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Earthquake or underground explosion?

Experiments help differentiate between nuclear test and natural events

By ***Manette Newbold Fisher***

Sandia researchers, as part of a group of NNSA scientists, have wrapped up years of field experiments to improve the United States' ability to differentiate earthquakes from underground explosions, key knowledge needed to advance the nation's monitoring and verification capabilities for detecting underground nuclear explosions.

The nine-year project, the Source Physics Experiments, was a series of underground chemical high-explosive detonations at various yields and different depths to improve understanding of seismic activity around the globe. These NNSA-sponsored experiments were conducted by Sandia, Los Alamos National Laboratory, Lawrence Livermore National Laboratory and Mission Support and Test Services LLC, which manages operations at the Nevada National Security Site. The Defense Threat Reduction Agency, the University of Nevada, Reno, and several other laboratories and research organizations participated on various aspects of the program.

Researchers think recorded data and computer modeling from the experiments could make the world safer because underground explosives testing would not be mistaken for earthquakes. The results will be analyzed and made available to many institutions, said Sandia principal investigator and geophysicist Rob Abbott.

The dataset is massive. "It's been called the finest explosion dataset of this type in the world," Rob said. "We put a lot of effort into doing this correctly."

The final underground explosion in the series took place June 22.

Explosion differences in hard, soft rock

Phase 1 of SPE consisted of six underground tests in granite between 2010 and 2016. Phase 2 consisted of four underground tests in dry alluvium geology, or soft rock, in 2018 and 2019. The results from both phases will be analyzed to help determine how subsurface detonations in dry alluvium compare to those in hard rock. Additionally, the SPE data can be measured against data collected from historic underground nuclear tests that were conducted at the former Nevada Test Site.

Depending on the experiment, up to 1,500 sensors were set up to take measurements. These diagnostics included infrasound, seismic, various borehole instruments, high-speed video, geologic mapping, drone-mounted photography, distributed fiber-optic sensing, electromagnetic signatures, gas-displacement recordings, ground-surface changes from synthetic-aperture radar and lidar (which measures distance using lasers) and others. Accelerometers were set up in multiple locations around the explosions, along with temperature sensors and electromagnetic sensors.

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SPE SETUP — Researchers prepare for a source physics experiment at the Nevada National Security Site. The NNSA-sponsored experiments were conducted at the site by Sandia, Los Alamos and Lawrence Livermore national laboratories, as well as other laboratories and research organizations. **Photo courtesy of the Nevada National Security Site**

CAREER PATH — Logan Carpenter, left, checks in with CECOR coordinator Tommie Kuykendall during a walk around Sandia's Albuquerque campus. **Photo by Randy Montoya**

From farm to computer lab

Cybersecurity consortium opens doors for intern

By ***Troy Rummler***

Logan Carpenter teases his co-workers when they complain about work. Growing up in rural Madison County, Virginia, he worked on a chicken farm through high school and took up landscaping and painting jobs on the side. Tending poultry, performing menial labor for low wages, and being consumed daily by bugs and southern humidity, Logan decided to go to college.

Now, Logan conducts cybersecurity research at Sandia. Life is good, he tells his colleagues. Work is stimulating, well-paying and indoors.

The link from one job to the other was a pipeline program that connects students at historically black colleges and universities with cybersecurity internships at Sandia and Lawrence Livermore national laboratories.

"There were not any other programs like this, and we spent quite a lot of time meeting with minority-serving institutions and learning what worked well and what did not," said Dimitri Kusnezov, deputy undersecretary for artificial intelligence and technology at DOE, who led the effort to form the Consortium Enabling Cybersecurity Opportunities & Research, or CECOR.

Created in 2015, the consortium has enabled Logan and others at participating institutions to come to Sandia for summer internships, gain work experience and cultivate interests and skills.

"CECOR is a great way for Sandia to bring these stellar and talented students from underrepresented, minority populations to the Labs to create a workforce that approaches challenges with diverse perspectives," said Han Lin, the program's manager at Sandia.

"Interns enter a job market rich with opportunities," said David Martinez, Sandia's recruiting manager. "About 300,000 unfilled cybersecurity jobs exist in the U.S., and there are approximately 2 million opportunities throughout the world."

Some interns find their best option is at Sandia, including Logan.

"Looking over everything I've done," Logan said, "the most pivotal part of my career was CECOR."

From farm to cables

When Logan came to Sandia as a computer science major from Norfolk State University in coastal Virginia, one of the first people he met was program

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LABNEWS Notes

Strategic Priority No. 4

Closing the gaps in threat detection capabilities

By ***Doug Bruder***

Associate Labs Director for Global Security

It's tough to hide a nuclear test.

The array of detection methods used by the U.S. and other countries is designed to capture the flash of light, seismic signal and radioactive isotopes that are characteristic of a nuclear event occurring anywhere in the world. But what if the goal was to detect covert activities in pursuit of a nuclear device before the testing stage? What if the potential proliferant is a rogue actor not yet on the radar?

Sandia's Strategic Priority No. 4, Detect Threats, is aimed directly at this scenario. This priority seeks to marshal and enhance Sandia's capabilities to develop transformational technical solutions that change the playing field for global monitoring and detection to be able to respond to potential threats, whether conventional, nuclear, chemical, biological or cyber. This effort seeks to identify ways that Sandia can detect potential threats not only to the U.S., but also those that could harm our allies.

As threats evolve, so must detection

Existential threats to our national security — those that would cause catastrophic casualties or dramatic changes to our way of life — are evolving, as are the sources of threats. Compared to 30 years ago, the sources of today's threats are more diverse, ranging from threats posed by superpowers to threats posed by rogue states that threaten the U.S. and world peace.

The Detect Threats Strategic Priority is focused on transforming Sandia's detection capabilities from exclusive, exquisite and targeted sensing, to ubiquitous and adaptable systems that sense what we cannot readily see. In other words, we intend to move from the development of specifically designed sensor technologies tailored to a known set of threats and signatures to develop detection capabilities that can be deployed rapidly, used to detect a broader range of threats, and share information to behave as an intelligent network.

To this end, Sandia must continue to lead the nation in developing capabilities to monitor activities related to threats as they occur, whether that is cyber threats, threats to critical infrastructure (such as the energy grid) within the U.S. or threats related to the use of weapons of mass destruction anywhere in the world. Through this priority, Sandia seeks to advance our nation's ability to detect threats before they are actualized.

The science of detection is also evolving. For example, the proliferation of all sorts of sensors (e.g., cameras, satellites, Apple watch data, seismic monitors) presents opportunities and challenges for the future of detection, as does the application of artificial intelligence and machine learning to sensing technology.

Sandia's involvement in NNSA's Low Yield Nuclear Monitoring project is an example of an ongoing research and development efforts to advance detection capabilities, specifically for monitoring low-yield nuclear testing. Funded by NNSA's Office of Defense Nuclear Nonproliferation, LYNM also involves Los Alamos, Lawrence Livermore and Pacific Northwest national laboratories.

Sandia's role focuses on applying big-data analytics to untrusted data sources to obtain actionable information on low-yield events.

Deliverables for FY19-FY20

Strategic Priority No. 4 calls for the following specific actions and deliverables over the next year:

- **Develop a threat detection R&D roadmap for innovative signature-sensor-analysis solutions.** We need to better understand the spectrum of threats (e.g., biological, chemical, radiological), environments (e.g., space, cyber) and detection characteristics such as time of relevance. From there, we will look for potential gaps in threat detection capabilities and how we could be more effective at detecting novel signatures through sensing and analysis.
- **Identify research areas in support of developing and deploying adaptable and reconfigurable sensors and sensor architectures.** The goal of this phase is to leverage the Science and Technology Advancing Resilience for Contested Space mission campaign as well as Intelligence Science Strategic Priority No. 3 (see the July 5 Lab News). We will seek to develop laboratory directed research and development proposals that address identified research needs, including proposals in support of STARCS, which seeks to advance the nation's capabilities for protecting its assets in space from adversary attacks. This phase will focus on identifying research areas to increase autonomy, reconfigurability and real-time responsiveness of sensors and sensor architectures.
- **Identify the requirements for the development of a testbed.** By developing a synthetic environment in which to evaluate sensors, architectures and analysis capabilities, we hope to increase the pace of innovation and lower risk.

