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Investigating stockpile stewardship applications for world's largest computer chip

COMPUTING PARTNERS — A worker at Cerebras Systems holds the world's largest computer wafer, to be used as part of the collaboration between Cerebras and three national labs. The partnership will accelerate future advanced simulation and computing applications in support of the national nuclear stockpile. **Photo courtesy of Cerebras Systems**

By **Neal Singer**

Sandia and its partners at Los Alamos and Lawrence Livermore national labs have announced a project to investigate the application of Cerebras Systems Inc.'s Wafer-Scale Engine technology. The immediate target is to accelerate advanced simulation and computing applications in support of the nation's stockpile stewardship mission.

NNSA's Advanced Simulation and Computing program is sponsoring the work, and the three national labs will collaborate with Cerebras Systems on the project.

"The ultimate goal of NNSA's advanced memory technology research and development program is to develop technologies for use in future computing system procurements," ASC program director Thuc Hoang said. "We are funding research in technologies that have the potential to deliver 40 times the application performance of our forthcoming NNSA exascale systems."

The Cerebras Wafer-Scale Engine, currently the largest computer chip in the world, was built specifically for artificial intelligence and machine learning work, said Andrew Feldman, founder and CEO of Cerebras Systems. "The engine contains 2.6

— CONTINUED ON PAGE 7

Photovoltaics researchers release five-year, early-life module degradation study

By **Kelly Sullivan**

A team led by photovoltaics researchers at Sandia has completed a five-year degradation study of 834 fielded photovoltaic modules, representing 13 types of modules from seven manufacturers in three climates. Their objective was to quantify degradation rates of recent, widely used photovoltaic technologies and release results publicly to inform relevant stakeholders and best practices.

The team's Progress in Photovoltaics article gives the results of their study

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IN IT FOR THE LONG HAUL — Photovoltaic modules for long-term evaluation installed at Sandia's Photovoltaic Systems Evaluation Laboratory in Albuquerque. **Photo by Craig Fritz**

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Lab News may contain photos shot prior to current COVID-19 policies. Individuals in photos followed all social distancing and masking guidelines that were in place when photos were taken.

EDITOR'S NOTE: Please send your comments and suggestions for stories or for improving the paper. If you have a column (500-800 words) or an idea to submit, contact Lab News editor Katherine Beherec at kgbeher@sandia.gov.

Great Minds in STEM salutes Sandian

Frank DelRio honored for outstanding technical achievement

PIT MANEUVERS — Sandia mechanical engineer Frank DelRio works on a nano-indenter to investigate the chemo-mechanical weakening of layered phyllosilicate muscovite mica in liquid environments.

Photo by Lonnie Anderson

By **Luke Frank**

Sandia mechanical engineer Frank DelRio likes to think small — microscopically small. His groundbreaking work in nanomechanics and nanotribology has earned him a trip to Pasadena, California, for the 2022 Hispanic Engineer National Achievement Awards Conference, HENAAC, where he will be honored for his technical achievements.

"Through nanomechanics, we look at how things deform, how they fracture, how they fatigue and respond to a mechanical stimulus," Frank said. "Through nanotribology, we're moving two surfaces relative to one another, trying to understand why we see the frictions that we see and developing lubrications schemes to mitigate those effects." He is an engineer of numerous technical achievements in assuring material and component reliability in products ranging from satellites in space to cellphones in the palms of our hands.

The prodigal son

Frank said that math and science pulled at him from an early age. "I've always enjoyed solving problems, building things and fixing things," he said. "My mom says that as early as she can remember, I tinkered with things, trying to figure out how they work. I was constantly trying to make them better."

This innate curiosity landed Frank in a magnet high school focused on science, technology, engineering and math. "I was lucky enough to be in the right place at the right time," he said. "I just kind of fell into it. By the end of high school, I had already made my way through the first two or three years of typical college math. Science was the same way."

