SANDIA LABNEWS
PUBLISHED SINCE 1949
Vol. 75, No. 16, Aug. 24, 2023

New Emergency Operations Center **Page 4**

The race to build the world's smallest atomic clock, again

TIMEKEEPER — As part of a Defense Advanced Research Projects Agency project, Yuan-Yu Jau is working on an atomic clock at Sandia that will use the element cesium, which has a natural resonance frequency of 9,192,631,770 hertz. **Photo by Craig Fritz**

By **Troy Rummler**

Yuan-Yu Jau is on a quest to build the world's smallest atomic clock, a device that measures time with extreme accuracy. If successful, he and his team at Sandia will have made one smaller than a sugar cube.

But he's not the only one pushing the limits of tiny timepieces.

Last year, the Defense Advanced Research Projects Agency challenged research teams to build smaller, more accurate clocks. Yuan-Yu is leading the Sandia team engaged in this effort.

"They want 1 cubic centimeter for everything, and currently there's no atomic clock with this kind of size," said Yuan-Yu, whose core design is even smaller — about 1 centimeter long and a mere 2 millimeters wide and tall, for a grand total of 0.04 cubic centimeters. DARPA requested the devices to be accurate within one-millionth of a second after one week.

— CONTINUED ON PAGE 6

Making materials more durable through science

Sandia researchers develop molecule that reduces wear and tear

By **Kim Vallez Quintana**

Sandia materials scientist Erica Redline and her team have developed a molecule that helps change the way polymers react to temperature fluctuations, which would make them more durable. This application could be used in everything from plastic phone cases to missiles.

Polymers, which include various forms of plastics, are made up of many smaller molecules, bonded together. This bond makes them especially strong and an ideal product to be used to protect delicate components in a wide variety of items. But with time, use and exposure to different environments, all materials begin to deteriorate.

Hot to cold, cold to hot, the big problem

One of the biggest factors in materials deterioration is repeated exposure from hot to cold temperatures and back. Most materials expand when heated and contract when cooled, but each material has its own rate of change. Polymers, for example, expand and contract the most. Metals and ceramics contract the least. This can create

— CONTINUED ON PAGE 7

A NEW TYPE OF POLYMER — Eric Nagel showing the latest batch of material developed by his team as they work to reproduce a molecule that changes the traditional behavior of polymers. **Photo by Craig Fritz**

SANDIA LABNEWS
PUBLISHED SINCE 1949
Managed by NTESS LLC for the National Nuclear Security Administration

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Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Published on alternate Thursdays by Internal, Digital and Executive Communications, MS 1468

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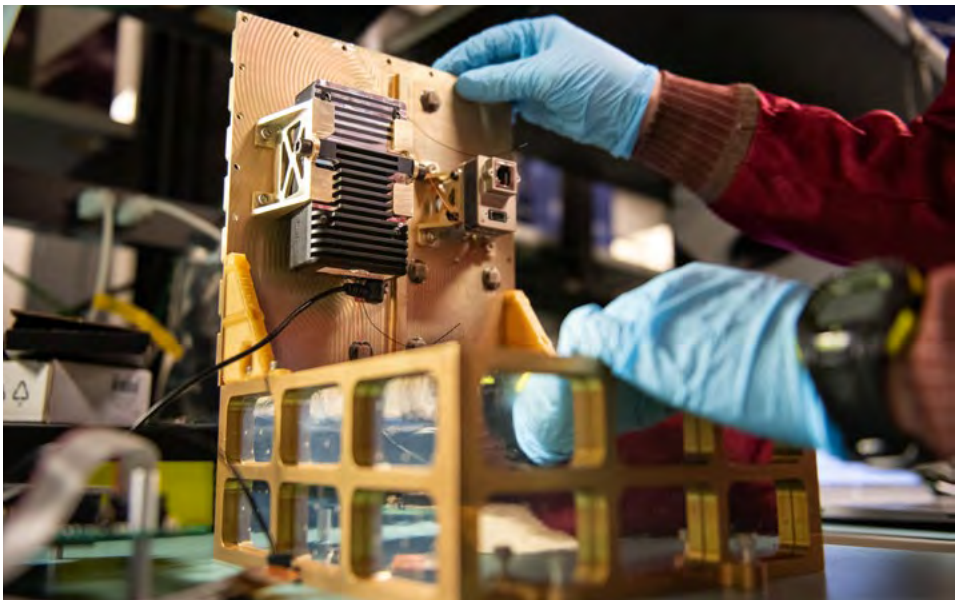
TABLE of CONTENTS

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 the Lab News editor at labnews@sandia.gov.

Testing new technology and research on orbit



TESTING THE NEW — Placing this payload, which includes a computer chip with advanced processing capabilities, aboard the International Space Station will help Sandia researchers evaluate new high-performance computing technology for use in future space systems. **Photo by Craig Fritz**

An experiment on International Space Station readies path to quickly mature technology for satellites

By **Kristen Meub**

Industry can develop new computer chips and other potential satellite payload components more quickly than national labs and other government agencies can design, develop, test and qualify them for satellites that must meet strict security and space-readiness standards. This can create a lag in using the latest technology for national security space systems.