Associate Labs Director for Global Security Doug Bruder
Photo by Randy Montoya

Building on the Labs' legacy

In his 1961 State of the Union address, President John F. Kennedy warned that "We must prevent the arms race from spreading to new nations, to new nuclear powers and to the reaches of outer space." Fast forward nearly 60 years and the threats have expanded to include chemical, biological and cyber. A key pillar to preventing proliferation of weapons of mass destruction involves detection. Sandia's involvement in detecting and monitoring atmospheric nuclear weapons tests dates back to the late 1950s. As Sandia seeks to expand the nation's threat detection capabilities, whether from known entities or from as yet unknown rogue actors, we will be building on this legacy and Sandia's deep knowledge base.

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LABNEWS Notes

EDITOR'S NOTE: Lab News welcomes guest columnists who wish to tell their own "Sandia story" or offer their observations on life at the Labs or on science and technology in the news. If you have a column (500-800 words) or an idea to submit, contact Lab News editor Tim Deshler at tadeshl@sandia.gov.

SIMPLIFIED SEARCH — From left, Monica Contreras, Leanne Wortman and Shannon Mulligan pitched an idea to simplify the way employees purchase items through Just in Time suppliers. They hope the new online process, which debuted Aug. 1, will save employees time and benefit more small businesses. **Photo by Randy Montoya**

Time is money

New Just in Time search tool enables quicker, streamlined service from Sandia suppliers

By ***Manette Newbold Fisher***

They had 90 seconds to convince executives that they could improve the Just In Time ordering process and save the Labs money, if they only had funding.

The JIT program enables employees to procure small-value, commercially-available goods and services directly from Sandia suppliers. JIT contracts are selected by a team of subcontract professionals through a competitive process and provide value-added services such as order entry, technical consultation and onsite maintenance and repairs.

Sandia's previous JIT inquiry process involved searching through massive catalogs for items ranging from safety glasses to chemicals, and supply chain buyer Leanne Wortman, subcontract manager Monica Contreras and year-round business intern Shannon Mulligan knew that process could be time-consuming. They also said calling multiple suppliers to find items isn't ideal, but when employees and Sandia buyers do call around, local small businesses often benefit.

So, in a minute and a half, Leanne, Shannon and Monica presented a potential solution that's as easy as filling out a two-question form. Their idea was one of three winners of the third annual internal competition held by Sandia's Fueling Innovations team, a group that aims to fund ideas and increase the capacity of Sandia's business community to solve problems.

"The goal of the tool is aimed to help end users, not just buyers," said subcontract manager James Brimhall, a member of Fueling Innovations. "Anyone responsible for buying needed a quicker way to find suppliers and items without having to do a lot of research."

The pitch competition took place last November and the team's idea received funding in January. The new tool debuted Aug. 1, after months of work and testing.

Sandia employees purchasing items can find the JIT inquiry tool on the JIT homepage under "What Can I Buy?" Users select an item category, add requirements and a description and then submit the query.

Suppliers are notified automatically by email, and they can respond directly to let customers know if they have the requested item under contract. If not, a quote can be provided.

While the tool does not replace any ordering processes, it helps end users find items faster than before. "This tool is supposed to help anybody who's looking for a commercial off-the-shelf item to determine if it's available through a JIT supplier," Leanne said.

Simplifying the process is only one benefit. When employees buy through JIT, they also save the Labs money because orders touch fewer hands on their way to customers.

For example, Leanne said, when employees purchase computers through the small, woman-owned HUBZone Sandia supplier rather than the manufacturer, the computers are properly tagged and prepared by the supplier rather than by Sandia employees.

If a computer is purchased through the supplier, "once it's in the system, it's done," Leanne said.

"JIT suppliers are already aware of all of our policies, and their prices have been locked in," Monica said.

Shannon, who works in Sandia's small business program, emphasized the benefit of using JIT to support small businesses.

"Roughly 80% of our JIT suppliers are small businesses," Shannon said. "This year, our small business goal is that 54% of our purchases come from small businesses, so if more people go through JIT, it will help us reach that number."

The team stressed that all Sandia employees can use JIT, and if they do, there could be a significant impact.

"This tool touches a lot of areas: the technical line, the small business program and JIT suppliers," Monica said. "A lot of areas are involved and impacted."

Fueling Innovations

Eleven teams participated in last year's Fueling Innovations internal competition. Six finalists presented ideas to executives, and three winning teams were funded. The two other winning proposals included an improvement to the Labs' Oracle contractor cost management invoice query, a tool that is heavily used by those managing contractor costs, and a project to incorporate machine learning in expense report tracking. The next competition will take place in October this year. Teams have already begun submitted their ideas to Fueling Innovations.

Getting ready for Family Day

By ***Stephanie Holinka***

The community involvement team is finalizing plans for numerous fun and educational activities that will be offered during Family Day events at Sandia's Albuquerque and Livermore campuses in September.

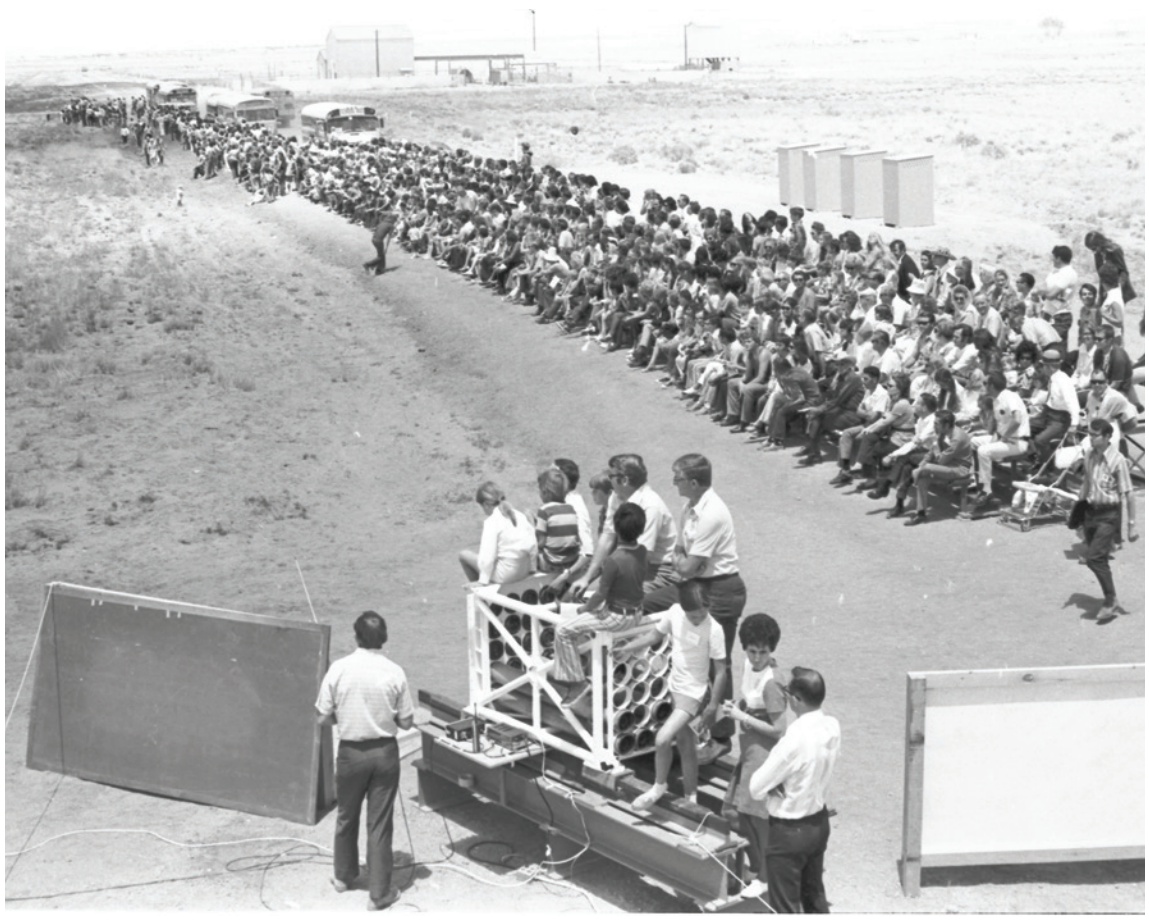
Some of the featured activities include a virtual reality experience; Lego airplane building; a Wheatstone bridge electrical circuit demonstration; tours of the Solar Tower, Trisonic and Hypersonic Wind Tunnels and Shock Tube Facility and much more.