Frank spent the next eight years chasing a doctorate in mechanical engineering. While in graduate school at the University of Colorado, Boulder, he learned of a Sandia Labs Microsystems Engineering Science and Applications, or MESA, fellowship. He applied, was accepted and spent more than two years working with Sandia scientists on his graduate school research.

With his doctorate in hand, Frank joined the National Institute of Standards and Technology in 2007 developing and refining standardized units of measurement at every level, from global communication networks to advanced nanomaterials and computer chips. He was enjoying his work at NIST, where he had become a project leader and group leader, when he learned of an opening at Sandia that aligned with his interests and skills. "I had relationships at Sandia from my days as an intern and even contributed to joint projects with the Labs working at NIST," Frank said. He returned to Sandia in 2020 as a member of the research and development technical staff in the materials science department.

The experimentalist

Frank spends much of his time conducting nanomechanics and nanotribology tests with his two good friends, a nano-indenter and an atomic-force microscope. "I call myself an experimentalist," he said, "focused on nanomechanics and nanotribology, basically poking at things at very small scales and analyzing the response to those mechanical stimuli, then extracting fundamental properties of the materials that I'm looking at.

"I've also been working at the DOE's Center for Integrated Nanotechnologies as an affiliate scientist," Frank said. "Much of my work at Sandia is in electronics, but now I'm working with nano applications in renewable energy and biomedical and health, and it really stretches my skills and interests," he said. Through the Center for Integrated Nanotechnologies, Frank

Frank DelRio's Notable Probes

Reliability of silicon thin films for electronics applications focused on the reliability of silicon films for next-generation microelectromechanical systems. Frank led the development of micromachined test specimens and contributed to the development of high-throughput "slack-chain" test specimens, facilitating thousands of fracture tests in record time.

Advent of additively manufactured metals for aerospace applications developed new methodologies to assess the small-scale mechanical and corrosion properties of additively manufactured metal components and used those capabilities to discover original materials and improve existing materials in high-temperature and corrosive environments for aerospace applications.

Development of additively manufactured polymers for regenerative medicine focused on examining properties of photopolymerized and other polymeric materials. The project facilitated a new measurement technique called sample-coupled-resonance photorheology to detect and remedy flaws that threaten the safety and reliability of additively manufactured products.

Stability of perovskite photovoltaic thin films for renewable energy focused on the stability of perovskite thin films in next-generation solar cells using coupled small-scale film characterization methods and full-scale device characterization methods.

Discovery of bioengineering strategies to control the self-organization of stem cells focused on the development of bioengineering strategies to extrinsically control the self-organization process of intestinal stem cells.

Advent of new protective and solid-lubricant coating layers for nanotechnology focused on the reliability of protective and solid-lubricant coating layers in nanoscale devices and electrical contacts via innovative small-scale tests to develop a mechanistic understanding of the failure modes.

Reliability of self-assembled monolayers in nanoelectromechanical systems focused on the reliability of self-assembled monolayers and other two-dimensional polymers using vacuum-based and liquid-cell atomic force microscopy, synchrotron-based structure measurements and strong industrial partnerships.

Development of small-scale mechanical microscopy methods for forensics applications focused on the development of broadly applicable, quantitative, traceable methods for applications of atomic force microscopy in forensics applications. This research demonstrated the effectiveness of atomic-force microscopy as a tool for forensic science via a case study on four types of evidence: trace evidence, questioned documents, impression and pattern evidence, and explosive materials.

Detection of adhesion and friction mechanisms in microelectromechanical systems focused on the roles of forces in the adhesion and friction of microelectromechanical systems, which identified a new and technologically important regime for thin-film adhesion.

works with experts at the top of their game from across the country. "It's an amazing integration of nanoscience talent," he said, "and a really neat way to apply the techniques we're developing to areas that we might not otherwise."

Frank's work might seem lofty, but it has applications in everyday life. "Our work has improved the reliability of everything from satellites to smart phones and televisions," he said.

HENAAC's special meaning

Frank is the recipient of scores of national awards, but this one is different. "This HENAAC award is really special," he said. "I'm dedicating this honor to my dad. He really taught me and my sister the value of working long, hard days and going after what you want. That came from his roots, his early days in Cuba and his Hispanic heritage and family."