A Sandia team is working to change that by creating an iterative process that uses

the International Space Station as a proving ground to rapidly test and mature technology in space.

In collaboration with NNSA, NASA and commercial space company NanoRacks, Sandia began its first demonstration this month when astronauts used the Canadian robotic arm to install Sandia's payload that will test high-performance computing technology on the NanoRacks External Platform, hosted on the International Space Station's Japanese External Module.

The payload, named LEONIDAS, will operate in orbit for about 10 weeks before returning to Sandia for additional evaluation. It also may be the first payload to fly an Advanced Micro Devices Versal in space, said James Meub, manager and one of the project's engineering leads. The Versal is a commercial computer chip that offers advanced processing capabilities and may better withstand the naturally occurring radiation found in space without using traditional radiation-hardened electronics.

"Because of their critical missions, national security satellites always need to work as expected," James said. "Typically, this means we use components that we trust because they have already performed well in space or have undergone a lengthy screening and testing process that simulates the space environment. Instead of focusing on perfecting the system on the ground and in the lab, the team will get performance data and experience integrating the technology with payload designs faster than before."

James said the data generated from each payload hosted on the space station will help inform and improve the next system's design and ultimately enable the team to be more responsive to national security threats and opportunities.

SPACE-BOUND — Sandia's payload traveled to the International Space Station this month on Northrup Grumman's 19th resupply mission. **Photo courtesy of Northrup Grumman**

Injecting new technology into long-term missions

Since 1963, Sandia has been developing satellite payloads to detect nuclear detonations. The Global Burst Detector, for example, looks for nuclear detonations around the world, offering real-time information to U.S. policymakers.

A high-rigor satellite like the Global Burst Detector can take a decade or more to go from concept to launch, manager John Dickinson said. For each new version of the Global Burst Detector, each part is tested individually and as a system, undergoing various surrogates for the space environment, including vibration, thermal vacuum and radiation testing.

"While this produces highly reliable payloads, it doesn't easily or quickly incorporate the latest technology," John said. "With this new approach, we can test new technology in space within 12 to 18 months, which will enable us to consider it for the next GBD and other payloads on a faster timeline."

Second payload matures novel research for space-readiness

Beyond testing new commercial technology like the Versal, Sandia also will be able to mature the new, fundamental research produced through its Laboratory Directed Research and Development projects.

Scheduled to launch after LEONIDAS, the upcoming payload named ASTRID will test four different technologies initially developed under Sandia's Science and Technology Advancing Resilience for Contested Space mission campaign. The campaign aims to develop new solutions for autonomously protecting satellites against threats.

LAB TESTING — Thomas Bradshaw, lead computer engineer for the project, prepares a payload for integration testing. **Photo by Craig Fritz**

The new technologies include:

- A vanadium dioxide paint, developed by physicist Erika Vreeland, that changes its optical properties to act as a heat window as temperature increases, to passively regulate a satellite's temperature and help defend it against directed-energy weapons.
- Protection against electromagnetic pulses, developed by optical engineer Charles Reinke, by surrounding a satellite's computer with a sealed metal box and then using piezolectrics — rapidly vibrating small actuators — to pass data and provide acoustic power, allowing a satellite to reboot and continue its mission after an electromagnetic pulse.
- Integrity box, led by cybersecurity researcher Sean Crosby, which applies time and location information and a tamper-proof digital signature to satellite-captured imagery, ensuring data authenticity.
- Radiation-hardened neural networks, led by manager Josh Donckels and electrical engineer Gary Simon, that have been trained on data altered by radiation, allowing the team to compare its performance against traditional neural networks trained on pristine data.

The NNSA Office of Space-Based Nuclear Detonation Detection funded LEONIDAS, while the initial research for ASTRID was funded by Sandia's Laboratory Directed Research and Development program.

EDITOR'S NOTE: James Meub is the husband of writer Kristen Meub.

Cutting-edge complex

Sandia ushers in new era of emergency preparedness

By **Luke Frank**

Sandia opened the doors Aug. 7 to its new, cutting-edge Emergency Operations Center aimed at enhancing incident management coordination and communications for the workforce and the community in the event of a crisis.

The $42.5 million, 25,000-square-foot facility, located on Kirtland Air Force Base, is scheduled for full operations by early 2024. It will house the NNSA and Sandia emergency management staff offices, along with the 24/7 Emergency Management Communications Center. This center will feature incident-management and coordination spaces, as well as multipurpose training rooms. The construction project was awarded to Summit Construction of Albuquerque.

Emergency Operations Center functions

Functions of the center include round-the-clock coverage by the Labs' emergency management specialists. The new facility is enhanced capabilities to collect, analyze and share incident information with internal and external emergency response organizations, such as Kirtland Fire Emergency Services, Sandia's medical clinic or the University of New Mexico Hospital.

