral fellow Dian Jiao were studying how CO_2 dissolved in water, with and without this enzyme. They thought the enzyme could be combined with something like Jiang's watery membrane to speed up CO_2 capture. An enzyme-loaded membrane is almost like an electronic toll collection system (such as E-ZPass). The enzyme speeds up the dissolving of CO_2 into water by a factor of 10 million, without interacting with other gases such as nitrogen or oxygen. In other words, the liquid Memzyme takes up and releases CO_2 only, and fast enough that diffusion is unimpeded. This innovation makes the Memzyme more than 10 times more selective while maintaining an exceptionally high flow rate, or flux, compared to most competitors that use slower physical processes like diffusion through solids.

"Partnership between theory and experiment, Sandia and UNM, has proven fruitful here . . . . Together we developed a membrane that has both high selectivity and fast flux for CO_2. With optimization for industry, the Memzyme could be the solution we're looking for to make electricity both cheap and green."

However, the nanopores in the membrane are very small, only a little wider than and a few times as tall as the enzyme itself. "What's happening to the enzyme under confinement? Does it change shape? Is it stable? Does it attach to the walls? How many enzymes are in there?" Susan wondered.

Susan and her postdoctoral fellow Juan Vanegas (8635) designed molecular simulations to model what happens to the enzyme in its little cubby to improve performance. Interestingly, the enzyme actually likes its "crowded" environment, perhaps because it mimics the environment inside our bodies. And more than one enzyme can squeeze into a nanopore, acting like runners in a relay passing off a CO_2 baton. Because of the unique structure of the membrane, the enzymes stay dissolved and active at a concentration 50 times higher than competitors who use the enzyme just in water. That's like having 50 E-ZPass lanes instead of just one. Protected inside the nanopores, the enzyme is still efficient and lasts for months even at 140 degrees Fahrenheit.

Working toward a greener future

Having successfully tested the CO_2 Memzyme at the laboratory scale, the Sandia-UNM team is looking for partners to help the technology mature. Each part of the membrane fabrication process can be scaled up, but the process needs to be optimized to make membranes for large power plants.

In addition, the team is looking into more stable alternatives to the common form of the enzyme, such as enzymes from thermophiles that live in Yellowstone National Park hot springs. Or the Memzyme could use different enzymes to purify other gases, such as by turning methane gas into soluble methanol to produce purified methane for use in the natural gas industry.

The CO_2 Memzyme produces 99 percent pure CO_2, which can be used in many industries. For example US oil companies buy 30 million tons of pure CO_2 for enhanced oil recovery. The CO_2 could be fed to algae in biofuel production, used in the chemical industry, or even to carbonate beverages.

Initial funding for this research was provided by Sandia's Laboratory Directed Research and Development office, with additional funding provided by DOE Basic Energy Sciences, Defense Threat Reduction Agency's Joint Science and Technology Office, and the Air Force Office of Scientific Research. The technology won a Federal Laboratory Consortium Notable Technology Development Award in 2014, an R&D100 award in Materials, and an R&D100 Gold Award for Green Technology in 2015.

"Partnership between theory and experiment, Sandia and UNM, has proven fruitful here, as it did in our earlier work on water purification membranes. Together we developed a membrane that has both high selectivity and fast flux for CO_2. With optimization for industry, the Memzyme could be the solution we're looking for to make electricity both cheap and green," says Susan.

For a video on the CO_2 Memzyme, go to http://tinyurl.com/gm7hpnt.

Sandia physicist is first woman to win 28-year-old IEEE award

By Nancy Salem • Photo by Randy Montoya

Sandia plasma physicist Christine Coverdale became the first woman to win the IEEE Plasma Science and Applications Committee Award in its 28-year history. The award recognizes outstanding contributions to the field of plasma science through research, teaching, and professional service to the scientific community.

Christine (5957) says she is grateful for the recognition from her peers.