He says HENAAC provides an important sense of community that brings people together and shows younger Hispanic students and professionals in STEM that it's possible to go to graduate school and become a professor, work at a national lab or be an industry leader. "Everybody has their own challenges and obstacles in life, and groups like HENAAC provide a community of support that creates opportunities for others," he said.

Great Minds in STEM is dedicated to keeping America technologically strong by promoting science, technology, engineering and math careers, especially in underserved communities. More than 60 companies, government agencies, academic institutions and uniformed services collectively nominated hundreds of outstanding HENAAC candidates this year. Award winners represent Hispanic contributions at the highest levels of academia, government, military and corporate America.

SCIENCE FRICTION — Sandia mechanical engineer Frank DelRio works on an atomic-force microscope to characterize the growth kinetics of amorphous carbon tribofilms on platinum-gold nanocrystalline alloys.

Photo by Lonnie Anderson

Answering the call

Sandians support national security mission

In support of the Nuclear Deterrence Modernization Efforts Rally Cry, Lab News continues to highlight employees and the ways that they contribute to Sandia's national security mission. Read more profiles from previous editions.

Michael Simmons

Hardware and software cybersecurity engineer
1.5 years at Sandia

After more than 30 years in the private sector, Michael joined Sandia in April 2021. He works remotely from California along-side his wife, Tuyet, who has been with Sandia for nine years.

Michael's work focuses on ensuring integrated circuits are protected from cybersecurity threats. Field programmable gate arrays are an important class of integrated circuits. He provides value to nuclear deterrence by helping transition government and commercial tools to aid the program's assurance efforts as they rely more on microelectronic devices. Comprehensive independent functional test is a notable example.

Photo by Craig Fritz

Michael's work leading the introduction of the test aims to provide hardware cybersecurity assurance for field programmable gate arrays across Sandia. He has collaborated with several product teams to pilot the test tool and is seeing tangible nuclear deterrence assurance benefits. The tool has the potential to make Sandia's supply chain much more secure, and Michael welcomes more opportunities for further collaboration across the Labs.

"Many groups across Sandia work to ensure field programmable gate arrays are safe to use. My work is one part of these efforts and is showing great potential," Michael said. "I embrace the opportunity at Sandia to perform meaningful and interesting hardware and software cybersecurity work serving my country, particularly with nuclear deterrence efforts."

— Andrea Mackay

Don Ward

W87-1 modeling and simulation integration co-lead
12.5 years at Sandia

As a postdoc, Don developed interatomic potentials for understanding defects in radiation detectors and solar cells. Today, he works with partners in qualification, weapon systems, analysis and testing to make sure modeling and simulation is being used to the best of its capabilities in shock physics, aerosciences, thermodynamics, solid mechanics, structural dynamics, radiation transport, electromagnetics and electrical modeling.

Photo by Randy Wong

Don also supports other systems, such as the W80-4 and W87-0, to assess radiation environments, especially hostile and fratricide environments.

"I help determine what environments are realistic potential environments for our systems to experience during a lifetime of their mission," he said, "and inform testing towards qualification to those environments using mod-sim."

Don said the biggest contribution is work with the U.S. Air Force to update environment definitions. "Through a very strategic, planned series of discussions, we convinced the Air Force that it was very important to change the requirements for the W87-1, to update from something that had been in place 40 years. It was a huge team effort in collaboration with LLNL, and I really feel like we're doing critical work here that has significant impact."

— J.C. Ross

Ray Byrne

Manager of Power Electronics and Energy Conversion System Department
33 years at Sandia

Ray and his team contribute to national security by assuring the electric grid is resilient against natural and manmade attacks. His program work focuses on developing power electronics to improve the safety, performance and cost of energy storage systems as well as developing next-generation power electronics to enable reconfigurable microgrids.