The new center will be home to Sandia's emergency management organization overseeing daily operations. Additionally, the center will provide 24/7 support for emergency and nonemergency calls, with space for three 911 call stations, two nonemergency call stations and one Sandia duty officer station.

The facility boasts redundant mechanical and electrical systems, a backup generator, showers, a kitchen with a pantry, a dining area and temporary sleeping areas, ensuring it can operate independently for at least 72 hours.

FRESH CUT — Sandia hosted a ribbon cutting Aug. 7 for its new Emergency Operations Center. Left to right are Sandia Environment, Safety & Health Director David Stuhan, Sandia Chief Operations Officer and Deputy Labs Director David Gibson, Labs Director James Peery, Under Secretary for Nuclear Security and NNSA Administrator Jill Hruby, New Mexico's U.S. Rep. Melanie Stansbury, NNSA Sandia Field Office Manager Daryl Hauck and NNSA Infrastructure Modernization Division Acting Director Amanda Tapia-Pittman. **Photo by Craig Fritz**

From the podium

Jill Hruby, undersecretary for nuclear security and NNSA administrator

"The new Emergency Operations Center is the last of four pilot projects supported by NNSA's Enhancement Partner, Construction and Commercial Practices (program). This pilot program presents an opportunity to streamline construction and requirements using approaches common in commercial construction. This new facility represents our commitment to a modern enterprise capable of meeting our mission requirements and giving our workforce the facilities they deserve. It is not buildings that make our mission a success. It's people. So, for those of you that are going to be in this building, thank you." **Photo by Craig Fritz**

David Gibson, chief operations officer and deputy Labs director

"This new expanded facility has a ton of new technology that allows us to really align our EOC capabilities with the national standards that exist for this important functional area. The center has three 911 call stations and two nonemergency call stations that will be used to monitor activities across the Laboratories. This allows us to share important information with collaborators and stakeholders across the enterprise and the broader community here. This is a very important facility as a symbol of our commitment to the safety and health of everyone." **Photo by Craig Fritz**

STYLISH STOREFRONT — Sandia's new Emergency Operations Center will house NNSA and Labs emergency management staff offices. **Photo by Lonnie Anderson**

Improvements with new center

The new facility provides numerous improvements to support Sandia's emergency management operations and response capabilities. Examples include:

- Larger, more flexible space.
- More area for a comprehensive center structure that aligns with the Federal Emergency Management Agency's National Incident Management System.
- Accommodations for up to 102 center staff — 62 in the main area and 40 in an overflow area — compared to the 18-staff capacity of the current location.
- An advanced situation center, video walls and monitors to share a common operating picture throughout the center.
- Advanced multipurpose training room with the latest technology.

NNSA's construction pilot project

Sandia's new Emergency Operations Center is supported by NNSA's Enhanced Minor Construction and Commercial Practices initiative and is the fourth of four initial projects in the pilot program. This initiative allows the acquisition of simple, non-nuclear facilities following commercial best practices within NNSA requirements. The streamlined acquisition and execution processes under the program accelerate delivery and increase buying power for commercial-like construction.

With the new center, Sandia reinforces its commitment to maintaining a robust emergency response system that safeguards its workforce, the community and the critical work carried out at the Labs.

Melanie Stansbury, U.S. representative, New Mexico 1st Congressional District

"This facility will help ensure safety and peace of mind so that our scientists, engineers and service members can do their jobs. You are on the edges of scientific discovery, and you are ensuring our national security, not only here in the United States, but abroad. So, I want to say thank you for your service, whether you're in the sciences, engineering, you're on the front lines as a member of our national security apparatus, whether you're a member of the armed forces or the National Guard or you are a support person who helps make everything that happens on this campus possible." **Photo by Craig Fritz**

David Stuhan, Sandia Environment, Safety and Health director and chief of safety

"This new state-of-the art facility is a symbol of the importance of being prepared and to really have the capacity and capability to respond to all hazards and threats. This facility truly reflects the Laboratories' commitment to protect our workforce, the public, property and the environment. And this facility will operate as the guardian for our national security mission here at Sandia." **Photo by Craig Fritz**

EMERGENCY OPERATIONS CENTER DRONE FLYTHROUGH

Atomic clock

CONTINUED FROM PAGE 1

Sandia has experience building compact clocks. In the early 2000s, the Labs helped develop the Chip Scale Atomic Clock, which is little larger than a matchbook, or about 17 cubic centimeters. At the time, CSAC was the smallest atomic clock in the world, and is still the smallest one you can buy.

Miniature clocks enable advanced navigation technology

The atomic clock was invented in 1948 at what was then the U.S. National Bureau of Standards, now the National Institute of Standards and Technology. Rather than measuring time by astronomical events like the Earth's rotation, or by mechanical means like gears, springs or pendulums, it measured time by electromagnetic signals emitted by electrons around an atom, making it incredibly precise.