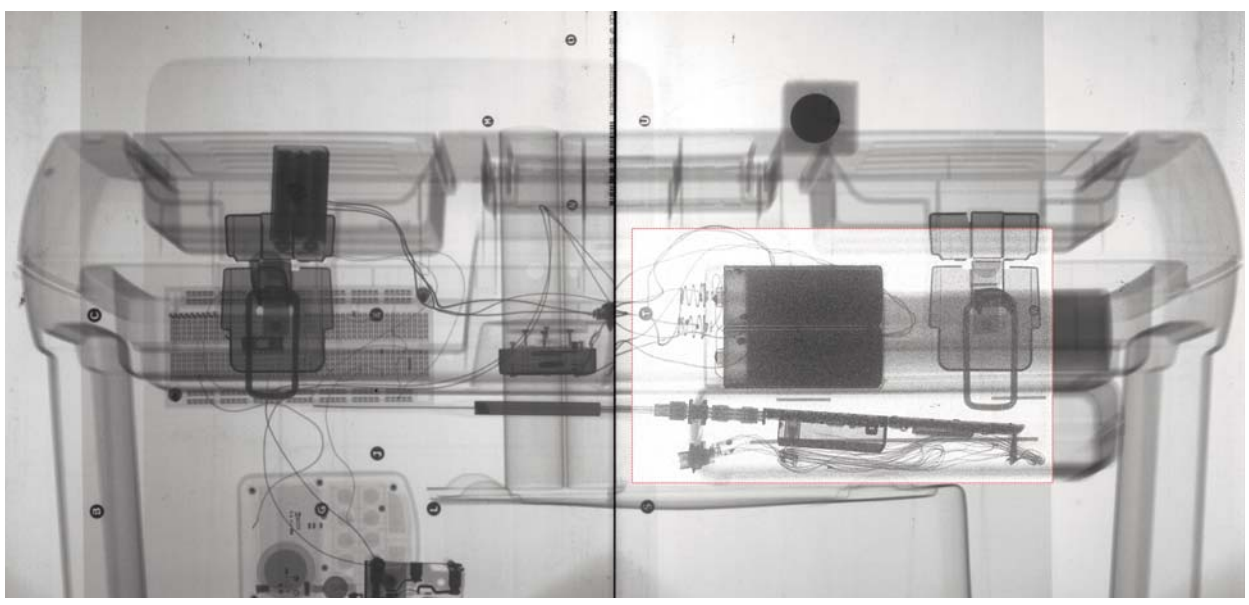
"This award means a lot to me," she says. "I've been lucky to have had many opportunities at Sandia to lead interesting and challenging projects, be mentored by highly capable people, and ultimately give back and mentor students and newer staff members."

Christine joined Sandia in 1997 and in 2011 was named a Distinguished Member of the Technical Staff. She has been involved in a broad range of experiments at the Saturn and Z pulsed power facilities centered around nuclear weapons certification and other national security projects. She most recently worked on radiation detection systems and diagnostics to assess warm and hard X-rays from Z-pinch plasmas.

Christine has a doctorate in plasma physics from the University of California, Davis, has authored or co-authored more than 120 papers, and regularly presents at conferences. She served three terms on the Executive Committee of the IEEE Plasma Science and Applications Committee and was technical program chair for the IEEE International Conference on Plasma Science in 2009, 2010, 2012, and 2015. She also served a four-year term on the IEEE Nuclear Plasma Sciences Society Administrative Committee.

Christine was on the Executive Committee of the American Physical Society (APS) Division of Plasma Physics and is senior editor for High Energy Density Physics for *IEEE Transactions on Plasma Science*. She is a Fellow of both the IEEE and APS.

A mother of three, Christine has worked with the leadership of IEEE and APS to include more women in technical programs and award nominations, and has promoted work-life balance by helping develop a child-care grant program for the IEEE Nuclear Plasma Sciences Society. "I worked with bosses and teams who were willing to be flexible," she says. "It's a good thing to balance family and work. I've tried to impress upon my kids to choose career paths that allow you do to many things in life."



THE SANDIA-DEVELOPED X-RAY TOOLKIT, or XTK, is a specialized X-ray visualization tool to help bomb disposal squads make fast, accurate, and precise assessments of potentially dangerous devices such as pipe bombs and IEDs. The image here, captured via the XTK software package using its unique image-stitching capability, shows the inner workings of a mock IED.

X-Ray Toolkit

(Continued from page 1)

look inside and analyze suspicious objects ranging from backpacks to battlefield IEDs to shipping containers. It's a high-pressure, time-sensitive job. "Every mission is different," Justin says. "Maybe it's just someone's lunch or a hoax, but maybe it's a pipe bomb. It's all about speed, precision, and accuracy. It's about having all the tools you need, none that you don't need, and supporting the bomb tech's natural work flow."

Before XTK, bomb techs had to learn to use multiple software packages, most developed for medical X-ray or photography applications rather than emergency response.

The federal government wanted a specialized X-ray visualization tool, and Sandia was tapped in 2009 to develop XTK with funding from NNSA and the DoD Combating Terrorism Technical Support Office. "We wanted something new and specific to the needs of national EOD personnel responsible for responding to nuclear terrorism events," says Marc Phipps, a former Army non-commissioned officer and bomb technician who headed up the XTK project for NNSA. "I was an Army guy and knew we could do better."

The XTK team spent hundreds of hours with EOD technicians learning how they work, and custom built the software to meet their needs. "There was a lot of collaboration. As a response organization, we were able to guide the software where it needed to be," Phipps says. "We went out with local bomb squads and brought Sandia coders with us to the field. Justin would be in the classroom writing code while the techs were testing the software. We would de-bug it right there. He wrote the code during lunch and when the techs came back it was ready. We gave everybody everything they ever wanted. It was awesome."