Sandia's Family Day is Saturday, Sept. 7, in New Mexico, and Saturday, Sept. 14, in California. Employees can register and find event details and a complete list of security requirements on the internal Family Day website. The registration deadline is Friday, Aug. 30.

Maps and information about the available activities for both the New Mexico and California events will be printed in the Aug. 30 issue of Lab News.

Interested in Volunteering?

Employees are needed as Family Day volunteers for information booths and other logistics. Register on Sandia's internal Volunteer for Family Day webpage.



BIG IMPACT — During the 1972 Family Day event, a large crowd of visitors gathered to watch a demonstration of Sandia's Rocket Sled Track, which is used to test impact, aerodynamics, acceleration and other factors influencing rocket performance. **Photo courtesy of Lab News archives**

Project on Nuclear Issues conference held at Sandia

What is PONI?

PONI was created in 2003 as a networking program to bring together junior and senior nuclear weapons professionals from the Nuclear Security Enterprise. Its annual conferences include networking events, new idea forums and deep dives into current nuclear policy, strategy and actions.

Three of the conferences (summer, fall, winter) are held at national laboratories, military institutions, or the Center for Strategic & International Studies headquarters in Washington, D.C. The Capstone Conference, held each spring at the United States Strategic Command in Omaha, Nebraska, highlights top presenters from the three previous conferences.

This conference series is an opportunity for emerging experts to learn about policy or technical aspects of the NSE, to develop and present new ideas and to engage with other nuclear issues professionals. These discussions include far-reaching implications of nuclear policy and discussions on nuclear weapons infrastructure, operations and strategy.

PONI is one of 53 Center for Strategic & International Studies research programs and one of the Center's four educational objectives, which include:

- The Nuclear Scholars Initiative, which aims to develop recent graduate students and young professionals related to nuclear issue decision making.
- The Mid-Career Cadre, to provide mid-career professionals with education and developmental opportunities.
- The Next Generation Nuclear Network, geared to provide guest authors with an online forum to publish their analyses.
- The PONI quarterly conference series.

As of January 2019, 18 Sandians have participated in the Nuclear Scholars Initiative and five have participated in the Mid-Career Cadre program. Those who are interested in learning more about the PONI conferences can contact Darrla Giersch or visit the PONI conference website.

PONI PARTICIPANTS — Sandia's Albuquerque campus hosted this year's Project on Nuclear Issues summer conference.

By ***Whitney Lacy***
Photos by ***Rebecca Gustaf***

The Project on Nuclear Issues conducted one of its four annual conferences at Sandia's Center for Global Security and Cooperation on July 9-10. Sandia Deputy Labs Director Dori Ellis opened the conference with remarks on Sandia's history, and Associate Labs Director for National Security Programs Mike Burns hosted a lunch. A simulated war game in which teams engaged in a "what if" nuclear war scenario kicked off the second day's events.

The 2019 Summer conference featured rich analyses on a range of prominent issues affecting nuclear weapons strategy, including the impact of long-range missiles and an evaluation of new technologies. Nuclear weapons in space and all their implications were discussed, with topics including space security and how machine learning can affect nuclear command, control and communication.

This year's keynote speaker was Annette Totten, director of the National Counterproliferation Center, which leads the intelligence community and interagencies to prevent the proliferation of weapons of mass destruction, their delivery systems and related technologies and expertise. Previously, Totten served as the deputy director for national intelligence management at the National Counterterrorism Center.

Conference attendees included Ambassador Linton Brooks, former NNSA administrator; Jacquelyn Schneider of the Naval War College; colleagues from other national laboratories, universities, military and federal agencies; and about 60 junior- and senior-level Sandians.

"It was a great opportunity to see so many people from across the National Security Enterprise here at Sandia," Dori said. "PONI provides a remarkable opportunity for critical thinking about nuclear issues for all national security professionals."

The highly anticipated simulated war game started early on day two of the conference, and attendees were assigned various roles, including executive, secretary of defense, secretary of economics, secretary of intelligence and others. Players had to decide how to invest their capabilities or partner with others in order to achieve their objectives.

The simulated war game helped teams understand the impact of cyber operations on international stability while exploring the relationship between new technologies, domestic politics, conventional military capabilities and nuclear threats.

PONI WELCOME — Deputy Labs Director Dori Ellis kicked off the PONI conference on July 9.

Life savers recognized at ceremony

By ***Stephanie Holinka***
Photos by ***Lonnie Anderson***

Safeguards & Security Director John Larson and other Sandia leaders honored 50 Sandians at the Life Saver Recognition Ceremony in July. Honorees included Pro Force officers, emergency management dispatchers, medical responders and others who contributed in some way to a lifesaving effort at Sandia over the past seven years.

John described the issue as "near and dear to my heart," recounting a story of his own experience with a heart attack in his 30s.

In all the emergency incidents described by Communications Director Frederick Bermudez, teams worked together to administer cardiopulmonary resuscitation and automated external defibrillator intervention, directed aid to individuals in distress and facilitated prompt evacuation to local hospitals.

Sandia is the first organization in the complex that has equipped all Protective Force vehicles with AEDs. Most buildings at Sandia are also outfitted with an AED device.

All Sandia Protective Force officers have been trained in basic first aid, CPR and AED use.

Sandia employees can learn more about lifesaving courses available through Employee Health Services, and can download a list of AED locations throughout the Labs in New Mexico.

TOKENS OF APPRECIATION — Life Saver Recognition Ceremony awardees received challenge coins and pins in appreciation of their efforts.

LIFE SAVERS HONORED — During the Life Saver Recognition Ceremony at Sandia in July, 50 Protective Force officers, emergency management dispatchers, medical responders and other employees were honored for contributing to lifesaving efforts at Sandia over the past seven years.

PROTECTIVE FORCE — Members of Sandia's Protective Force attended the Life Saver Recognition Ceremony to honor those who have helped during life saving events at Sandia over the past seven years.

SMASH HIT — Sandia engineers June Stanley, left, and Chris Grosso demonstrate how the drop tower they built abuses batteries to understand how the lithium-ion cells respond to different types of stress. **Photo by Randy Montoya**

Sandia abuses batteries for better energy storage

Researchers create 'ninth way of killing a battery'

By ***Michael J. Baker***

They crush 'em. They pierce 'em.

They roast 'em, soak 'em in saltwater and short circuit 'em.

They overcharge and even over-discharge 'em. Heck, they can even shoot them with lasers.

Those poor batteries never really stand a chance against Sandia researchers whose job is to test the cells beyond their limits.

And now, with a new indoor tower that allows battery-abuse researchers to drop 200 pounds or more on the outmatched lithium-ion cells, they've created yet another way to learn even more about how batteries respond to stress.

"This becomes our ninth way of killing a battery," said Sandia battery-abuse testing engineer Chris Grosso. "It hits with so much force that so far, we are just chopping the batteries in half."

Lithium-ion batteries are most commonly found in electric cars, computers, medical equipment and aircraft. And they are getting more powerful all the time. The constant push for more storage and power drives the need for tests such as those offered by the new drop tower, said Sandia mechanical engineer June Stanley.

"As far as we know, nobody in the U.S. has done any drop tests for impact testing like this," June said. The data collected will aid industry in developing safer, more reliable batteries with more efficient performance. It will also help in responding to emergencies such as electric-vehicle crashes, she said.

"An impact test like this is more real world, more realistic to what would happen," she said. "The test can give us a better understanding for first responders and how they handle an emergency. It can also be beneficial for industry researching and developing new technology."

The drop tower looms inside a hangar-type building that easily can be vented and cleared if there's smoke from a battery fire. Researchers control the tower remotely and watch the action on monitors inside a trailer parked about 30 yards away.

What they see is the drop tower reaching upward to just below the 14-foot ceiling. A battery sits in a steel tray bolted to a load cell to measure the impact force at the base of the tower as a weight of at least 200 pounds is perched above, at heights up to 8 feet, 8 inches.

The push of a button unleashes the weight. Gravity takes over, followed by a violent collision of weight onto battery. Wires connected to the battery and the tower measure speed, force, temperature and voltage. Cameras record the impact and resulting carnage. Data flashes to computers in the trailer.

So far, the team has tested single-cell lithium-ion batteries and a 12-pack of such batteries taped together. While the tests have not produced the sparks and heat that would occur in a slower-moving hydraulic crush test, they have generated useful data, June said.