Atomic clocks paved the way for GPS, which relies on super-accurate, synchronized clocks.

Ironically, DARPA is now investigating small, accurate clocks to help vehicles navigate when GPS is unavailable. This works like how you might calculate distance driving a car on a long stretch of highway. If you drive a steady 60 miles per hour, you know after one hour you've traveled 60 miles. A trusty clock is half the equation.

For defense applications, navigation must be extremely precise. DARPA is seeking clocks that are accurate to millionths of a second for up to a week. While the world's best clocks are large machines that can maintain this accuracy for tens of thousands of years, pocket-sized versions are less accurate. Sandia's and DARPA's goals are to be 30 times more accurate than current state-of-the-art, small-scale clocks.

TESTING LASERS — A probe is used to test a green indium gallium nitride laser diode being developed at Sandia for next-generation quantum sensors. **Photo by Craig Fritz**

SHRINKING GAME —Darwin Serkland is developing novel microscopic semiconductor lasers for use in next-generation atomic clocks at Sandia. Needle probes positioned under a microscope drive 2 milliamps of current into a laser diode, which produces almost 1 milliwatt of monochromatic light at a wavelength of 894 nanometers. The laser diode shown here is a hundred times smaller than a grain of salt. **Photo by Craig Fritz**

The agency also requires improvements in power consumption and sensitivity to temperature and vibration.

"This is way more challenging than what people have done so far," Yuan-Yu said.

Reducing size, weight and power makes advanced navigation systems easier to field in different kinds of vehicles — from naval vessels to drones and satellites.

Clock design based on 16-year-old prototype

Yuan-Yu is confident he and his team can build the device. In a way, he already has.

Sixteen years ago, then a physics instructor at Princeton University, he built his first prototype of what he called a laser atomic oscillator. It was about the size of a toolbox, but it performed the same basic action as an atomic clock. It produced a steady, clock-like pulse derived from shining a laser through a cloud of potassium atoms.

Importantly, it was self-contained. The oscillator did not require outside electronic equipment to control the machine's periodic pulse.

Support hardware is common in many kinds of atomic clocks, and it usually takes up most of the space. If you removed the support electronics from a matchbook-sized CSAC, you'd find the physical ticking takes place in a package only about the size of a grain of rice.

Yuan-Yu said his prototype was only as large as it was because a big machine was easier to build than a small one, "You know, with my sausage fingers."

Now, he has the tools to make it smaller.

Team to build device at Sandia microelectronics facility

Yuan-Yu plans to swap out potassium atoms for cesium and shrink his original design using machines and tools at Sandia's Microsystems Engineering, Science and Applications complex, a hybrid research, development and production facility for microelectronics.

Because his design doesn't need peripheral hardware, he thinks he can dramatically reduce the size, weight and power requirements of atomic clocks.

"We will use only the volume of the physics package that exists in the existing CSAC clock, but we will get rid of those complicated electronics around it," Yuan-Yu said.

His initial funding under DARPA is for two years, with the possibility of additional funding if he and his team meet size and performance benchmarks.

Polymers

CONTINUED FROM PAGE 1

a problem when combining these materials.

Erica said most items are made up of more than one kind of material. "Take, for example, your phone, which has a plastic housing, coupled to a glass screen, and inside that, the metals and ceramics that make up the circuitry. These materials are all screwed, glued or somehow bonded together and will start expanding and contracting at different rates, putting stresses on one another which can cause them to crack or warp over time."

Erica kept hearing the same complaint from many of Sandia's customers. "They're always talking about thermal expansion mismatch problems and how their existing systems are hard to work with because of all the filler they need to add to compensate."

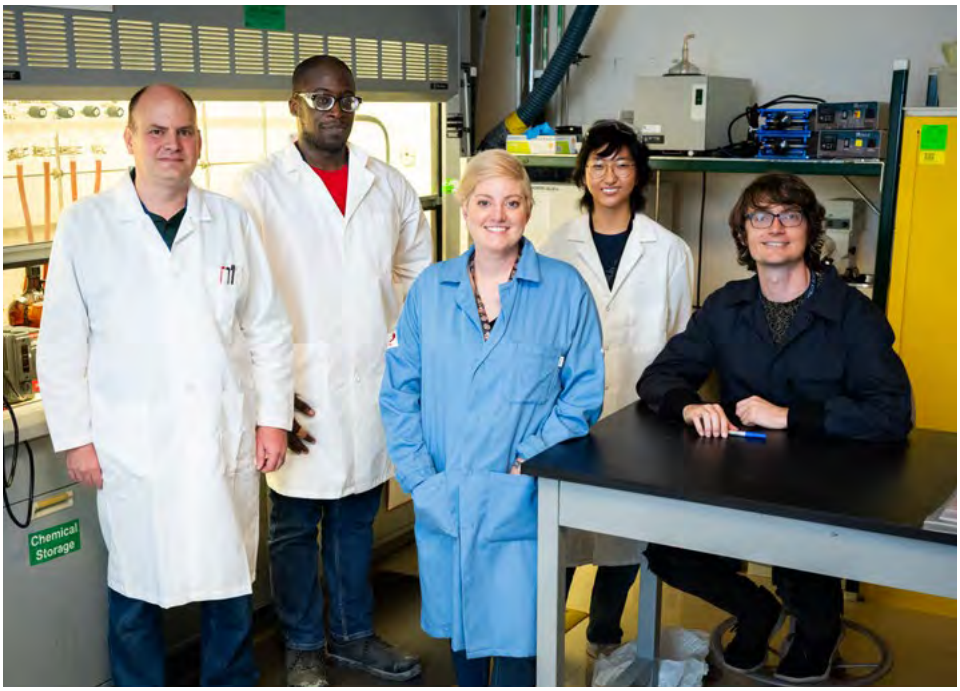
With that, Erica's idea was born. "I thought, what if I conjured up a perfect material? What would that look like?"