Justin says Phipps had "a vision of what this software could be. We'd get something done and he'd give us more. Make it do this, make it do that. Have it talk to the scanners, stitch images together, enhance so we can see things better, now add measurement tools. We did all that. Now make it compress the images so I can upload them over a satellite data-link. Piece by piece, Marc had us put into one user-friendly package all the tools that could make the bomb tech more effective."

Customize features, manage incidents

Phipps says there were dozens of versions of the toolkit before XTK 1.0 was ready. "We made it simple to use," he says. "EOD personnel can customize the features and set it up the way they want to use it. They can manage an incident as needed."

A bomb tech scans an object and acquires an image, then applies "all our XTK magic to it," Justin says. "But it doesn't begin or even end with looking at the images. XTK assists the bomb tech in every step of the operation from planning X-ray exposures to transmitting images out of the field."

The software tools can help optimize X-rays, identify critical device components, create 3D visualizations, stitch multiple images together to cover large objects, and compress large images for transmission. XTK also offers file management, measurement, markup, image sharing tools, and the ability to create training scenarios and after-action reports. "We wanted to equip responders to be better able to respond," Phipps says.

Greene says bomb techs must manipulate a radiographic image to learn what it is. "XTK is very versatile and lets us manipulate the X-ray to identify certain components. There are no alternatives to identifying what's in the X-ray," he says. "That's the key to rendering safe any IED or explosive. If you don't know what's inside the packet, the render safe tool might be wrong."

In tandem, Sandia designed the patented Grid-Aim system, an optional hardware accessory kit for XTK that lets users quickly and precisely disable the internal components of an IED with minimal damage to surrounding property and infrastructure, preserving the rest of the device for evidence.

'How do we get that?'

As XTK and Grid-Aim were being developed for government use, Phipps saw that the system could help military and civilian bomb techs do their jobs better. "We were working with FBI and state and local EOD people," he says. "All the local guys said, 'How do we get that?' Well, the government paid for it, why not give it to them? So we gave it away."

The technology transfer began in 2012 when the government began outside distribution of XTK software. "It was huge. People everywhere wanted it," Phipps says. "We were teaching classes all the time and set up a website and 24-hour phone number. It was almost a full-time job answering emails and phone calls. It took off because it was what people needed."

Sandia wasn't able to train the tens of thousands of people who wanted XTK so the technology was licensed to multiple companies that provided training and helped get XTK widely distributed in a short time. Bob says instructors are tested and certified every year to maintain high-quality training. Grid-Aim was licensed separately to four companies that produce and sell the hardware.

A success story

XTK is used by DOE, DoD, and the Department of Justice. US allies including the United Kington, Australia, and Canada, use the software, with more requests coming in from international training partners. Sandia updates XTK regularly with new features and versions designed for mobile computer platforms, such as touch-screen tablets. "It keeps getting bigger," Phipps says.

"XTK is a success story, taxpayer money put to good use," Justin says. "Even after all these years I get feedback all the time about how much of a difference it has made for people. One guy calls it the single most impactful, game-changing thing he's seen in his years as a bomb tech. It bridged the gap between our world at Sandia and the rest of the world."

Greene says bomb techs know and appreciate that NNSA, which funded the initial work, made the software available as a free app, and continues to update it. "That's important to them," he says. "It's their lives and the lives of others on the line."

Summer institute introduces Sandia interns to NW work

By Sue Major Holmes

The "sprint" part of Sandia's summer NW SPRINT competition for interns was more of an all-out run.

Three intern teams, augmented by Sandia staff, designed a nuclear weapon component, built it with additive manufacturing techniques, and tested it on a centrifuge — spending eight weeks on work that Advanced Mechanical Design Senior Manager Carl Vanecek (2610) says traditionally might take a year.

Along the way, interns were "exposed to the whole product realization process as they are developing concepts, creating prototypes, simulating their design, and actually testing their product to see how it performs," says Mechanical Design Manager Fran Current (2996).

NW SPRINT, for Nuclear Weapons Summer Product Realization Institute, formalizes a contest that began in 2015 when interns from three Sandia centers spent the summer developing designs for a nuclear weapon discriminator mechanism, using emerging additive manufacturing techniques and collaborating with Sandia's partners at the Kansas City National Security Campus (KCNSC).

The contest generated innovative designs, and Sandia put in a provisional patent application for one of them, Carl and Fran say. "You wouldn't put that component into the stockpile out of the box, but it's intriguing because they're designs you wouldn't necessarily think about," Carl says.