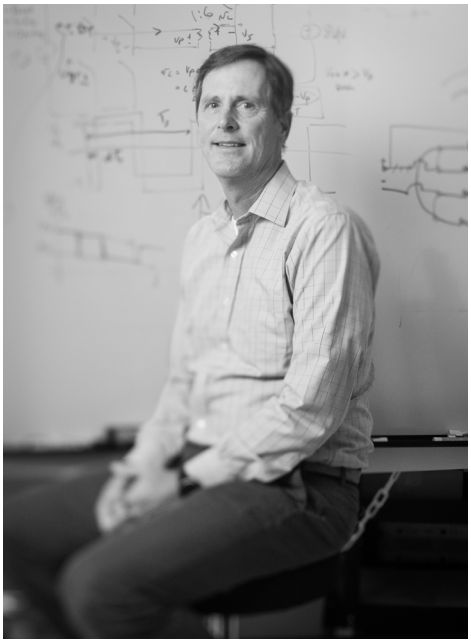


Photo by Craig Fritz

Energy storage is a fundamental component of any resilience solution and critical to integrating renewables as we decarbonize, Ray said. "Since the electric grid is the foundation of modern society, and often identified as one of the greatest engineering achievements of the last century, our work provides a significant contribution to national and economic security."

— Sarah Johnson

Jamey Christy

Electrical engineer
12 years at Sandia

When Congress and the president make stockpile decisions, the underlying data must be good — and it all starts with Sandia's testers, devices programmed to evaluate nuclear weapon components and systems to verify safety, security and reliability.

Photo by Craig Fritz

"The tester is the tool. The end product is the data," said Jamey, who has been designing testers for his entire Sandia career. His work touches numerous weapon and delivery systems, which keeps the work interesting and the impact clear.

Surveillance lab testing often utilizes centrifuges, which recreate a nuclear weapon's flight path, but also complicate data collection.

"We're trying to collect the best quality data while spinning really fast and applying real-world conditions like vibration, vacuum and temperature," Jamey said. Lab tests complement flight tests by enabling the same hardware to be tested multiple times across controlled, extreme conditions.

All this testing is part of the Integrated Stockpile Evaluation program and the annual assessment process. Jamey interacts with the Weapons Evaluation Test Laboratory team in Amarillo, Texas, who help design, operate and maintain the testers, and surveillance engineers who analyze and evaluate the data.

"Everything we do supports collecting the most accurate and valuable data possible," he said.

— Mary-Ellin Brooks

Joe Ronevich

Materials scientist
10 years at Sandia

Joe started at Sandia as a postdoc in the Hydrogen Effects on Materials Laboratory and quickly realized that Sandia was a place he wanted to stay. His research has focused on understanding materials compatibility with gaseous hydrogen.

Joe can address challenging materials compatibility research questions for national security but also questions related to storing and distributing hydrogen for clean energy. His work provides the technical basis for codes and standards used by industry in ensuring the structural integrity of hydrogen infrastructure. All of this inspires significant collaboration.

Photo by Randy Wong

"Collaboration is key, and at Sandia we are in a great position to collaborate both with other national labs but also with the international community who share a common interest in understanding hydrogen effects on materials," he said. "The continual interactions we have with collaborators ensure constant evolution of our knowledge so that we can characterize and address the challenges of hydrogen embrittlement."

— Mattie Hensley

Worlds largest computer chip

CONTINUED FROM PAGE 1

trillion transistors, 850,000 artificial intelligence cores and powers the Cerebras CS-2, the industry's fastest artificial intelligence computer," he said.

Simon Hammond, federal program manager for NNSA's Advanced Simulation and Computing's Computational Systems and Software Environments program, said, "This collaboration with Cerebras Systems has great potential to impact future mission applications by enabling artificial intelligence and machine-learning techniques, which are an emerging component of our production simulation workloads."

The new contract is part of NNSA's post-Exascale Computing Initiative investment portfolio, which has the objective of sustaining the technology research and development momentum, and strong engagement with industry that the initiative had started via its PathForward program. It aims to foster a more robust domestic high-performance computing ecosystem by increasing U.S. industry competitiveness in next-generation high-performance computing technologies.