In the aftermath of the drop, the batteries are unstable and the safety status of about half the cells is unknown, she said. "It certainly helps with a better understanding for first responders to handle a situation like that."

Testing leads to improvement

The maximum weight that can be used to smash, crush or chop a battery is 500 pounds because of the components chosen, Chris said. "That can easily be upgraded, if needed, and we can keep adding weight to get more force."

Welded tube steel and off-the-shelf rails and bearings make the drop tower cheap to maintain, even if less than elegant to look at, said Chris, who designed the tower's electronics and operating software.

"When the inevitable fire comes, parts can be replaced cheaply," he said. "It doesn't have to be pretty, but it does have to be effective, and we have to be able to justify the cost to our customers."

June joined Chris about 2½ years ago and improved the mechanical design, safety and engineering controls to move the tower from idea to reality. June, who spearheaded the manufacture and installation of the drop tower, said the team plans to improve the contraption as more tests are performed and customers ask for different types of tests.

"This is just the base design," she said. "We have hopes and plans to improve on it."

Future improvements will include adding springs or gas-pressurized pistons to boost the downward acceleration of the weight, increasing the impact force.

"To get more impact force, we can increase the mass or the acceleration of the object impacting the battery, or both," June said. "Right now, we are accelerating at the rate of gravity. Our goal is to have a much higher rate of acceleration, thus more force."

Other plans will develop as industry continues to push the envelope on the power that batteries can produce and store. And as those batteries work their way into more everyday devices, Sandia researchers will continue to get better at abusing them.

It's that itch to push batteries past their limits that will ultimately push development. The more data available, the better developers can design the next generation of energy storage devices with improved performance, reliability and safety.

"As an added capability to what we are already doing, the drop tower is very cool," Chris said. "Our customers have been asking for something like this, and it just shows that we have got some serious brain power in our lab."

DOE expo highlights small-business services

NNSA administrator and deputy labs director deliver remarks

By ***Michael J. Baker***
Photos by ***Lonnie Anderson***

The Department of Energy hosted its Summer '19 New Mexico Small Business Expo in Albuquerque Aug. 6-7, featuring Sandia and other DOE contractors.

"Sandia is committed to our relationships with small businesses," Deputy Labs Director Dori Ellis said during her remarks opening the event. "The small businesses in this state have been at the heart of generating jobs, making sure that the economy is healthy and providing a workforce that we couldn't get any other way."

The event was DOE's second such event this year, the first in the summer and one of the largest, with 500 people registered, representing hundreds of small businesses. During her opening remarks, Dori took the opportunity to thank those small businesses and urge them to continue to seek ways to work with Sandia.

"We believe it will support our project goals, positively affect the local and regional communities and provide a foundation for growth," she said. "Sandia is dedicated to strengthening national and regional economies by providing contracting opportunities for small businesses."

NNSA Administrator and DOE Undersecretary for Nuclear Security Lisa E. Gordon-Hagerty delivered the first-day's keynote address, emphasizing that small businesses play a vital role in national security efforts.

"We recognize that small business contractors and subcontractors deliver great value to our taxpayers — and we're all taxpayers — and we look to small businesses as important innovators," Gordon-Hagerty said.

With emerging threats and the most complex global security environment since the Cold War, DOE national labs are critical to keeping America safe, she said.

"I can say with certainty that small businesses play a vital role in this national security mission," Gordon-Hagerty said. "Small businesses play a crucial role in that effort and continue to play a vital role in our national security enterprise so that we can keep defending the American people."

During the expo, small-business experts from Sandia, Los Alamos National Laboratory, DOE offices and other programs held breakout sessions to discuss opportunities for small businesses. Other speakers during the expo included Albuquerque Mayor Tim Keller on the first day and U.S. Sen. Martin Heinrich, U.S. Rep. Deb Haaland and New Mexico Gov. Michelle Lujan Grisham on day two.

SMALL BUSINESS BOOST — NNSA Administrator and DOE Undersecretary for Nuclear Security Lisa E. Gordon-Hagerty, left, talks with Sandia Deputy Labs Director Dori Ellis at DOE's Summer '19 New Mexico Small Business Expo.

VITAL TO SECURITY — During her keynote address, Gordon-Hagerty spoke of small businesses as vital to the national security mission.

CECOR

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coordinator Tommie Kuykendall, who told him to drink lots of water and wear sunscreen.

Every CECOR intern at Sandia gets to know Tommie. She's on the selection committee when they apply and becomes their primary contact once they arrive. Like many New Mexico natives, she bubbles with advice about living in the Southwest. "A lot of these students have never been away from home, or at least not this far from home," Tommie said. "So I try to be there if they need me. I do give them a little advice when they first get here."

Behind the scenes, she's a traffic controller at the intersection of students, labs and universities. She networks with professors and swaps information with her counterparts at Lawrence Livermore National Laboratory. At Sandia, she connects students with the right people and projects for their interests.

"I've always felt that reaching back into communities is important because that's going to get kids real experience," Tommie said.

Logan agrees. "Being that most of the projects are team-oriented, you get the opportunity to learn from other interns and really experience how it is to work with others to solve problems," he said.

Over his summer internship, Logan helped update a cybersecurity training simulation designed at Sandia called TracerFIRE (Forensic Incident Response Exercise). One of his jobs was to hack into their simulated network to identify weaknesses. He also built equipment that linked with the network to act as a kind of visual score board, automatically adding water to containers when users completed tasks.

Within a few weeks, Tommie was impressed. Logan had a habit of strolling down the halls of his building when he had a question, knocking on doors until he found someone with the answer. His personality, she thought, would thrive at Sandia, and she started introducing him to managers. "We need people who are willing to take a chance," Tommie said.

When cybersecurity becomes national security

Demand for cybersecurity specialists has grown rapidly at Sandia, in part because computer networks are becoming closely tied into physical security and public safety, Logan said.

For example, industrial control systems are devices used to monitor and regulate equipment. If a boiler in a factory gets dangerously hot, an industrial control system recognizes that and shuts it down automatically. Control systems also facilitate communication between airports and airplanes, and regulate electricity flowing to hospitals and emergency services. Security in these systems is paramount because, while facilities might have backup systems, failure could have immediate, potentially life-threatening consequences.

Increasingly, these systems are being connected to the internet. But securing them against web-based threats is challenging because their software is often custom-designed for niche tasks, rather than mass-produced. Custom controls require custom testing, which can take up to a year to develop and execute.

Logan and his research team are studying whether they can design a universal platform to emulate virtually any control system with a desktop computer, which could shave months off finding and patching vulnerabilities.

To help address pressing national security demands, Sandia formed a task force in 2018 that ensures every cybersecurity or computer science resume it receives that meets minimum requirements is reviewed by Sandia professionals. As a team, the task force circulates resumes among hiring managers to find jobs for as many qualified applicants as possible.

About CECOR

The Consortium Enabling Cybersecurity Opportunities & Research was created as one piece of a DOE initiative to create educational opportunities in technical areas for minority youths, said Dimitri Kusnezov, deputy undersecretary for artificial intelligence and technology at DOE.

"The cyber program was one of the important legs of this effort that aligned with the administration's priorities in cyber and DOE's needs," Kusnezov said.

The resulting organization lets students attend affordable schools close to home while benefitting from the resources of a national network of colleges, universities and DOE's labs and sites.

The consortium also aims to improve cybersecurity education in minority-serving institutions. Participating faculty engage in collaborative research with DOE and get increased access to its facilities. This, Kusnezov said, will hopefully increase the number of students who graduate with science, technology, engineering and math degrees relevant to DOE needs.

MEASURING SUCCESS — Logan Carpenter, far left, designed hardware for cybersecurity training software with fellow Sandia interns in 2016. Plastic tubes filled with water as software users completed tasks, showing the relative scores of different teams.
Photo courtesy of Sandia National Laboratories

Building digital bridges across New Mexico

Sandia's K-12 computer donation program reaches 80 schools in 12 counties

By ***Luke Frank***
Photos by ***Rebecca Gustaf***

True to form, Sandia is connecting people with information and ideas from around the world. This time, it's New Mexico students ages 5-18 in classrooms from high schools in Silver City to elementary schools in Albuquerque's North Valley, and several points in between.