2015 contest led to summer institute competition

Staff members participating enjoyed the contest so much, and felt that interns got so much out of it, that they wanted to do it again.

So the Additive Manufacturing Discriminator Design Competition morphed into NW SPRINT. Championed by Weapons Engineering & Product Realization Div. 2000 VP Gary Sanders and Div. 1000 VP and Chief Technology Officer Rob Leland, it will carry forward with a new contest each summer. Its goals: have non-traditional teams develop innovative concepts using new technologies, identify gaps in those technologies and how to address them, and create a pipeline for recruitment.

Interns Ryen Ormesher and Karl Johannes, who competed both years, say more Sandians were aware of this year's contest, which involed designing a small component that senses acceleration. The device had to actuate and close its contacts under sustained acceleration — a requirement that simulated environments in a typical rocket launch.

Requiring teams to demonstrate functionality "increases the challenge pretty significantly," Ryen says.

It also compressed the contest timeline. At the mid-point in 2015, Ryen's team was still deciding among designs. By this year's halfway mark, the team was prototyping a design "to make sure that we have time to go back and redesign and retest," says Ryen, a junior biomedical engineering student at North Carolina State University. "Allowing enough time to do multiple iterations and multiple prints has been the hard part."

Karl's team had narrowed its choice to two designs and was printing and testing parts to see how they'd function in a system, preparatory to printing full systems to test. "It's helpful that we had more people working on it this year," says Karl, now in graduate school at the University of Colorado Boulder after receiving a mechanical engineering degree this year from New Mexico State University (NMSU).

Teams included interns from several universities

Karl's team — which won the competition — was sponsored by Carl and included members from the University of New Mexico, Cornell, New Mexico Tech, NMSU, and the University of Florida. Ryen was on a team sponsored by Surety Analysis Senior M anager Tommy Woodall (0430) that also had members from the University of Texas, Missouri University of Science and Technology, NMSU, and Texas A&M. The team sponsored by Advanced Weapons Systems & Surety senior manager Manuel Contreras (2223) included members from New Mexico Tech, UNM, Oklahoma State University, and Community College of Denver.

Teams were judged Aug. 4 by a panel made up of Sandia distinguished mechanical engineers Daniel Petersen (2613) and Allen Roach (2735), Labs' additive manufacturing Deputy Director Mark Smith (1801), University of Texas mechanical engineering professor Carolyn Seepersad, and KCNSC senior technical manager David Spieker.

The competition drew about 20 interns, either full or part time. Each team included interns and newly hired and more experienced staff members, helped by experts in safety from Org. 400, 3-D modeling from Org. 2900, manufacturing from KCNSC, materials from Org. 1800, and additive manufacturing from around Sandia.

CHALLENGE WINNERS — Student members of the NW SPRINT winning team pose with their trophy after challenge pose after judging Aug. 4. Three intern teams, augmented by Sandia staff, spent eight weeks this summer designing a nuclear weapon component, building it with additive manufacturing techniques, and testing it on a centrifuge. (Photo by Tommy Woodall)

Deputy Chief Engineer Scott Holswade (2200) says the contest promoted "accelerated cycles of learning."

Completing design cycle in short period

"We took people more or less off the street and gave them an assignment they were able to complete in a very short time, eight weeks. It's amazing that we were able to do a complete design cycle in that amount of time," he says.

Technology is changing quickly and the pace of change is accelerating, he told the interns at a June kickoff. "We need that ability to rapidly think about things, to solve problems, and to get our models and simulations to agree with what we're seeing in the lab."

It's also more inclusive. The challenge brought in people who had little exposure to the weapons program and took them through an entire design cycle in a short period, in contrast to a more traditional approach of years of apprenticeship-type training, Scott says. "It lowers barriers," he says. "If we can do it with interns and early-career staff, we can certainly do it with the wider Sandia population."

Fran, who works in the B61-12 program, says that until the summer contests, it was hard to find significant assignments for interns because of the classified nature of weapons work. Now, he says, "I feel very comfortable bringing in interns knowing that I'm going to have something for them to work on that's meaningful throughout the summer."

Ryen says seeing a project through from start to finish was a unique intern experience. "We get to learn a lot about the design process and what goes into making sure that whatever your design is, it meets the requirements you're given."

Karl enjoyed using additive manufacturing in 2015 at Sandia and wanted to return. "I really like everyone that I worked with, so coming back for another summer seemed like a good idea. Certainly NW SPRINT has been fun."

Sandia experts, students explore mechanical challenges

By Mollie Rappe

How many engineers does it take to study two steel bars bolted together?

This summer almost 40 students ranging from local high school students to international postdoctoral fellows gathered at Sandia's Nonlinear Mechanics and Dynamics (NOMAD) Summer Research Institute to study this deceptively simple system for the third year in a row.