Erica and her team believe they have done it.

The molecule in action

The team modified a molecule so that it can easily be incorporated into a polymer to change its properties. "This really is a unique molecule that when you heat it up, instead of it expanding, it actually contracts by undergoing a change in its shape. When it's added to a polymer, it causes that polymer to contract less, hitting expansion and contraction values similar to metals. To have a molecule that behaves like metal is pretty remarkable," Erica said.

CHEMISTRY AT WORK — Sandia chemist Chad Staiger uses a separatory funnel to remove byproduct from the synthesis of a molecule. **Photo by Craig Fritz**



THE BRAINS BEHIND IT — From left to right, Sandia chemist Chad Staiger, technologist Kenneth Lyons, materials scientist Erica Redline, intern Alana Yoon and postdoc Eric Nagel are part of a research team helping make materials more durable. **Photo by Craig Fritz**

Endless possibilities

This molecule could be used in endless ways. Polymers are used as protective coatings in electronics, communications systems, solar panels, automotive components, printed circuit boards, aerospace applications, defense systems, flooring and more.

"The molecule not only solves current issues but significantly opens up design space for more innovations in the future," said Sandia chemical engineer Jason Dugger, who has been looking at potential applications, especially in defense systems.

Another key to this invention is that it can be incorporated into different parts of a polymer at different percentages, such as 3D printing.

"You could print a structure with certain thermal behaviors in one area, and other thermal behaviors in another to match the materials in different parts of the item," Jason said.

Another benefit is helping reduce the weight of materials by eliminating heavy fillers. "It would enable us to do things much lighter to save mass. That is especially important when launching a satellite, for example. Every gram we can save is huge," Jason said.

Erica said she has also been approached

by an epoxy formulator who believes this molecule could be incorporated into adhesives.

The next step

The team has only created this molecule in very small quantities, but they are working to scale production so that Sandians can test the molecule to fit mission needs.

Sandia organic chemist Chad Staiger is the man who makes the molecule. It takes him about 10 days to make between 7-10 grams. "It's unfortunately a long synthesis for this molecule. More steps equal more time and more money. You usually see five- to six-step syntheses in higher value materials such as pharmaceuticals. In polymers, the cheaper the better for wide scale adoption," he said.

The team is working to reduce the steps using funding through Sandia's technology maturation program, which helps prepare products for the marketplace. "My role is to see if there is an easier way to make it at a commercial level," postdoc Eric Nagel said.

"There is nothing like it out there," Eric said. "I am really excited at the possibilities of what this technology can do and the applications that could be associated with this. It's pretty phenomenal and pretty wide open."

Jason agreed: "It really is a sky's the limit kind of thing."

Recent Patents

April–June 2023

Note: Patents listed here include the names of active Sandians only; former Sandians and non-Sandia inventors are not included.

Following the listing for each patent is a patent number, searchable at the U.S. Patent and Trademark Office website.