"We anticipate technologies developed as part of the program will be tested on the Advanced Simulation and Computing program's advanced architecture prototype systems and will eventually affect the production of advanced and commodity technology platforms used by the three labs," said Robert Hoekstra, senior manager of the extreme scale computing group at Sandia.

Feldman said his company is proud to have been selected for the work.

"Cerebras is excited to collaborate with the pioneering researchers and scientists at Sandia, Lawrence Livermore and Los Alamos national laboratories," he said. "Cerebras exists to enable researchers and scientists to push the boundaries of current knowledge, helping them solve problems that are intractable on existing computer infrastructure, as well as vastly accelerate cutting-edge simulation workloads. Our multiyear partnership with the Advanced Simulation and Computing program will expand the boundaries of the application of artificial intelligence and high-performance computing to physics across a range of important applications."

James H. Laros III, Sandia project lead and distinguished member of technical staff, said he is looking forward to the collaboration. "The technology holds great potential for impacting how we accomplish our mission in the future."

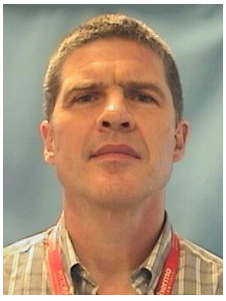
Mileposts

Kevin Zavadil 35

Scott Mitchell 30

Luis Mendoza 20

Troy Skousen 20



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Photovoltaics research

CONTINUED FROM PAGE 1

and represents years of work at Sandia's Photovoltaic Systems Evaluation Laboratory and partnering labs at the National Renewable Energy Laboratory and the University of Central Florida.

"The PV market is continuously changing, and there is a lack of long-term field data for these newer technologies, which raises the question whether durability has been affected or not," team lead Marios Theristis said. "Purchasing PV modules directly from the open market allows us to conduct an unbiased analysis and inform the public in an onymous manner by also releasing the data. Partnership with NREL and UCF was imperative for such a study because it enabled us to install identical systems in different climates and characterize them following a well-controlled and harmonized measurement plan."

According to the researchers, the cost of photovoltaic modules has declined sharply (by up to 85% according to one recent NREL report) in the last decade, thanks to economies of scale, the use of new, higher efficiency cell designs, automation of production lines, larger modules and changes to the bill of materials, like thinner glass and frames, new encapsulants and backsheets, and more.

However, those cost-saving changes to module designs and materials could affect module durability and reliability, and the levelized cost of electricity is sensitive to the power degradation rate. As power degradation increases, the levelized cost of electricity rises and system lifetime falls.

The scientists measured the performance degradation of the fielded photovoltaic modules in New Mexico, Colorado and Florida. They measured performance under standard test conditions at the start of the study, examined initial power stabilization and periodically retested the modules over the following five years to monitor degradation rates over time.

They found that degradation rates are highly nonlinear over time, and seasonal variations were present in some module types. Mean and median degradation rate values of -0.6% per year were consistent with rates measured for older modules. Of the 23 systems studied, the study found that six had degradation rates that would exceed the warranty limits in the future, whereas 13 systems demonstrated the potential of achieving lifetimes beyond 30 years, assuming degradation rate trends have stabilized.

"This is an encouraging outcome. With the increasing installations of photovoltaics, consumers and other stakeholders will be interested to learn that PV durability appears to be consistent in the face of rapid technology improvements and cost reductions," Marios said. "However, it is also concerning that 26% of the systems might exceed the warranty limits. Opportunities still exist to reduce degradation rates to levels that enable even longer PV module lifetimes. For example, for 35- and 50-year lifetimes, PV modules should operate at degradation rate values greater than -0.55% per year and -0.4% per year, respectively."

The scientists also raised important points for discussion. How the degradation rate is defined, whether relative to specifications or initial post-stabilization rating, can influence the resulting rate. This resulting rate may have significant influence on purchase costs, warranty and insurance claims or feasibility studies for project financing.