"The heart of NOMAD is that the problems we're trying to solve in nonlinear mechanics and nonlinear dynamics are too large to be solved by a single researcher at a single institution. My idea was to create some mechanism for graduate students to come in, learn the basics of research in these fields, develop networks and collaborations, and really get inspired," says Matt Brake (1556), mechanical engineer and founder of the NOMAD Summer Research Institute.

ANELA BAJRIC, a grad student at Denmark Technical University and a participant in Sandia's NOMAD Summer Research Institute, discusses the results of her research on detecting damage on railroad bridges, a nonlinear system. (Photo by Randy Montoya)

Friction, Fatigue, and Failure

Over the course of the six-week institute held at the University of New Mexico's Manufacturing Training and Technology Center the students — mentored by about 30 Sandia engineers and external faculty members — pounded and prodded, modeled and simulated the two-piece, three-bolt steel bar.

A simple steel bar is well understood at a mathematical level. How it responds to stress and where it might break can be calculated (with a pretty high degree of confidence). However, by cutting the bar in two and bolting it back together, all the rules change. It becomes "nonlinear." Understanding nonlinear systems is important because practically everything outside a textbook is nonlinear: bridges, cars, airplanes, and bicycles. NOMAD also is investigating how other nonlinear systems wear out or break; this year's theme was "Friction, Fatigue, and Failure."

The students came from 17 institutions and 11 countries. Some heard about NOMAD at a conference, some heard about it from their graduate advisers, some heard about it from institute alumni, and three students have attended each summer since the program's inauguration.

Scott Smith (1556), a graduate student at University of Maryland, Baltimore County, and a year-round intern at Sandia, has attended the institute all three years. He says he keeps coming back because he likes doing the experiments and enjoys meeting people from around the world and escaping the mid-Atlantic humidity.

Long Wu, a graduate student at the Delft University of Technology, met Matt at a conference and heard about the institute. "I thought this is a good chance to collaborate with people from different universities and different countries." Long says, "In my PhD project I can only talk with my adviser; everyone else is doing different research. I think this is a good chance for us to share our knowledge."

Martin Buck, a graduate student at the University of Stuttgart, heard about the institute from a colleague who had attended the first two years. Buck came to NOMAD hoping to learn about improving the understanding and implementation of interface reduction methods, network with experts in the field, and learn whether he wanted to stay in academic research or go into industry after he graduates.

TWO STEEL BARS bolted together poses interesting challenges in nonlinear dynamics. (Photo by Matt Brake)

Inspiring Albuquerque high school students in STEM

A new facet of NOMAD is a science, technology, engineering, and math (STEM) education outreach project. Frustrated by the lack of diversity among the mechanical engineering applicant pool, Matt set out to inspire local high school students from under-represented groups to consider science and engineering.

As part of NOMAD, 11 high school students were hired as Sandia interns. They assisted the graduate students with the experiments and administered a cross-cultural psychology research survey for Matt and his collaborator Gergana Todorova at the University of Miami. But the students also played around with engineering software tutorials and participated in student-directed lectures.

"I want to give the students around here a chance to learn about the engineering sciences and the social sciences. Engineering is not something scary where you have to be an expert in mathematics; it's something that you can do," says Matt. "Despite the stereotypes, engineers are real people, we have a lot of fun, we get to play with cool software, and do cool experiments."

Kestrel Kiegel, a senior at Albuquerque High School, says she thinks NOMAD is a really cool summer job. She enjoyed helping the graduate students with their experiments and added, "The grad students are really nice."

Ricardo Smith, a senior at Atrisco Heritage Academy High School, liked the engineering software tutorials. One tutorial focused on a 3-D model of a teapot that he used to explore how to design and model smooth surfaces, something trickier than building with cubes.

Once the students completed the tutorials, they designed streamlined objects that would efficiently use less building material but stay strong. The objects ranged from cymbals, chairs, bridges, and skateboards to high-heeled shoes, depending on the students' interests.

Rob Kuether (1556), the future head of the institute, said, "I hope NOMAD will produce cutting-wedge research in the area of nonlinear mechanics and dynamics, and provide further insight into some of the technical challenges faced by mechanical engineers. These discoveries will hopefully advance the engineering sciences to allow a variety of industries to design and manufacture new products with improved safety, reliability, and enhanced performance. In addition, I'd like to see the collaborations formed within NOMAD eventually lead to joint efforts in answering other challenging research problems."

SANDIA CLASSIFIED ADS

How to submit classified ads

INTERNAL WEB: On internal web homepage, click on NewsCenter, then "Classified Ads" in the center of the page, under Employee Resources. If you have questions, call Michelle at 844-4902.

MISCELLANEOUS

COMPUTERS: Toshiba laptop, 15.5-in. screen, $195; Lenovo desktop, w/keyboard & mouse, $150; Windows 10 installed. Hale, 298-1545.