- **Christopher Campbell:** Method of controlled conversion of thermosetting resins and additive manufacturing thereof by selective laser sintering. Patent #11618835
- **John A. Mitchell:** Using pyrometry to identify porosity in additively manufactured structures. Patent #11623408
- **Lyle M. Pickett, Julien Luc Manin and Kevin Wan:** Low soot stoichiometric compression-ignition combustion. Patent #11629661
- **Brian Zahler Bentz, Sean Donovan Fournier, Richard Karl Harrison, Christopher Murzyn, Christopher Blair Saltonstall Jr. and Oskar Fick Searfus:** Mapping and imaging ionizing radiation in two and three dimensions. Patent #11630218
- **Christopher Todd DeRose:** System and method of phase-locked fiber interferometry. Patent #11644301
- **Michael Gehl:** Integrated silicon optical amplifier with reduced residual pump. Patent #11652330
- **Oscar Negrete:** CRISPR-CAS based system for targeting single-stranded sequences. Patent #11661599
- **John Mudrick, Karl Douglas Greth, Craig Y. Nakakura, Jeffry Joseph Sniegowski and Caitlin Rochford Friedman:** Plasma-based method for delayering of circuits. Patent #11664238
- **Ross Guttromson:** Adaptive controller for forced oscillation suppression in the grid. Patent #11664662
- **Michael P. Frank:** Oscillator for adiabatic computational circuitry. Patent #11671054
- **Jonathan Joseph Coleman and Kyle Chris Klavetter:** Electrodeposited platinum-gold alloy. Patent #11674234
- **Evan Michael Anderson, Paul Davids, Jin K. Kim and David W. Peters:** Continuous full-resolution two-color infrared detector. Patent #11674850
- **Michael P. Siegal, Michael Wanke, Amalie Frischknecht, Carlos Perez and Kyle Chris Klavetter:** Electrophoretic device and method to detect analyte ions. Patent #11674925
- **Ben Maestas, Kent B. Pfeifer, Sean Michael Crosby and Kurt Daniel Brenning:** Systems and methods for in-situ calibration of scintillation spectrometer. Patent #11675098
- **Thomas A. Friedmann, Ashok Kodigala and Nicholas Boynton:** Heterogeneous integration of an electro-optical platform. Patent #11675126
- **William M.S. Stout and Vincent Urias:** Transparent application-layer/os deeper packet inspector. Patent #11677668
- **Tyler Phillips Eckles and Robert Meagher:** Detection of cholinesterase inhibition with microfluidic devices and systems thereof. Patent #11680946
- **Nicholas Myllenbeck, Patrick L. Feng, Melinda Sweany and Peter Marleau:** Scintillator array for radiation detection. Patent #11681055
- **Travis Forbes, Jesse Moody and Benjamin Thomas Magstadt:** Programmable delay device enabling large delay in small package. Patent #11683023
- **Stephen Percival, Christopher Campbell and Erik David Spoerke:** Cross-linkable nanocomposite anticorrosion coating. Patent #11685836
- **William Whitney Schonbein:** In-network compute assistance. Patent #11689605

Sandia computer scientist recognized for advocacy work in deaf and hard-of-hearing communities

Clint Stimpson named Employee of the Year by Careers & the disABLED Magazine

By **Maggie Krajewski**

When many of us consider what it would mean to live with a disability, we often focus on the dis – the "without." How would our world, our lives, our day-to-day be different without the ability, to do something?

While the without is certainly a part of Sandia computer scientist Clint Stimpson's story, his ability to use his experience to help others in his community and lead by example is one of the many reasons he was recently awarded Employee of the Year by Careers & the disABLED Magazine.

"When I was three, I was diagnosed with severe-to-profound hearing loss. While not completely deaf, this meant I would have difficulty hearing and comprehending sounds and speech without an amplification device or hearing aids," Clint said.

This diagnosis gives Clint a perspective into two communities – one that can hear and one that cannot. Existing in the middle might cause some to feel estranged, but this was not the case for Clint.

"Growing up in Idaho and later Colorado, I attended schools for deaf and hard-of-hearing students and more traditional public schools. I made friends, found support, gained mentors and found my way in both worlds. However, I realize this is not the case for everyone growing up in these same communities," Clint said.

Clint's own experience, paired with the knowledge that not everyone has the same support he had, has been a driving force behind his advocacy work within the deaf and hard of hearing community.

He authored a proposal that led to a successful effort in Rapid City, South Dakota, to introduce sign-language as one of the foreign languages taught in high schools. He has volunteered in Houston and Los Angeles where he helped teach sign-language and other subjects to deaf children. This work included a focused effort on helping deaf Latino immigrants with language delays.

Clint lives with his wife and their five children in Utah, where he takes an active role as a leader, mentor and dedicated volunteer working with his local deaf and hard of hearing community. He has spent more than a decade volunteering as a scout leader, engaging with deaf scouts and the children of deaf parents. He regularly visits Utah schools to teach deaf and hearing students about science, technology, engineering and math. He also helps high school students seeking to certify their sign language ability according to national proficiency guidelines.

Additionally, he helps businesses and community leaders create recorded content translated from English to American Sign Language. He also volunteers as a handyman for deaf residents and at schools for the deaf in and around his town.

At Sandia, Clint works on the Geometry and Meshing team. Before he became a full-time Sandian in 2019, he worked as a contractor.

"Working as a contractor, communications could be difficult, especially as a remote employee. Most meetings were over the phone, and it was hard for me to fully participate and comprehend what was being discussed," Clint said. "But when I become an official Sandian, the technology made available helped foster an environment where I could succeed. Microsoft Teams has been of the most helpful tools, in large part thanks to its live-caption feature."

LEADER AND CHANGE MAKER — Sandia computer scientist Clint Stimpson was recently awarded Employee of the Year by Careers & the disABLED Magazine for his commitment to advocacy and volunteerism in the deaf and hard-of-hearing communities. **Photo courtesy of Clint Stimpson**

Beyond the technology, Clint said the support of his team and manager, Michael Skroch, have been key to his success.