This year, Sandia's K-12 computer donation program saw more than 1,250 computers and other IT accoutrements quickly loaded into compact cars, flatbed trailers and full-size delivery trucks. Chris Martinez, lead technologist for Socorro Independent School District, loaded 10 desktop computers, 10 laptops and 20 monitors into his vehicle for the quick trip back. "This is so important to our students," Martinez said. "It's vital in helping stage all of our learning for them."

The program, created by Sandia's community involvement, property management and reapplication departments in 2003 following an executive order from President Bill Clinton, has donated more than 17,250 computers across the state. The executive order "streamlines the transfer of surplus federal computer equipment to the nation's classrooms to help ensure that American children have the skills they need to succeed in the information-intensive 21st Century."

Because computer technology evolves so quickly, Sandia's workforce is encouraged to regularly acquire new computers to meet Labs-wide performance standards. When new computers and components are ordered, the old equipment is sent to Sandia's property management and reapplication department. The outdated computers are wiped, and the computers and other components are stored for the yearly donation event.

As the school year approaches, Sandia communicates with New Mexico school districts about their needs and puts together pallets of equipment for schools to pick up. "They just have to make it out here," Joey Giron, Sandia's logistics operations manager, said. "We'll help load them up and get them on their way.

"Sandia considers the K-12 program essential to the community," Joey said. "These computers are 4-6 years old and have plenty of good use left in them, so we're placing them in classrooms in need. This is another way can we support generations of New Mexicans in developing essential computer and life skills, and ultimately being competitive in a dynamic workforce."

2019 donations

CPUs	900+
iPads/laptops	250+
Monitors	170
Printers	100
Keyboards	400
Mice	150
Power cords	100

BRIDGE BUILDERS — A representative from the Socorro school district loads computers and equipment onto a trailer. Sandia's K-12 computer donation program distributed more than 1,250 computers and equipment to 80 schools in 12 New Mexico counties.

CLASS ACT — From left, Elizabeth Chavez, Vincent Moya and Semiramis Novak help pack donated laptops for K-12 school representatives to take back to their districts.

Three Sandia teams win NA-50 Awards of Excellence

By ***Stephanie Holinka***
Photos by ***Lonnie Anderson***

Jim McConnell, associate administrator for NNSA's Office of Safety, Infrastructure and Operations, presented three Sandia project teams with NA-50 Awards of Excellence during a July ceremony at Sandia's Albuquerque campus.

B1012 Battery Test Facility

The B1012 Battery Test Facility team was recognized for its efforts in the building of Sandia's new Battery Test Facility, which was completed two months ahead of its construction schedule and came in under budget with no lost time or recordable safety incidents. The facility will be used to test unique power sources.

The team, led by Paul Schlavin, included Carol Watson, Chuck Cormier, Malia Orell, Rod May, Chris Orendorff, Dana Richter, Abby Hoffman and Marvin Roybal.

Tactical Team for Intern Space

Sandia's real estate team was recognized for partnering with several organizations to develop and implement short-term "tactical leases" designed for minimal investment with varied and streamlined operating procedures to ensure all work is performed safely and securely.

"This strategy has proven effective to help manage the Labs population surge during the summer months, so uncleared intern populations and their mentors can set up work schedules that balance the interns' onsite and offsite engagement effectively," said team member Jack Mizner.

The team, led by Candle Martinez, also included Janelle Abreu, Joe Aragon, Joshua Johnson and Joan Yourick.

NASA KRUSTY Criticality Experiment Team support

Nuclear engineer Gary Harms was recognized for helping test NASA's KRUSTY (Kilowatt Reactor Using Stirling TechnologY) project, a prototype fission reactor coupled to a Stirling engine.

B1012 WINNERS — The B1012 Battery Test Facility team posed with Associate Administrator for NNSA's Office of Safety, Infrastructure and Operations Jim McConnell, third from right, and Sandia Deputy Labs Director Dori Ellis, third from left, following the NA-50 Awards of Excellence ceremony.

TACTICAL TEAM WINNERS — The tactical team for intern space posed with Associate Administrator for NNSA's Office of Safety, Infrastructure and Operations Jim McConnell, second from right, and Sandia Deputy Labs Director Dori Ellis, left, following the NA-50 Awards of Excellence ceremony.

Coming home

FORGING A PATH — Dori Ellis has been named Sandia's new deputy labs director, a role she said is the culmination of a career that started at the Labs 40 years ago. "People follow their own paths, and mine has been more than I dreamed of," she said. "I could not be happier that the road brought me back to Sandia." **Photo by Rebecca Gustaf**

Dori Ellis named Deputy Labs Director

By ***Nancy Salem***

Not so long ago, Dori Ellis' distinguished career at Sandia seemed over. Then new adventures came her way — and brought her back.

Dori Ellis' dad was an old-school guy who believed deep in his soul that women should stay home and be wives and mothers. Dori tried, marrying in her teens and having two children, but college beckoned. Not just college, engineering.

"He'd look at me and say, 'Tell me again why you want to be a mechanic?'" Dori recalls. "He just couldn't understand it."

A single mom at 21, Dori pressed on and built a career that took her from the University of Wyoming to leadership positions at Sandia Labs, Lawrence Livermore National Laboratory, the University of California, and back to Sandia, where she recently was named Deputy Laboratories Director.

Small-town girl

Dori grew up in Edgerton, a town of 253 people in central Wyoming. Her dad graduated from high school at age 12 and became the owner of an oil recovery business. Her mom graduated at 15 and raised eight kids: six girls and two boys. Dori was the sixth daughter.

There were 30 in her high school class. Dori was good at science and math and graduated at 16. "I got married and had a couple of kids," she said. "When I found myself a single mom, I decided to go to college."

An older sister who married young, had children and went back to school inspired and gave Dori the strength to enroll in architectural engineering. She was working her way through school, and the program demanded unusually long hours that made it hard to raise her toddlers. The mechanical engineering department offered a scholarship so she switched, becoming the department's only woman.

"It was an excellent move," she said. "It turned out the classes I was enjoying the most were in mechanical engineering."

Dori met Tom Lane, a Sandia senior manager who made a recruiting trip to the University of Wyoming. He told her about the One Year On Campus program, which would allow Sandia to hire her with a bachelor's degree then send her back to school for a master's. Dori transferred to the University of New Mexico to complete her undergraduate degree then entered the program, returning to UNM for a master's in mechanical engineering. She came back to Sandia as a staff member in 1979.

A fast rise to the top

Dori quickly became a manager, one of just seven technical women at Sandia in that position. There were about 50 women total on the technical staff. "It was pretty daunting," Dori said. "But growing up in the family I grew up in, you didn't ask whether you fit in or not, you just did it." She managed departments, including environmental testing, experimental mechanics and sensor systems.

In 1992, Dori became director of the Nuclear Waste Management Center, supervising 26 managers and a budget that rose from $50 million to $85 million in three years. "It was one of the bigger programs at the Labs then, with both the Waste Isolation Pilot Plant and Yucca Mountain," she said. "It was a very compelling mission, but also highly visible and a political hot-button issue."

From 1995 to 2010, Dori moved as director to several different areas, including nuclear reactor engineering, transportation surety, national security and arms control, international security and institutional development. She spent part of 2007 as acting vice president of infrastructure operations, and for two years was chief operating officer for defense systems and assessments, which at the time, was doing $850 million a year in work for others, including satellite programs, military systems, information operations and support to the intelligence community.

"I really enjoy startup and cleanup and putting systems in place to make things easier for the people who are executing the programs," she said. "It's less interesting for me if something is static."

Dori spent almost a decade in international programs and loved the work. Sandia at one time had active projects in more than 130 countries. "It was fascinating," she said. "We were working a lot with Russia and the other former Soviet Union countries, protecting materials and weapons. The technology challenges were significant. We wanted to create enough protection for the Russian systems without divulging the physical security technology for our own weapons."

In 2010, then Labs Director Paul Hommert asked Dori to be principal staff director, a position she held until deciding to retire in 2011. After 33 years at Sandia, "it seemed like the right time to go," she said.

What to do next

Dori found she wasn't good at retirement. In 18 months she finished a to-do list she thought would take years. "Then I sat twiddling my thumbs wondering what I would do next," she said.

Dori did consulting work for Lawrence Livermore National Laboratory, and in 2013, joined the lab as associate director in charge of

program development for Strategic Partnership Projects, leaving New Mexico for California.

Two years later, she became executive director of operations at the University of California Office of National Laboratories. "I worked at Lawrence Berkeley, Lawrence Livermore and Los Alamos, getting familiar with their operations," she said.

