Blowing bubbles to catch CO₂

By Mollie Rappe

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

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 CO₂ emissions efficiently.

CO₂ is a primary greenhouse gas and about 600 coal-fired power plants belch out more than a quarter of total US CO₂ 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 CO₂. 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 CO₂ emissions at a cost-effective $40 per ton by 2025. Sandia and UNM’s new CO₂ Memzyme is the first CO₂ 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 CO₂ 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 CO₂ 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 times more efficient in absorbing CO₂.

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Membrane that harnesses the power of nature to reduce CO₂ emissions efficiently.

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

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...

Pension offer to former employees doesn’t affect current participants 2
Sen. Heinrich hosts energy storage summit 2
Encouraging STEM success for women of color 3
5 energy companies get tech-to-market help from Sandia 4
Summer institute introduces students to NW work 6
Friction, Fatigue, and Failure is theme of NOMAD institute 9
We deliver! Sandia materials handlers show their skills 7
... and constant as it works to develop partnerships 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 home-made 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 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.

"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."

Bomb techs up their game with Sandia’s XTK software

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

"It was not focused on generating revenue for Sandia," says Justin Garrettson (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 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
• Offered it to military and law enforcement bomb squads to download free from the XTK website

 "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
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 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.

Five years at Sandia is a 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.

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’ll try to share some of our 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. 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 office or two, try to remember it about me, which were six parking lot numbers, then I’d embed the office number in my DNA.” Then there were building numbers. “Meet me in the lobby of 899? Can you stop by 823? I led 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 where 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.”

“I didn’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 bomb you really, and you had to figure out what they were or what they meant? I was lost! I needed a reference book. I realized I needed an official badge.”

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“I don’t even try to remember the names of some of the people who work here. I have to rely on my badge or a reference book. I needed a reference book.”

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, nsalem@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.

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 855-550-9485 is available to eligible former employees Monday through Friday from 8 a.m.-4 p.m. Mountain Time, except on certain UI holidays.

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.”

The summit was co-organized by AIP’s National Physicists’ League, which promotes the science and application of physics, and the IEEE-USA Energy Policy Committee, which advocates for practical and effective policies to support energy solutions. Heinrich’s event was one of a series of events planned throughout the year.”

Sandia National Laboratories
http://www.sandia.gov/LabNews

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When hurricanes take aim

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 Tedemariam (B112), 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 6800, and Centers B100 and B900.

“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 crucial 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 (B112), 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.

“Our gap analysis 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 road systems, population distribution, and potential storm conditions.

“When 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 pop-ulations, 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 we have the plan in place to see what comes 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

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.”

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.
5 energy companies get technology-to-market help from Sandia 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, 13 companies were selected to receive $8 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 round-two 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 NRE of Lubbock, Texas; Oscilla Power Inc. of Seattle; Heliot Biosci Inc. of Woodside, California; SkyScape of Ann Arbor, Michigan; and Nishtar 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. 1993. “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, 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.

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

Small Business Voucher Pilot (SBV) provides essential funding and expertise to 5 small businesses.

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Five energy companies get technology-to-market help from Sandia (Continued from page 1)

times more selective for CO₂ over nitrogen, the main component of flue gas.

Stabilized, bubble-like liquid membrane

One day Jiang was monitoring the capture of CO₂ by a ceramic-based membrane using a soap bubble flow meter when he had a revolutionary thought: What if he could use a thin, water-permeable membrane bubble, to separate CO₂ from flue gas that contains other molecules such as nitrogen and oxygen?

“Thinner is faster when you’re separating gases.”

Polymer-based CO₂ 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 the right molecules get through. Then the molecules must travel long distances through the membrane say, at the Eubank 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.

CO₂ moves, or diffuses, from an area with a lot of it, say flue gas from a plant which can be up to 15 percent CO₂, to an area with very little. Diffusion is fastest in air, hence the rapid spread of popcorn aroma, and slows 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 they are fragile. Even the lightest touch can make them pop. Jiang and his postdoctoral 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

Partnership between theory and experience with UNM has been fruitful here . . . . Together we developed a membrane that has both high selectivity and fast flux for CO₂. With optimization for industry, the Memzyme could be the solution we’re looking for to make electricity both cheap and green.