Likewise, Michael views Clint as key to his team's achievements and to the larger Sandia mission.

It was Michael who nominated Clint as Employee of the Year for Careers & the disABLED Magazine.

"Clint's can-do attitude for his work and customers is a trait that also shines through his various community contributions and volunteer work," Michael said. "When I learned of this nomination opportunity I immediately thought of Clint because he embodies the 'ABLED' emphasis of the award. His proactive approach reminds of us of the larger workplace benefits achieved by Sandia's accommodation of all abilities."

Mileposts


Tony Chavez 40


Charles Hanley 35


Darrla Giersch 30


Steve Kleban 30


John Ball 25


Jim Fernandez 25

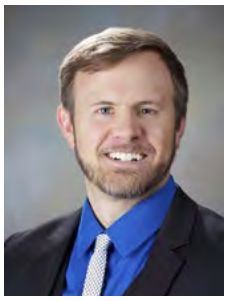

Rudy Garcia 25


Heidi Herrera 25


Brian Post 25


Kevin Stamber 25

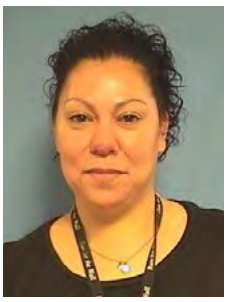

Alexander Tappan 25


Aaron Hamburger 20


Gloria Hill 20


Rick Kellogg 20


Beverly Manuelito 20


Marlene Palacio 20


Karen Pruett 20


Rick Chavez-Hatton 15


Cele Jaramillo 15


Kris Kuhlman 15


David Littlewood 15

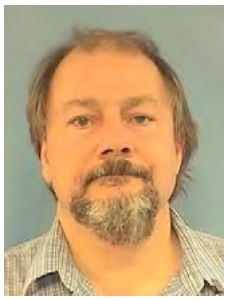

Scott Peterson 15


Shawn Taylor 15


Michael Wells 15

Recent Retirees


Daniel Wesolowski 15


Dan Kettleborough 35

Sandia gives $1M to nonprofits

Labs celebrate community partners on National Nonprofit Day

By **Katrina Wagner**

In celebration of National Nonprofit Day on Aug. 17, Sandia recognized organizations that make a major impact in their communities. National Technology and Engineering Solutions of Sandia LLC, on behalf of the Labs, is proud to support nonprofit organizations that focus on families and education as part of its corporate contributions program.

This year, more than $1 million in grants have been awarded to 102 nonprofits in New Mexico and California that improve our local communities by increasing family stability and supporting educational success.

"Sandia's corporate contributions represent a commitment in the communities where we work and live, with the goal of making an impact on the programs, the people and the children who receive services from these outstanding nonprofits," community relations specialist Roberta Rivera said.

For more information, read Sandia's annual Community Involvement Report.

WELCOME HOME — Saranam LLC Office Management Assistant Angela Walde, left, and her mother Cecilia Salas unpack a new vacuum in an apartment for a family that will move in soon. In 2023, Saranam received a $15,000 grant from Sandia to help provide stable housing to families experiencing homelessness in New Mexico. **Photo by Katrina Wagner**

FRESH PRODUCE — Sandia California staff packaged oranges, apples and plums at the Alameda County Community Food Bank for delivery to smaller neighborhood meal programs. The food bank received $7,000 from Sandia to provide nourishing food to people experiencing food insecurity.

Photo by Michelle Walker-Wade

Exploring new worlds

Sandia shares XR tech with community

By **Kim Vallez Quintana**

Imagine yourself as an explorer on Mars, a member of a rescue team tasked with finding trapped miners, a lab technician having to transfer vials filled with hazardous materials without actually touching them or a soldier equipped with X-ray vision like Superman, able to see through walls before entering a building. These are just a few of the scenarios people got to experience during XR Demo Day at Explora Science Center and Children's Museum of Albuquerque.