Marios said consumers and stakeholders interested in learning more about the modules tested will soon be able to view all flash test data collected at Sandia, the National Renewable Energy Laboratory and the University of Central Florida's Florida Solar Energy Center at DuraMAT DataHUB.

"This study is a great example of how the national laboratories are working together with universities to answer critical questions about the durability of solar energy technologies," said Sandia senior scientist Joshua Stein. "Few institutions are able to sustain long-duration experiments involving such a large number of modules."

"We continue to deploy new technologies as they become available in the market," Marios said. "Therefore, we will continue to report on all PV lifetime stages, and we will also leverage the field measurements, along with imaging data, to give attributes to what drives degradation and why."

Making history in wind studies

Sandia's Scaled Wind Farm Technology facility reopens for business

By **Kelly Sullivan**

The Scaled Wind Farm Technology facility, known as SWiFT, is the first DOE Wind Energy Technologies Office user facility in the U.S. to offer multiple wind turbines to measure turbine performance in a wind farm environment. It serves as Sandia's premier testing lab for innovative wind turbine rotor designs.

The facility was briefly closed but has reopened with two heavily instrumented meteorological towers and three research-modified Vestas V27 wind turbines. Research performed using smaller wind turbines, like the Vestas V27 turbines, can be directly scaled to much larger turbines, greatly reducing the cost and time needed to setup and conduct experiments. These turbines have been modified and configured to represent the physics relevant to utility-scale machines but are small enough to be cost efficient.

"The SWiFT facility is a center of excellence within the DOE's portfolio of renewable energy research complexes," said Timothy Riley, project lead for the SWiFT facility. "This team has much to be proud of, as they have positioned the SWiFT facility to be a sustainable and impactful choice for partnering with others for advancements in wind turbine blade research and turbine controls, as well as meeting the future needs of renewable energy integration."

Changing the landscape

Sandia proposed the concept of a scaled facility to the DOE in 2011 as a cost-saving solution to wind turbine research. Located at the Reese Technology Center in Lubbock, Texas, SWiFT has evolved into a facility where researchers study the dynamics of turbine-to-turbine interactions and wake dynamics, as well as innovative rotor blade designs. In addition to supporting DOE's Wind Energy Technologies Office, SWiFT partners with private- and public-sector organizations such as universities, industry and other national laboratories.

SPIN DOCTORS — An engineer tests rotor blade instrumentation at the National Rotor Testbed in a Lubbock, Texas. **Photo by Tim Riley**

Research activities at SWiFT include improving the physical understanding of wake effects; validating high-performance-computing models; reducing wind plant underperformance and operations; reducing operation and maintenance costs from wind turbine interactions and loads; increasing energy capture and reducing imbalance loading and decreasing wake losses with advanced rotor designs. The SWiFT team also leads in blade design and future innovation by advancing knowledge of aerodynamic, aeroelastic and aeroacoustics phenomena and simulation.

"Our dedicated team of researchers, engineers, technologists and environmental health and safety colleagues are driving future innovation by improving our knowledge of wind turbines and providing a safe, public, open-source research testbed to support the broader wind energy community," Tim said.

Where the wind blows

Over the years, the SWiFT facility's staff and partners have grown a sustainable and robust safety culture. They have built strong relationships with teams of experts in many fields and have focused on identifying and mitigating potential hazards.

Current partner organizations include Texas Tech University's National Wind Institute and Group NIRE. Created as a field demonstration site in 2010 by Texas Tech, Group NIRE is dedicated to solving the challenges of integrating renewable energy sources and emerging energy-efficient technologies with the electric grid.

The groups are working together to integrate the SWiFT facility with Texas Tech's Global Laboratory for Energy Asset Management and Manufacturing. This move will advance collaborative research in the areas of microgrid and distributed energy, as well as in cyber simulations of microgrid and distributed energy sources.