Dori also began talking to Steve Younger and agreed to be part of the team he was assembling to bid on Sandia's management contract. When the contract was awarded to National Technology and Engineering Solutions of Sandia in late 2016, Dori was named associate labs director for Integrated Security Solutions, based at Sandia's Livermore, California, campus. "It was wonderful coming back, absolutely wonderful," she said. "It felt like coming home."

She says her 33 years as a Sandian helped her when she returned. "Having touched so many places in the Laboratories, I brought a different sense of the things that would make the most impact," she said.

Dori was promoted to deputy labs director, succeeding Dave Douglass in the role on June 28. "This, for me, is the culmination of a long career that has evolved over time," she said. "I could not be happier that the road brought me back to Sandia."

The road ahead

Dori looks forward to the challenges ahead. "What we're trying to do as a leadership team is really important," she said. "I think we can continue on the current pathway and be even better. Operationally, we're ahead of where we were two years ago but still have work to do."

Dori said one of the Labs' biggest issues is staffing. "The staff we want are in high demand, particularly in our critical skills, such as computer science, computer engineering and program management," she said. "I really want to make sure we have a structure in place that is attractive to our young people. Facilities, too, are high on my priority list, along with safety and security and making sure we have the right systems and support for the programs we are executing."

Something that didn't change in Dori's years away from Sandia was the dedication of staff to the Labs' national security mission, she said. "People here have a passion for their work, patriotism and belief in what we do," she said. "The quality of the people is just outstanding."

Dori, who enjoys reading, bike riding and cooking in her spare time, has been married nearly 30 years to retired Sandian Larry Ellis. Together they have five children and eight grandchildren living in Canada, New York, North Carolina and Texas and working in fields ranging from orthopedic surgery to project management. "I could not have done this without Larry's support," Dori said. "He has been such a rock to lean on. He loved his career and loved the technology, but he was good at retirement. He has always been all in as I've made career changes."

While her lifestyle is far different from what her dad envisioned, Dori knows he and her mom would be proud. "People follow their own paths, and mine has been more than I dreamed of," she said. "There's more to do and I'm not ready to retire. Maybe I'll be good at it someday."

LEADING THE WAY — Dori Ellis hit the ground running as deputy labs director and says she's looking forward to the challenges ahead. "What we're trying to do as a leadership team is really important," she said. "I think we can continue on the current pathway and be even better.
Photo by Rebecca Gustaf

DEPUTY HAND-OFF — Dave Douglass handed off the job of deputy labs director to Dori Ellis on one of his last days in the office. Dori, who took over on June 28, says her top priorities are staffing, facilities, safety and security.
Photo by Lonnie Anderson

Retiree Deaths

Donald Grab (age 88)	January 6
Gertrude Martin (96)	January 6
Donald Strall (82)	January 7
Harold Gough (90)	January 8
Jewel Wheelis (89)	January 10
Francis Graham (93)	January 10
Neal Alvin Branson (94)	January 10
Leonard Flesner (96)	January 11
Stanley Edmund (72)	January 12
William Roady (81)	January 13
Stephen Stronach (70)	January 14
David Zagar (77)	January 16
Kenneth Miller (83)	January 17
R. Sue Henderson (86)	January 18
Thomas Bergstresser (80)	January 21
Richard Chavez (82)	January 21
Jon Meeks (79)	January 23
Rita Martinez (70)	January 23
Rodney Nissen (81)	January 25
Vernon Marsh (87)	January 29
Seyfred Toledo (64)	January 30
Michael Eaton (62)	February 2
Arba Smith (78)	February 7
Gloria Starzynski (97)	February 9
Dennis Johnson (75)	February 10
Timothy Harrington (68)	February 12
Larry Grube (73)	February 14
Jimmie Lee Akins (70)	February 14
Stephen Zdunek (96)	February 15
Polly Scardino (80)	February 16
Betty Turk (85)	February 16
Billie Palmer (86)	February 18
Robert Padilla (72)	February 18
Robert Franssen (66)	February 19
Betty Sherred (91)	February 23
James Murray (93)	February 24
Samuel Mcalees (90)	February 24
Christopher Arana (80)	February 26
Elizabeth Parker (67)	February 26
Richard Sparks (76)	February 28
Charles Dusing (67)	March 1
John Justus (91)	March 3
Roger Chavez (68)	March 3
Robert Schwing (82)	March 5
Arthur Andazola (78)	March 7
Lawrence Skenandore (81)	March 7
John Middleton (85)	March 10
Frank Ross (88)	March 14
Paul Beauchamp (72)	March 15
Roy Diesing (88)	March 16
Roy Hanson (87)	March 18
Jimmy Thompson (85)	March 18
R. Glen Kepler (90)	March 23
Herman Armijo (93)	March 23
Arsenio Montoya (92)	March 26
Edna Baca (97)	March 27
Albino Garcia (77)	March 28
Robert Strout (91)	March 31
Gary Scrivner (77)	March 31
Arthur Hassig (93)	April 2
George Kaye (78)	April 5
Robert Knapp (82)	April 6
David Sample (85)	April 10
William Busby (93)	April 11
Doris Jackson (94)	April 12
Andy Railey (97)	April 18
Frank Padilla (73)	April 19
Arthur McCarthy (84)	April 20
Donald Clarin (87)	April 22
Carl Zickert (96)	April 26
Victor Gabaldon (68)	April 27
James Schirber (88)	April 8
Sandra Ferrario (72)	May 2
Judy Rader (64)	May 5
Patricia Self (89)	May 9
Olin Bray (76)	May 22
Mary Campbell (98)	May 23
Carmelo Rindone (99)	May 24
Orval Talley (92)	May 24
Alfred Foster (95)	May 26
John Weinlein (80)	May 26
Glenn Norris (89)	May 30
L. Eugene Voelker (75)	May 30
Farrell Brumley (92)	May 31
John Mena (85)	June 2
Barton Brooks (61)	June 3
Gerald Wilson (85)	June 17
Thomas Downey (74)	June 17
Keith Marlow (90)	July 1
L. Marvin Guier (91)	July 3

Money for life

Financial Wellness Month offers Sandians fiscal strategies for achieving goals

BENEFIT BREAKDOWN — Sandia benefits analyst Leslie Jaramillo presents during the July 9 Financial Wellness Fair in the Steve Schiff auditorium. **Photo by Matthew Fensterer**

By ***Myles Copeland***

Ever watch a presentation and feel like the speaker is talking directly to you?

Accounts payable financial administrator Michele Duran experienced that feeling while watching "Women: Demand More from Your Money and Health," a webinar hosted by the CBS Early Show's Gayle King and viewed by a crowd of more than 150 Sandians in Albuquerque's Steve Schiff auditorium, July 18.

"I have five kids and I'm always focused on doing things for them," Michele said, adding that the webinar's message about women often deferring their own physical and financial health to care for others resonated with her. "I've put off saving as much as I could for retirement to pay for their college."

While watching the presentation, she said, "I had this epiphany. This lit a fire for me to pay off debt and save more for retirement."

The webinar watch party was among 25 events offered during July across the Albuquerque and Livermore campuses as part of Sandia's Financial Wellness Month.

"Our hope is that the financial wellness events will help our employees focus on their financial goals, make informed decisions and plans, and gain the confidence to stick with their plans for long-term financial wellness," said senior manager Leah Mitchell, whose retirement investment management team collaborated with Sandia's Total Rewards organization to orchestrate the month's events.

"Debt management, saving, home buying, preparing for retirement — these are important to different people at different points in life," said Mary Romero Hart, Total Rewards senior manager. "Sandians are diverse, and we want to be sure we're offering information and support that's relevant in their life today."

Attendees at the July 9 Financial Wellness Fair in Albuquerque reflected a range of financial priorities.

"I basically know nothing — I signed up for the 401(k), but I wasn't confident," said newly-hired project controller Tiantian Trimble, who used the fair to connect with Sandia's investment advice and management service providers. "I already talked to Financial Engines and I'm going to set up a consultation."

Several years ago, systems engineer Nitin Shah started where Tiantian is now. "I've been saving for retirement since my first paycheck, and for specific goals like purchasing a home and my kids' education, and then trying to be mindful of tax reduction strategies year-round," said Nitin, adding that he is focused on conveying sound financial wellness practices to his adult children. "If you start early, time is in your favor. I'm feeling comfortable as I look forward to retirement at some point."