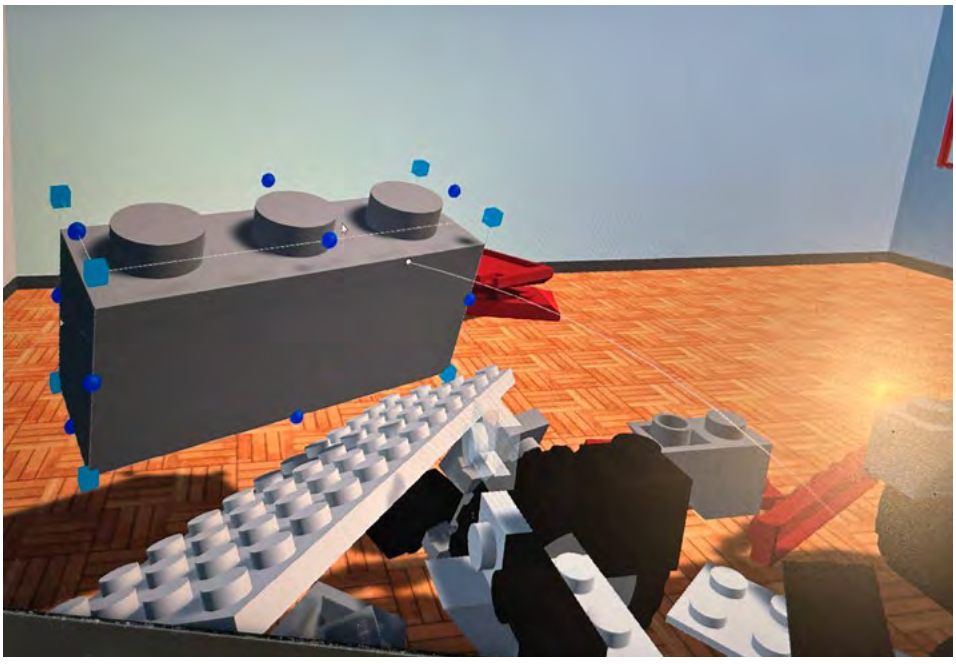
The event provided a rare opportunity for the public to experience some of the extended reality, or XR, software that Sandia helps create along with companies like Microsoft Corp. and HaptX Inc. It opened up a whole new world for children like 7-year-old Chloe Lockett and 12-year-old Paloma Rodriguez who were tasked with building a virtual Lego car. "I was in there and didn't even see anybody; it was just me and my feet. It was fun," Chloe said.

"I thought it was amazing because I could do so many things. I liked how much I could interact with the Lego pieces by picking them up and then moving them. You could see all the detail and how they were put together. It was like I was actually there doing the work," Paloma said.

But the event also intrigued adults. "It felt like you were right in there," said Zhanna Williams, wife of Sandia solutions architect Derrick Williams. "I was tasked with putting together a broken maze; it really was just amazing.".

NNSA has provided ongoing investments in XR technology and research at Sandia, helping grow its capabilities and applications. XR tech is used in various ways for Sandia's key missions, including training, design, research, collaboration

A WHOLE NEW WORLD — Chloe Lockett, 7, breaks apart a Lego car in her first virtual reality experience. **Photo by Kim Quintana**



LEGO CREATIONS — A screenshot of one virtual world that participants could explore during XR Demo Day at Explora. The event shared virtual and augmented reality software created at Sandia. **Photo by Kim Quintana**

CAUGHT IN A MAZE — Zhanna Williams, spouse of Sandia solutions architect Derrick Williams, navigates a broken maze that she must reassemble as part of a virtual reality scenario. **Photo by Kim Quintana**

and knowledge retention.

The XR demo was part of Sandia's fifth annual XR Conference, which brought together XR developers, enthusiasts, representatives from other national labs and the public to experience frontier XR technology for themselves.

"It's rare that other labs get to see each other's technology, that industry gets to meet with labs and that the public gets to see what we are doing at Sandia, all at the same event," said Matthew Gallegos, a member of Sandia's research and development team and the chair of this year's XR event.

Some of the demonstrations used haptic gloves, which allow the user to not only maneuver through a virtual world but also perceive the feeling of virtual objects with their hands. In one scenario, participants worked inside a lab with a partner to move around glass test tubes. With each move, the gloves conveyed the sense their fingers were actually squeezing the tubes.

"It's pretty cool; I can see how this helps with the training," said Collin Anderson, who works at Los Alamos National Lab and attended the conference. "It helps the team with visualization. We do something similar but don't have projects exactly like this."

In one demonstration from HaptX, users were able to experience sensations of rain, clouds and flowers, and even fight off extraterrestrials who had invaded a farm.

Visitors also got to put on a Microsoft HoloLens headset and walk around a computer-generated model of the Curiosity rover as if it were physically there, tour the Mars Gale Crater in augmented reality, interact with Sandia's Gemini-Scout Mine Rescue Vehicle, look at molecules and change a tire in virtual reality, peer into a holographic display, communicate with artificial intelligence and take the Spot robot for a walk.

This team is already working on next year's XR Conference and Demo Day. "It's an opportunity to bring together national labs, industry and academia with a focus on XR. It creates synergy, business opportunities and partnerships," Matthew said.

Team members also say it serves as an engaging and fun way to learn about various roles that one could transition to within Sandia. But another goal, of course, is to reach out to children and inspire.

"After all, they are our future Sandians," Matthew said.

SEEING AND FEELING — Sasha Kucher engages in an augmented reality scenario using haptic gloves to transfer hazardous materials via test tube in a lab setting, as part of the XR Demo Day at Explora.

Photo by Brittany Mullins

SPOT IN ACTION — A group of children watch as Spot the robot maneuvers around the play area at Explora. Spot is one example of Sandia's artificial intelligence capabilities.

Photo by Brittany Mullins