SWiFT personnel are also working with Texas Tech avian researchers and South Plains College wind turbine technician interns to fully engage Lubbock-area academic institutions. The Sandia wind energy program is exploring how to best use the SWiFT facility's location at the Reese Technology Center, the more than 19 acres and the assembly and test building

subleased from Texas Tech. Activities at the combined property will support the current and future needs of the Wind Energy Technology Office and other DOE research areas, such as possibly using renewable energy for hydrogen generation.

"The team is already looking ahead to potential new areas of research and experimentation at the SWiFT site in Lubbock," Tim said. "Turbine A1 is operating the National Rotor Testbed project, and Turbine A2 is being readied to support the project's wake interference testing. The SWiFT project team is also working with investigators to prepare for the Additive Manufactured System Integrated Tip project using the B1 Turbine in the next fiscal year. Additionally, once the interconnect between SWiFT and the Global Laboratory for Energy Asset Management and Manufacturing is functionally tested, there are already projects in development that can very quickly be initiated at the site. These projects will lead to greater use of SWiFT beyond scaled rotor and wake research."

WINDS OF CHANGE — Texas Tech University wind turbine technician Miguel Hernandez operates NRT Turbine A1 from the control building. The turbine can be viewed from his window.

Photo by Tim Riley

HELP US HELP THE COMMUNITY THIS SEASON

COLLECTION BINS LOCATED AT

BLDG. 825, SSA (SOUTH PARKING LOT) 7 – 9 A.M.

BLDG. 800 7 – 9 A.M.

VARIOUS SANDIA LABORATORY FEDERAL CREDIT UNION LOCATIONS IN ALBUQUERQUE, EDGEWOOD, LOS LUNAS & RIO RANCHO 11 A.M. – 1 P.M.

CHECK THE COMMUNITY INVOLVEMENT WEBSITE FOR CREDIT UNION DROP OFF LOCATIONS

Turkeys will go to Roadrunner Food Bank, Rio Grande Food Project, East Mountain Food Pantry, Bethel Storehouse and St. Felix Pantry.

GO DIGITAL IN LIEU OF A TURKEY, YOU CAN MAKE A FINANCIAL CONTRIBUTION TO ROADRUNNER FOOD BANK HERE

QUESTIONS TO KATRINA WAGNER

Solve for X Day draws staff from many sites

By **Katrina Wagner**

On Oct. 15, more than 200 volunteers from multiple Sandia sites participated in Solve for X Day. Employees volunteered with their family and friends to help in the communities where they live and lend a hand to nonprofits that provide a variety of services and resources.

Sandia's Creative Services team organized one of the more colorful projects on Solve for X Day. They planned and painted three community murals near the playground at Saranam, a nonprofit that assists families experiencing homelessness in New Mexico by providing housing, food, education and job training.

"Everyone was incredibly creative, helpful and thoughtful in all they did. As I walked through the playground area today, it felt so much more welcoming and encouraging. I know it will make such a difference for our families as they come together to play," Saranam Community Engagement Coordinator Sunny Holmes said.

Other volunteer groups harvested, sorted and prepared food, repaired bikes, created blankets at home and built benches and a ramp.

Solve for X Day was an opportunity for employees to work in the community in support of the annual Sandia Gives campaign.

COLORFUL COMMUNITY SPACE — From left, Creative Services designers Stephanie Blackwell and Stacey Reynolds and photographer Lonnie Anderson stand next to one of the three murals they designed the concepts for and led Sandia volunteers in painting at Saranam, a nonprofit that assists families experiencing homelessness in New Mexico. **Photo courtesy of Saranam**

ENGAGING COMMUNITY — Communications specialist Meagan Brace paints a square on a community mural at Saranam. The mural depicts a patchwork-like grid, and volunteers were encouraged to design a patch in their own style. **Photo by Katrina Wagner**

KID-FRIENDLY ART — Sandia volunteers paint designs on each square of the grid. Children were invited to participate in the process and contribute their own creations. **Photo by Katrina Wagner**