35 MM CAMERA, Olympus, vintage 0M-10, 2 lenses, zoom, filters, manual override, make offer. Dennett, 379-9971.

WEGA TV, Sony, 36-in., w/stand & remote, $50 OBO. Hayden, 796-9080.

MURPHY BEDS, full size, cherry finish, cost $1,500, asking $750 OBO. Mozley, 884-3453.

LADIES SHOES, sizes 8-1/2 & 9, elegant pumps, dressy sandals, mid-heals, mostly black, hiking boots, fur-lined boots, shoes brand new, boots almost new, make offer. Joseph, 480-521-4989.

FRONT BICYCLE CHILD CARRIER, Yepp Mini, used once, like new, $60. Beckett, 801-709-4639.

ARROW SHED, 9' x 10' x 7', frame kit, anchor kit, in containers, ready for assembly, new $790, asking $400. Chabai, 505-228-0038.

FUTON, queen, all wood, w/drawers, covers, matching storage ottoman, text for photos, $150/all. Greenberg, 505-377-6480.

GRASS HAY, second cutting, high quality, barn stored, $8/bale. Rivers, 720-4701.

HOME FURNITURE: living, dining, bedroom sets, good condition, email for more info. Craven, 505-514-3589, juliamcraven@gmail.com.

SEWING MACHINE, Singer, circa 1968, metal in legged maple cabinet, $80. Stephenson, 505-414-2466.

LAPTOP TABLE STAND, height adjustable, vented, built-in cooling fan, removable mouse pad tray, $15. Rosul, 900-3678.

PILATES PRO-CHAIR DELUXE, Malibu, sculpting handles, resistance springs, $275. Scott, 505-301-6554.

STEREO RECEIVER, Marantz #SR4021, Marantz AV surround receiver, #SR5001, Marantz DVD player, #DV4001, w/remotes & manuals, $300. Maurer, 505-903-9079.

SLEEPING BAG, oversize, 39" x 84", 5-lbs. fill, roomy & warm, like new, $50; felt-sole waders, $55. Kercheval, 505-266-5833.

JEWELRY CHEST, solid wood, 8 drawers, top storage w/mirror, sides open for hanging jewelry, $100. Beale, 220-0513.

ALLOY WHEELS, 3, 16-in., 7-spoke, $125/all. Smith, 505-903-0911.

SHEET MUSIC, liquidating ~700 pcs., late 1800s through 1960s, $280. Brown, 366-1582.

WINE RACK, modular, wood, 40 bottles, details at http://wmstubblefield.com/sale-items, $25. Stubblefield, 263-3468.

BARREL CHAIR, brown shades, 38"H x 60"W x 60"D, $100; desk, w/L-extension, cherry mahogany, $300. Clark, 505-228-3181.

ROOF-TOP TENT, 3-4 person, ~72" x 96" sleeping area, 3-in. thick foam mattress, excellent condition, $800. Smith, 269-1211.

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: On internal web homepage, click on NewsCenter, then "Classified Ads" in the center of the page, under Employee Resources. 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

'05 CONVERTIBLE 350Z ROADSTER, 6-spd. manual, adult owned, garage kept, very low 76K miles, excellent condition, beautiful, fast, fun, $12,950. Sanchez, 238-2978.

'13 FORD CMAX HYBRID, 4-dr., all options, green, 15,850 miles, excellent condition, $15,000. Mata, 505-620-9664.

'07 TOYOTA HIGHLANDER, FWD, 260K miles, good condition, well maintained, $5,700. Logan-Condon, 459-8398.

'14 GMC SIERRA SLE Z71, 4x4 pickup, 4WD, 14.4K miles, excellent condition, $32,000. Herrera, 505-489-3919.

RECREATION

'10 PIAGGIO BV250 SCOOTER, always garaged, only ridden once a week, 2,439 miles, like new, $3,500. Laskar, 639-9127.

'08 CROSSROADS TRAVEL TRAILER, pull behind, 31-ft., lightweight, slide out, seldom used, all amenities, sleeps 8, $16,000. Aubert, 505-286-9173.

'12 JAYCO JAYFLIGHT SWIFT TRAVEL TRAILER, sleeps 4, w/sleeper sofa, 20-ft., looks new, $10,500. Fernandez, 238-7279.

'06 FOUR WINDS CAMPER TRAILER, Ultra Lite, 27-ft., tow behind, excellent condition, in Edgewood, $12,000. Mathews, 505-321-7650.

'03 WINNEBAGO M-27P FORD, Class C, 29-ft., 2 slides, entertainment center, 32-in. flat screen TV, retail $33,100, asking $28,600. Vigil, 200-2222.