“Out of this our group has developed a bubble-like, liquid membrane. The membranes are biological catalysts that speed up chemical reactions. Even the process of CO₂ dissolving in water can be sped up by carbonic anhydride, an enzyme that combines CO₂ with water (H₂O) to make super soluble bicarbonate (HCO₃⁻) 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 CO₂.”

Susan and her former postdoctoral fellow Dian Jiao were the first to have an idea of how to make and work with this enzyme. They thought the enzyme could be combined with something like Jiang’s watery membrane to speed up CO₂ capture. An enzyme-loaded membrane is almost like an electronic toll collection system (such as E-ZPass). The enzyme speeds up the dissolving of CO₂ 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 in CO₂ and releases CO₂ only, and last enough that diffusion is unimpaired. 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.

However, the nanometer-sized membrane are very small, only a little wider than a and a few times as tall as the enzyme itself. “What’s happening to the enzyme under confinement? Has the enzyme changed or has any part of it detached 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 baton. Because of the unique structure of the membrane, the enzymes dissolves 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 nanoparticles, the enzyme is still efficient and lasts for months even at 140 degrees Fahrenheit.

Working toward a greener future

Having successfully tested the CO₂ Memzyme at the laboratory scale, the Sandia-UNM team is looking for partners to help the technology mature. Each of the membrane fabrication process can be scaled up, but the process needs to be optimized to be more competitive for large power plants.

In addition, the team is looking to more stable transformations to the common form of the enzyme, such as enzymes from thermostable 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.

“CO₂ Memzyme produces 99 percent pure CO₂, which can be used in many industries. For example US oil companies buy 30 million tons of pure CO₂ for enhanced oil recovery. The CO₂ 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 the 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. A patent has been filed and a partnership between 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 CO₂. With optimization for industry, the Memzyme could be the solution we’re looking for to make electricity both cheap and green.” says Susan.

For the CO₂ Memzyme, go to http://tinyurl.com/jgm9htp.
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 (1957) 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 1987 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 she has promoted work-life balance by helping develop a child-care grant program for the IEEE Nuclear Plasma Sciences Society. "I worked with buses and teams who were willing to be flexible," she says. "Its a good thing to balance family and work. I've tried to impress upon my kids to choose career paths that allow you to do to many things in life."

The XTK team spent hundreds of hours with EOD techs to develop XTK with funding from NNSA and the DoD Combating Terrorism Technical Support Office. "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 says 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."

"XTK is a success story, taxpayer money put to good use," says Justin. "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."

Sandia was 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 Kingdom, 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. "I keep getting 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 for a fee, 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 than just an assignment. Three intern teams, augmented by Sandia staff, designed a nuclear weapon component, built it with additive manufacturing techniques, and tested it on a centrifuge. (Photo by Tommy Woodall)

Three intern teams, augmented by Sandia staff, designed a nuclear weapon component, built it with additive manufacturing techniques, and tested it on a centrifuge. (Photo by Tommy Woodall)

"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 and build project 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 people in who had little experience with the weapon systems 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 B61-6 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 whole summer."

Ryen says seeing a project 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 to make parts and test them on a centrifuge. "It's amazing that we were able to do a complete design project and go into manufacturing.

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 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 engineering scientists and the kind of work engineering is — not some fictitious story where you have to be an expert in mathematics, it's something that you can do," says Matt. "Despite the stereotypes, engineers are people who 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 Arizco Heritage Academy High School, liked the engineering software tutorials. One tutorial focused on a 3-D model of a truss that he used to study 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 aerodynamically use less building material but still stay strong. The objects ranged from cymbals, chains, bridges, and skateboard to high-heeled shoes, depending on the students' interests. It's a chance for the interns to get exposure to the research and design processes that mechanical engineers and computer scientis tors face daily.

"I think this is a good chance to collaborate with people from different universities and different countries," Long Wu 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 Burch, 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 Wu 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."