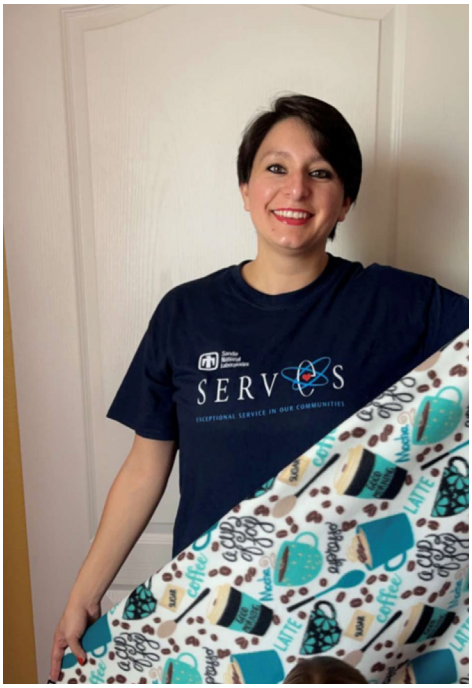
BEAUTY IN THE DETAILS — Technologist Casey Gauderon paints fine details on a phoenix she created for the community mural at Saranam. "This was a community building opportunity that added beauty to our city," Casey said. **Photo by Katrina Wagner**

PACK THE PANTRY — Weekends and summer breaks are difficult for students that depend on school for meals. Employees in Carlsbad, New Mexico, from left, engineer Ryan Jackson, technologist Kristen Lason, engineer Michael Feng, manager Steve Wagner, quality assurance specialist Jennifer Long, engineer Amelia Hayes, business management professional Andrew Wittmayer, technologist Joseph Perez and engineer Paul Docherty collect donations for Packs for Hunger, which feeds 300 children every weekend. The team delivered the food and stocked pantry shelves to help people in the community. **Photo by Eva Cruz**

FRESH COAT OF PAINT — Members of the Sandia Pride Alliance Network, from left, computer scientist Nick Leathe, mathematician Josh Clifford, cybersecurity researcher Jon Robinson, mechanical engineer Jennifer Brett and technologist Alex Hickman refresh the halls of the Transgender Resource Center of New Mexico with a coat of paint. The agency supports transgender, nonbinary and gender nonconforming communities through direct services, education and advocacy and has conducted several awareness trainings at Sandia.
Photo courtesy of the Transgender Resource Center of New Mexico

FALL HARVEST — Postdoc Raquel Weston-Dawkes, left, and community relations specialist Michelle Walker-Wade dig up vine weeds from a crop at Fertile Groundworks in Livermore, California. Volunteers harvested 376 pounds of summer vegetables from the community garden that will be shared with people in the community.
Photo courtesy of Fertile Groundworks

TUNE UP — Associate Labs Director Rita Gonzales repairs a bicycle with Free Bikes for Kidz New Mexico, a nonprofit that collects, cleans and repairs used bicycles before they are donated to children at afterschool programs, public health clinics and tribal organizations. Their goal is to help every child enjoy the feeling and freedom of riding their first bike.
Photo by Amy Tapia



GIVING BACK FROM HOME — Technologist Amelia Reyes displays a blanket she made that will be donated to a homeless family. The most popular Solve for X Day project was the no-sew blankets. Sixty-five employees picked up fabric that was precut and made blankets at home that were returned to Sandia and will be distributed to various nonprofits that serve homeless families. "I chose this project to teach and show my 2-year-old daughter sympathy, empathy and compassion," Amelia said. "There are people out there that are in need of basic necessities. This is my way that together my daughter and I can help others by doing things we love."
Photo courtesy of Amelia Reyes

THREE GENERATIONS OF SERVICE — Quality engineer Christine Salley, her mother Sharon and daughter Maggie volunteer to organize donations at (Re)Build Store with Rebuilding Together Sandoval County, a nonprofit that provides home repairs and help with accessibility to low-income residents in the community. "Sandia is making a big impact to our little community, and I hope everyone realizes how special that is in Sandoval County," Rebuilding Together Sandoval Country Director Bradley Wood said. **Photo by Katrina Wagner**