REAL ESTATE

3-BDR. HOME, 2 baths, 2-car garage, 1,384-sq. ft., 6 mos. old, fireplace, granite, new appliances, refrigerated AC, NW petroglyphs, REC contract considered, $240,000. Sanchez, 505-293-7246.

4-BDR. HOME, 2-1/2 baths, 3-car garage, 2 living areas, loft outside kid's bdr., master on first floor, great schools, MLS#872657, $429,000. Irwin, 263-1155.

2-BDR. HOME, 2-1/2 baths, Rio Rancho, gated community, Cabezon, $189,900. Erdman, 505-554-5264.

3-BDR. HOME, 1-3/4 baths, 1,672-sq. ft., renovated, North Valley, beautiful wood floors, variance, fireplace, $175,000. Green, 505-239-6914.

3-BDR. HOME, 2 baths, 2-car garage, 1,550-sq. ft., corner lot, near Ladera Golf Course, $170,000. Gallegos, 505-264-3174.

80 ACRES, Dinkle Road, between Moriarty & Edgewood, will consider REC. Brooks, 505-410-7210.

TRIPLEX, 2,650-sq. ft 1-bdr. units, 1,900-sq. ft., new roof fall '15, low maintenance, 2 of 3 bdrs. remodeled, cap rate of 11%, 330 Truman NE, $150,000. Dwyer, 271-1328.

3-BDR. HOME, great yard, Sandia school district, 7 mins. from Eubank gate, 1517 Altez NE, MLS#867074, $140,000. Reynolds, 505-884-0020, ask for Janie.

CONDO, 2 master bdrs. w/full baths, plus 1/2 baths, 1,144-sq. ft., 1-car garage, stainless appliances, quartz counters, community pool, $110/mo. Assoc. dues, $164,000 OBO. Yepez, 650-485-3640.

WANTED

STUDENT, good w/pets, to walk medium-size dog, 3x per week, Juan Tabo/Indian School, $20/wk. Brunt, 505-385-7259.

WASHER & DRYER, for family in need, donation or low cost. Smolenski, 505-553-5944.

AIR DRYING RACK, standing only, for multiple items, metal or wood. Andreoni, 505-400-9563, text preferred.

ROOMMATES, Volterra, no pets, $600/mo., utilities, WiFi, maid service included. Guillen, 505-385-8189.

ROOMMATE, 3-bdr. home, 2-1/2 bath, 2,100-sq. ft., Ventana Ranch, no pets, $550/mo., internet, cable, utilities included. Davidson, 832-701-8880.

Driver Safety Games puts safety standards into high gear

By Rebecca Brock • Photos by Lonnie Anderson

Ever wonder how equipment and supplies arrive at the Labs safely, securely, and on time? Sandia's material handlers — think of them as the Labs' own "Fed Ex" drivers — are the first people to touch everything we use.

"These are the unsung heroes of Sandia," says Fleet Services Manager Mark Crawford (10265). They are the hardworking men and women who are trained to work under extreme conditions and amongst numerous hazards."

Supporting Sandia's central safety principles, Logistics Operations 10260 staged a friendly safety skills event on Kirtland Air Force Base as an exercise in safety standards and continuous improvement. Five teams of operators, paired in teams of two, represented Sandia logistics groups including Reapplication and Transportation/Receiving.

"For us this event is a learning experience, and an opportunity to train alongside our comrades in other departments," says Robert Naranjo (102621) a utility truck driver who competed with teammate Ray Ortiz (102621), a commercial driver.

Participants were faced with challenges such as operating forklifts with various bulky loads, maneuvering through a narrow obstacle course both backwards and forward, and driving a 3-ton stake truck through sharp turns. And to do it all safely.

Diana Goold (10264), manager of Property Management and Reapplication, says the exercise benefits many logistics professionals at Sandia. Says Diana, "An event like this is a great opportunity for us. We have evaluators from internal and outside organizations who give us detailed feedback. We compile all the lessons learned from the exercise, and then present it to our entire team."

Sandia assessors from Safety Engineering (4122) were joined by guest observers from San Juan Community College, the largest truck driving program in the state, and two officers from the New Mexico Motor Transportation Department.

Sgt. Carlos Perea from the New Mexico State Police assessed the law enforcement side of safety to ensure drivers complied with Department of Transportation regulations. Perea says, "What I've noticed about Sandia operators is they are good communicators and they work really well together."

The event was coordinated by Liz Carson (10265), who says the 75 material handlers at Sandia have a lot in common: "They are friendly, dedicated, and customer-service driven," she says.

Maury Tiehen from San Juan Community College observed the driving skills on the course. "It's obvious to me," he says, "that the supervision and leadership at Sandia do a good job, from hiring the right people, to getting them the training they need to do the job safely."