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**How to submit classified ads**

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**MISCELLANEOUS**

- **COMPUTERS:** Toshiba laptop, 15.5-in. screen, $195; Lenovo desktop, i5 processor, 8 GB RAM, 500 GB hard drive, extended warranty $310 installed. Hale, 298-1345.
- **35 MM CAMERA:** Olympus, vintage 1970s, focusing, 28-70 mm 35 mm SLR, b/w film, $100. Chabai, 505-228-0038.
- **ALUMINUM PUMPS:** Black, $150. Fernandes, 238-7279.
- **LAPTOP TABLE STAND:** Height adjustable, vented, built-in cooling fan, removable mouse pad tray, $15. Rosul, 909-4977.
- **REAL ESTATE**
  - **CONDO:** 2 master bdr., w/balcony, 1,070 sq. ft., 2 1/2-ba, wall-to-wall carpet, built-in cabinets, central air, $229,000. Blumenthal, 900-3678.
  - **CONDO:** 2 master bdr., w/full baths, 1,234 sq. ft., 2-ba, 2 parking spaces, central air, $315,000. Gallegos, 505-264-3174.
  - **HOMES FOR RENT:** 2-bdrm, 1 bath, 1,080 sq. ft., 1 car garage, school district, near bus line, $750. Vargas, 505-296-3738.
  - **HOMES FOR RENT:** 2-bdrm, 1 1/2-ba, 1050 sq. ft., 1 car garage, $750. Kuntz, 505-351-4207.
  - **HOMES FOR RENT:** 3-bdrm, 2 1/2-ba, 1,550 sq. ft., 2 car garage, school district, near bus line, $850. Vargas, 505-296-3738.

**TRADE SCHOOLS**

- **PILATES PRO-CHAIR DELUXE:** Malibu, sculpting handles, resistance springs, $275. Scott, 505-350-6554.

**SANDIA CLASSIFIED ADS**

By Rebecca Brock • Photos by Ronnie 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 (10360). “They are the hardworking men and women who are trained to work under extreme conditions and among 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 continuing professional improvement. Five teams of operators, paired in teams of two, represented Sandia logistics groups including Requisition and Transportation/Receiving.

“For us this event is a learning experience, and an opportunity to train alongside our assessor from Safety Engineering,” says Diana Goold (10264), manager of Property Management and Reapplication, “so it’s an important feedback mechanism for us to improve our training.”

Sandia assessors from Safety Engineering (1122) were joined by guest observers from Juan Cueto, Jike College, the largest truck driving program in the state, and two officers from the New Mexico Motor Transportation Department.

Sgt. Carlos Pereyra from the New Mexico State Police assessed the lawn enforcement side of safety to ensure drivers complied with Department of Transportation regulations. What I’ve noticed about Sandia operators is that they are good communicators and they work really well together.”

Evelyn Kercheval, coordinator of Liz Canon (10360), who says the 75 material handlers at Sandia have a lot in common: “They are friendly, dedicated, and customer-service driven,” she says.

“Like all of us 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.”

**How to submit classified ads**

**DEADLINE:** Friday noon before week of publication of issues changed by holidays. Submit by one of these methods:

- **E-MAIL:** Michelle Fleming (classads@sandia.gov)
- **FAX:** 505-346-1600 (Dept. 951)

**INTERNET 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 644-4902. Because of space constraints, ads will be posted on a first come basis.

**Ad rules**

1. Limit 18 words, including last name and phone number if available. If you reserve space on 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 at e-mailing. No phones, faxes, mail, only e-mail.

4. Type or print ad legibly; use acceptable abbreviations.

5. One ad per issue.

6. We do not run the same ad more than twice.

7. No “for rent” ads except for employees of active Sandia members of the workforce, retired Sandians, and DOE contractors.

8. No commercial ads.

9. For active Sandia members of the workforce, retired Sandians, and DOE contractors.

10. Housing listed for sale is available on temporary assignment.

11. Work Wanted ads limited to active Sandia members of the workforce.

12. We reserve the right not to publish any ad that appears offensive or in bad taste.

13. All classified ads must be e-mailed to classads@sandia.gov. (classads@sandia.gov)

**MAIL:** MS 1468 (Dept. 951)

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Sandia’s clean water stewards

By Karl 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 unaware 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 agricultural, recreational, and municipal water resources 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 systems 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.

Remember the TITANS

University Days event supports research, recruiting partnerships

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 TraceFIRE (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.