Employees can view select Financial Wellness Month videos from Sandia's internal financial wellness website.

SOUND ADVICE — Prudential's Adam Gemus, right, talks with Sandian Josh Maxwell during the July 9 Financial Wellness Fair in the Steve Schiff auditorium lobby. **Photo by Zane Brown**

FINANCIAL WELLNESS

SANDIA CLASSIFIED ADS

AD SUBMISSION GUIDELINES

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

Questions to Michelle Fleming at 505-844-4902.

Submit by one of the following methods:

- **EMAIL:** Michelle Fleming (classads@sandia.gov)
- **FAX:** 505-844-0645
- **MAIL:** MS1468 (Dept. 3651)
- **INTERNAL WEB:** Click on the News Tab at the top of the Techweb homepage. At the bottom of the NewsCenter page, click the **"Submit a Classified Ad"** button and complete the form.

Due to space constraints, ads will be printed on a first-come, first-served basis.

MISCELLANEOUS

YOUNG AT HEART CHICKEN & WAFFLE DINNER, Nazarene Church on Paseo, Aug. 16, 6 p.m., $12. Martin, 505-281-7227.

ROOM AIR CONDITIONER, portable, good condition, $25; compound mitre saw, Hitachi C10 FCG, 10-in. blade, $75; Thule SideKick roof box, $100 OBO. Haass, h3haass@gmail.com.

ELECTRIC SMOKER, Masterbuilt, like new, $90. Moreno, 505-238-0494.

MOTORCYCLE HELMETS, HJC, w/receive/transmit capability, $30 ea.; Tourmaster jackets, 1 new, 1 worn once, $145 ea. Wells, 505-292-0179.

POTTED SPIDER PLANTS, 2, large, must pick up, $35 ea. Blickem, 505-323-6832.

DRYER, Amana, 2018, excellent condition; Frigidaire washer, good condition, works well, $300/both. Drebing, 505-235-4144, ask for Janis.

TRUCK BOX, rugged, black, locking, for tools & more, fits Nissan XE truck or small-size pickup, $125 OBO. Bristol, 505-400-3421.

GAS DRYER, Maytag, model MGD6000XW, steam cycle, 27-in., $150. Sutherland, 505-345-1183.

HANSELMANN POTTERY DISHES, tan wheat art, 157-pcs., plates, vases, serving, glass, bowls, etc., 1980s, $1,500. O'Grady, 720-587-9857.

CAT WASHROOM NIGHT STAND, $40. Hussong, 505-280-4307.

TIRES, Michelin Primacy XC, 275/65 R18, w/TPMS, installed on machined wheels, like new, <350 miles, $1,100. Richardson, 505-331-9882.

NM UNITED TICKET, soccer game, Sandia night, Aug. 17, sec. 103, row G, seat 2, $14. Mishalanie, 917-697-0419.

MOTORIZED GOLF CARTS, 3, Kangaroo Caddy, Hillcrest, $50-$250; remote control, accessories & parts. Bear, 505-881-7128.

VINTAGE ELECTRIC GUITAR, '71-'72, Gibson ES335TD, w/case, $2,850 OBO. Baca, 505-792-1941.

'29 ATWATER KENT TABLE MODEL RADIO, Pathe floor model phonograph, 78-rpm records. Johnson, 505-263-2210.

DESK UNIT, 8-pc., $950; dining set, 7-pc., w/ leaf, $225; both Ashley Furniture, cherry wood, photos available. Holmes, 505-328-8154.

BAR-HEIGHT TABLE, Pinnadel, w/4 chairback stools, $350; Koze model 100 pellet stove, $250. Baca, 505-916-4400.

TRANSPORTATION

'03 FORD TAURUS, V6, beige, like new, interior & exterior excellent condition, 62K miles, $4,500 OBO. Morgan, 505-452-6137.

'96 BMW Z3 ROADSTER, 1.9L, 5-spd. manual, convertible, leather, only 34K miles, garaged, excellent condition, $8,900 OBO. Yourick, 505-259-8005.

'13 CADILLAC CTS, luxury coupe, candy apple red, 46K miles, excellent condition, across from Auto Hobby Shop car sales, now $18,750. Baca-Asplund, 505-304-3242.

FORD RANGER, 1 owner, 63,636 miles, $5,000 OBO. Benson, 505-250-9716.

'14 MAZDA CX5 TOURING, red, 101.5K miles, great condition, well taken care of, $10,000. Sapp, 505-221-1199 or sapp.aw@gmail.com.

'13 NISSAN SENTRA, AT, PW, keyless entry, 104K miles, great student car, runs/looks great. $5,500. Martinez, 505-515-9440, ask for Dani Rae.

'08 FORD RANGER, long bed, 4-cyl., AT, red, 112K miles, great condition, $6,700 OBO. Romero, 505-307-9389, send text.

RECREATION

'04 BMW F650 MOTORCYCLE, excellent condition, road ready, new tires & rear shock, 30K miles, clean title, $2,600. Garcia, 505-504-0058.

'05 DUCATI MULTISTRADA MTS1000DS, red, factory hard bags, heated grips, hand guards, risers, 14K miles, low mile tires, $2,000. Strasburg, 505-459-2891.

'12 STARCRAFT TRAVEL STAR 229TB, used Ultralite triple hybrid travel, hard to find, 3 queen beds, $13,500 OBO. Ruiz, 505-280-7077.

'13 FOREST RIVER V-CROSS VIBE 6804, 19-ft. travel trailer, light, w/slide out bunks, great for small trucks/SUVs, $10,000. White, 505-238-2437.

'14 SKYLINE NOMAD CAMPER, toy hauler, 16-ft. box fits ATV, see CL# 6934034049 for details, parked at KAFB RV sale lot. Plummer, 505-301-3457.

'05 FLEETWOOD TIOGA SL, new roof, new tires, excellent condition, 31K miles, $28,000 OBO. Tafoya, 505-264-7510, ask for Tim.

MOUNTAIN BIKES, East Mountains: men's Mongoose GRH MGX 6.5; women's MOTIV M Smoothie, $75 ea. Willmas, djwillmas@gmail.com.

'05 TRAIL LIE 8263S TRAVEL TRAILER, 1 slide, satellite TV, 2K PSW inverter, 4 6V battery bank, new tires, queen bed, ducted AC/heat, great condition, $11,000. Kercheval, 505-266-5833.

REAL ESTATE

3-BDR. TOWNHOME, 2-1/2 baths, 2-car garage, 1,584-sq. ft., built in 2007, great location (schools, library, gym, entertainment), $210,000. Keliiaa, 505-363-5461.

3-BDR. HOME, 2 baths, 1,750-sq. ft., updated, desirable Willow Wood, 5 mins. to KAFB & Sandia, FSBO, $259,000. Sanchez, 505-228-4200.

WANTED

ROOMMATE, 2-bdr., 2 baths, recently remodeled, North Valley, gated driveway, large yard, pets OK, furnished living room & kitchen. Fetterolf, 505-608-4338.

APARTMENT/CONDO, needed in Orlando, FL area. de la Fe, 505-377-7224.

SHARE-A-RIDE

LOOKING FOR OTHERS W/NEED, form rideshare/carpool to transport student to and from Hope Christian near Paseo/Louisiana. Rivers, 505-720-4701.

Mileposts

New Mexico photos by Michelle Fleming

California photos by Randy Wong

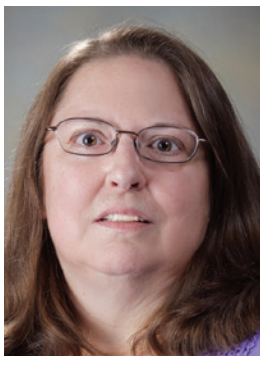

Douglas Hodge 35


Greg Sjaardema 35


Chris Hogg 30


Deanna Jaramillo 30


Tom Tarman 30


Brenda Townsend 30


Tim Wiseley 30


Cathy Sleeter 25

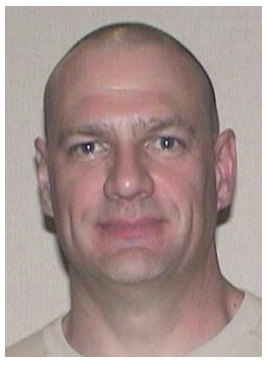

Lee Marshall 20


Tamara Rodriguez 20


Beverly Rudys 20


Alicia Aragon 15


Marcia Cooper 15


Shane Schumacher 15


Julie Thai 15


David Urrea 15


Anna Williams 15

Source physics

CONTINUED FROM PAGE 1

"The data is designed to eventually be freely available to anybody, so that any other researcher from any country can use the data to understand these events," Rob said.