Sandia's clean water stewards

ENVIRONMENTAL TECHNICAL PROFESSIONAL John Kay (4141) inspects a construction site at Sandia before a storm to ensure proper protection measures are in place near stormwater drains.

By Karli Massey

Monsoon season is well underway in New Mexico and other areas across the Southwest. The flash floods caused by monsoon storms occur with little or no warning, move at very fast speeds, and can bring walls of water 10 to 20 feet high.

In addition to the safety hazards that storms can rain down, the stormwater generated in almost an instant can pick up debris from roads, chemicals from lawns, oil from cars, and bacteria from animal waste. Many people are unware or forget that storm drains lead directly to open water bodies without any treatment, which is different than sanitary sewers that divert waste water to a treatment plant. All the trash and pollutants picked up by stormwater then pour into drains and arroyos and compromise water quality.

While the unpredictability of severe storms can wreak havoc, Sandia's Stormwater Program is deliberate and constant as it works to develop strategies to prevent and reduce pollutants from entering the local ecosystem.

"We work with members of our workforce to help them understand how their work may adversely impact stormwater quality," says Kathie Deal (4141), environmental technical professional and Stormwater Program lead in the Environmental Compliance and Monitoring Department.

"The Rio Grande is one of New Mexico's greatest treasures," adds Kathie. "It's a critical habitat for many bird and fish species and a municipal, agricultural, and recreational water resource to local communities. Sandia is committed to protecting the Rio Grande, its tributaries, and the surrounding environment."

As Sandia strives to be a good steward of the environment, federal and local regulations provide the framework to achieve this goal. The National Pollutant Discharge Elimination System (NPDES), which is administered by the US Environmental Protection Agency, controls water pollution by regulating sources that discharge pollutants into waters of the United States. Sandia/New Mexico holds three NPDES permits that detail allowable activities and reporting mechanisms for discharging stormwater system to the Rio Grande or its tributaries (e.g., Tijeras Arroyo).

"We're aware that not everyone can know about the specifics of environmental regulations; that's why we're here to provide consultation on the requirements and to offer training so customers can effectively integrate pollution prevention measures into their mission-critical work," says Carolyn Daniel (4141), environmental technical professional and one of the three permitting leads for the program.

Areas and activities that have the most potential to create stormwater pollutants at Sandia are landscaping, waste stockpiles, and maintenance and construction activities. Members of the workforce involved in these types of activities are required to take Stormwater Pollution Prevention training (SW100 and SW200).

"While one purpose of our stormwater program training is to help Sandia comply with regulations, the course also shares best practices that help us all work together toward preserving natural resources," Carolyn says.

STORMWATER runoff races down an arroyo in Albuquerque's Northeast Heights, headed for the Rio Grande.

At work and at home

Stormwater pollution prevention is not just something to follow at work; it's something everyone should practice every day.

- Good housekeeping — Keep exposed areas clean to reduce potential pollutant sources.
- Maintenance — Inspect, test, and repair equipment and vehicles to avoid spills or leaks. Properly dispose of or recycle motor oil and other household hazardous chemicals/wastes.
- Waste — Keep areas free of garbage and floatable debris. (Pick up after your pet; E. coli from domestic animal waste is the most common pollution source in stormwater runoff.)
- Erosion and sediment control — Stabilize exposed areas and control/contain runoff.
- Landscaping — Reduce water consumption by xeriscaping. Minimize use of pesticides, herbicides and fertilizers; adhere to manufacturer specifications.
- Get involved — Volunteer in local stream restoration and watershed clean-up activities.

Remember the TITANS

University Days event supports research, recruiting partnershsips

TITANS (Technical Internships to Advance National Security) University Days is an annual event that supports research and recruiting partnerships with Sandia's Academic Alliance/Campus Executive schools, the Minority Serving Institutions Partnership Program, and other universities across the country.

About 20 faculty members participated in this year's event, held July 25-28, that included tours, technical talks, and activities at various locations around Sandia. TITANS University Days is held in conjunction with the Student Internship Program Symposium, which gives students the opportunity to present what they worked on over the summer. Faculty have the opportunity to visit with students, gain insight into Sandia's capabilities and the broad spectrum of work being done at the Labs, and develop relationships with research staff, fostering potential collaborations and future recruiting efforts. One of the highlights this year was a visit to TracerFIRE (Forensic Incident Response Exercise), a hands-on cybersecurity learning experience.

TITANS is an umbrella program over three Division 5000 internship institutes: the Center for Analysis Systems and Applications, the Center for Cyber Defenders, and the Monitoring Systems and Technology Intern Center. Interns are exposed to all three institutes and work in a wide range of technical fields dominated by computer science and engineering and electrical and mechanical engineering.

Photos by Nick Kerekes