The project is also serving as a training ground for the next generation of nonproliferation scientists and engineers, with student interns from 14 universities and colleges coming to Sandia to work with the data, he said.

The key to differentiating subsurface events

Satellites essentially eliminate the possibility of surface nuclear testing going unnoticed anywhere in the world, but underground testing is more difficult to detect and characterize, due to limited access and visible characteristics, as well as difficulty discriminating nuclear explosions from other types of seismic events, said Zack Cashion, Sandia's chief engineer for Phase 2 of the project.

When scientists study earthquakes, they look at compressional waves (primary or P-waves) and shear waves (secondary or S-waves). Rob said explosions typically produce more P-waves relative to S-waves when compared to earthquakes.


DAG-4 — Sandia researchers, from left, Zack Cashion, Rob Abbott, Danny Bowman, Mark Timms and Austin Holland, stand on an 8-foot diameter hole filled with gravel, sand, cement and explosives prior to the fourth underground explosion in dry alluvium geology conducted this summer.
Photo courtesy of Sandia National Laboratories

Prior to SPE, scientists noticed that some foreign underground nuclear tests looked more earthquake-like when compared to previous nuclear explosions around the world, which indicated more experimental knowledge was needed to improve modeling and the ability to track global testing, Rob said.

"The only way to understand that better, in our opinion, was to do actual physical experiments," Rob said. "We couldn't just simply have new modeling codes without something to test those new modeling codes against."

In both SPE phases, one hole was used to hold multiple explosive devices of different yields. In Phase 2, the hole was 8 feet in diameter and originally 1,263 feet deep. For the first Phase 2 experiment that took place last summer, an explosive canister containing about 1 metric ton TNT equivalent of nitromethane was lowered into the hole and covered with a careful design of gravel, sand and cement. Consecutive experiments used the same hole. Explosives in the amounts of 50 metric tons, 1 metric ton and 10 metric tons of TNT equivalence were lowered where the gravel and sand left off from the previous experiment.

Zack led the design of the instrumentation and borehole accelerometers that captured data for the second phase of the experiments. Twelve instrumentation boreholes were drilled on 120-degree azimuths on four radial rings that were 33, 66, 131 and 262 feet from the test hole. The instrumentation holes were filled with 58 instrumentation modules, each containing a set of accelerometers, magnetometers, gyroscopes and temperature sensors.

The goal for every experiment was to gather high-quality data from as many sensors as possible. On test days, when everyone was in place, Zack said the mood became intense.

"It is time to execute on plans that have been discussed for months or years, that required monumental group effort and coordination to implement, and it all comes down to one moment," Zack said. "You're sitting there watching your screen and it's 'Three, two, one, fire,' and then you might not feel anything.

"Depending on the system, you might not even see anything change on your screen until after the duration of recording is complete," he said. "You're waiting there for, it might be four seconds, but it feels like an eternity, and then you go look at the data and wipe your brow that the event occurred as planned and that it was indeed recorded."

Determining explosion depth, size

Sandia scientist Danny Bowman measured SPE sound waves using ground and airborne microphones. He said when events take place underground and make the ground surface move, the earth acts as a giant speaker and can transmit sound.

"We know earthquakes do this," Danny said. "In this test series, we tried to understand how this takes place; how we can use the properties of sound to determine how big the explosion was and how deep it was."

Most infrasound data was gathered from ground sensors set up for the experiments, and Danny said there were some surprises throughout SPE. When tests took place in granite, the scientists learned they could use sound to determine the size and depth of the explosion, he said, but other geologic formations provided no predictive power. And even though explosions were larger in Phase 2, they didn't always provide infrasound.

"Our task in the next couple years, once all the data is collected and we have a chance to analyze it, is to take this exceptional dataset and derive some predictive power from it," Danny said. "I believe that's possible, but we're in the trenches right now. We don't have the bird's eye view of it."

The work has been fulfilling, said Rob, who worked on SPE since the beginning of Phase 1. Zack agreed, saying the results came from a large, collective team effort.

"I remember being a kid and watching space-launch movies and wanting to be one of those people in the room looking at a screen and caring about your little detail of this huge project and wanting to see that it worked," Zack said. "It really is an experience like that. When it's game time, everybody wants to win. We're all there together as a team and everyone wants to see it go well."

Operation Backpack

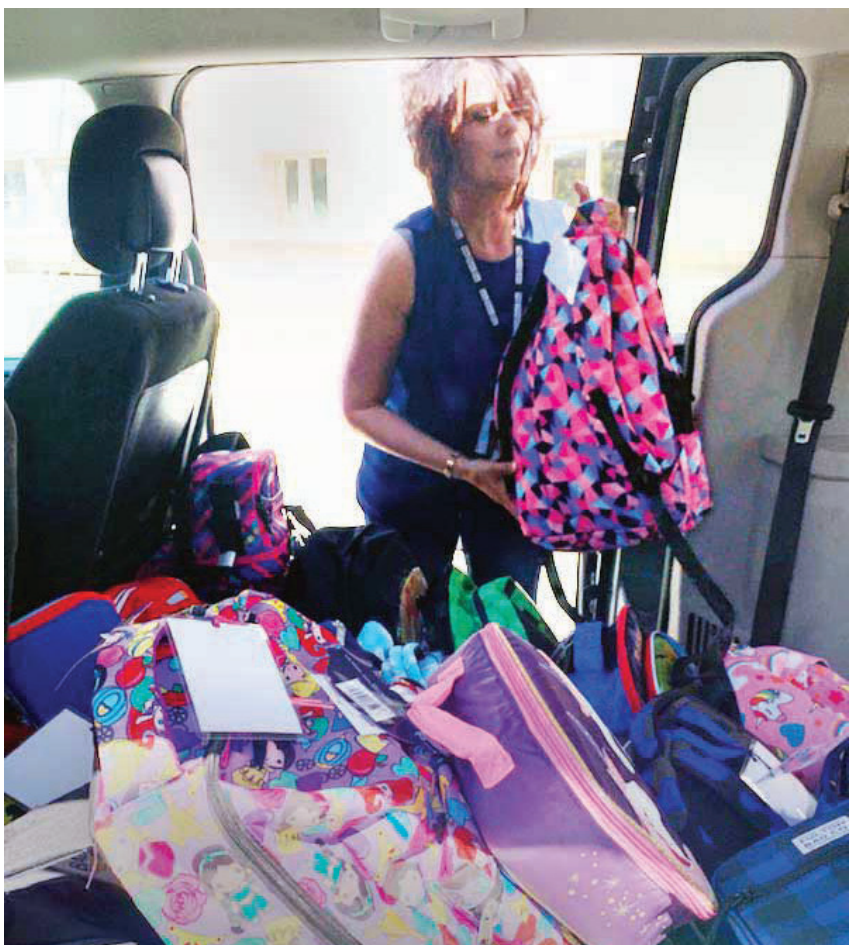
PACK TO SCHOOL — New Mexico employees show off some of the backpacks donated during this year's Operation Backpack event. **Photo by Randy Montoya**

By ***Luke Frank***

Thanks to the generous donations of Sandia employees, 240 backpacks were donated this year to the children of military families at Kirtland Air Force Base. Operation Backpack was launched at Sandia's California campus several years ago for the greater Bay Area military bases and has enjoyed robust participation since. This year, the community involvement team along with Sandia's military support committees brought the campaign to Albuquerque to benefit KAFB families.

SANDIA DELIVERS — From left, Kayla Norris, Rachel Sowell and Adina Eliassian prepare school packs donated by Sandia/California employees. On the right, Rachel Sowell loads backpacks into a van to deliver to the children of Bay Area military families during Operation Backpack. **Photos by Michael Langley**

LEADER OF THE PACK — Sandia/California employees donated numerous backpacks to support Bay Area military families during this year's Operation Backpack event. **Photo by Rachel Sowell**



OPERATION SUCCESS — Adina Eliassian volunteered for Operation Backpack in California, helping to deliver 55 backpacks on Aug. 8. **Photo by Michael Langley**