



High-tech invisible ink spells trouble for counterfeiters

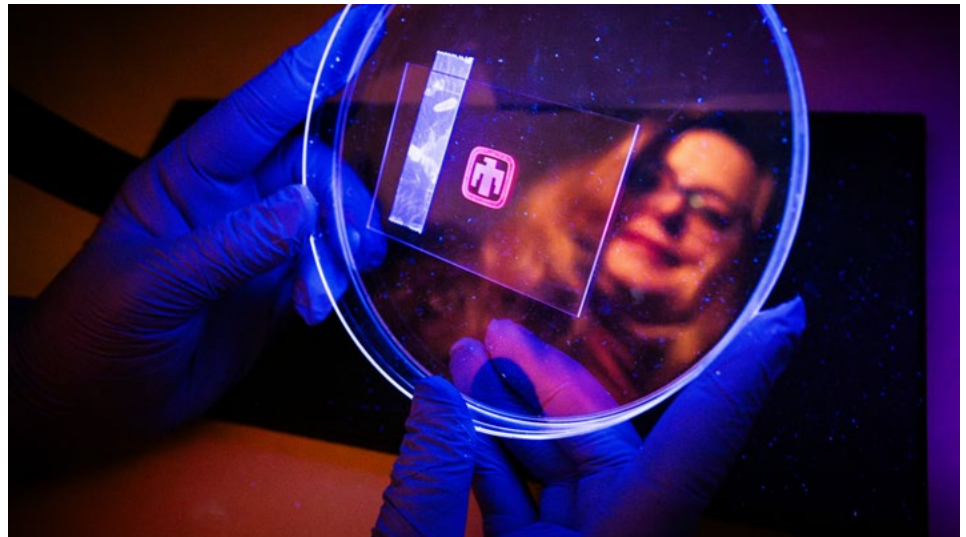
Sandia team seeks partnerships to develop anti-counterfeit, anti-tamper tech

By **Troy Rummler**

A high-tech invisible ink invented at Sandia could become the newest tool for stopping counterfeit goods. The research team is now seeking partnerships to help develop and ultimately commercialize the new technology.

Beyond their negative economic impact, counterfeit goods can threaten public

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A BIG REVEAL — Materials scientist Dorina Sava Gallis shows a sample of an optical tag with the Sandia logo under an ultraviolet light. **Photo by Craig Fritz**

Increasing national security with satellites that team together



TEAM FOR GREAT RESULTS — An autonomous constellation developed by Sandia, the Air Force Research Laboratory and others could work together during national security missions. When one satellite detects a possible object of interest, others in the group could help identify it with more information from their sensors.

Image by Eric Lundin

E pluribus satellibus unum

By **Troy Rummler**

Imagine a satellite observing ships on the ocean. As it takes pictures of each ship, an algorithm decides what kind of vessel it is. But one sneaky sailor paints a pattern on the deck that confuses the satellite, so it can't decide what it's looking at.

How can the satellite work around its problem? According to new research, the answer could someday be: with a little help from its friends.

For the past six years, Sandia has been working on an autonomy project led by the Air Force Research Laboratory to enable a cluster of relatively small and

inexpensive satellites to work together as a single, autonomous unit. The project could improve the nation's ability to conduct national security missions, including intelligence, surveillance, reconnaissance, climate monitoring and emergency response.

A confused satellite, for example, could communicate its problem to others in the network, which could straight away point their sensors to the same spot, combine their data and make a positive identification.

"This is a paradigm shift from large, exquisite, billion-dollar satellites to talking about multiple million-dollar satellites," said Sandia project manager Jered Mitchell.

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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.

Sandia named among Forbes' top employers, twice



TOP WORKPLACE — Providing employees world-class research facilities, Sandia is the only New Mexico company to make Forbes' 2023 list of Best Large Employers. The Labs was also named among the Best Employers for Diversity.

Labs listed as a Best Large Employer and Best Employer for Diversity 2023

By **Kenny Vigil**

Forbes has named Sandia a top employer for 2023 in two categories. First, Sandia is listed as one of America's Best Large Employers, the only New Mexico company to make the list in that category.

Market research firm Statista conducted anonymous surveys of approximately 45,000 Americans working for businesses with more than 5,000

employees. Respondents were asked to rate how likely they would be to recommend their current employer and also to nominate companies other than their own. The final list ranks the 500 large employers that received the most recommendations.


"Sandia is a mission-focused, people-centric organization," said Brian Carter, Sandia's chief human resources

officer. “Creating and maintaining an environment where all Sandians can thrive as they execute our mission of keeping the world safe and secure is a top priority and continual area of focus for us. It’s an honor to be recognized by Forbes as a place where people want to work.” In addition to Sandia, the list includes NASA, Apple Inc., Microsoft Corp., and Google LLC. Forbes also

listed Sandia as a Best Large Employer in 2021, 2019 and 2017.

Diversity recognition

Sandia also made Forbes’ list of Best Employers for Diversity 2023. For the diversity list, Statista also conducted anonymous surveys, asking participants to rate their organization on criteria such as age, gender, ethnicity and LGBTQ+

equality. Each company’s diversity-related best practices, such as the presence of employee resource groups, were reviewed and incorporated into the rankings. Sandia has 14 employee resource groups with chapters in New Mexico and California and various networking groups. Learn more at [Inclusion and Diversity](#). 

Invisible ink

CONTINUED FROM PAGE 1

health. In 2022, the U.S. Drug Enforcement Administration seized more than 58.4 million fentanyl-laced fake pills. Six out of 10 pills the administration tested contained potentially [lethal doses](#) of fentanyl, according to its website.

This year, fentanyl-laced medicine was reported to have been sold in some northern Mexican pharmacies.

Sandia’s inks offer a new way to mark authentic pill bottles and other goods, which could help legitimate companies get ahead of fraudsters and keep consumers safe.

“The development of new technologies that can effectively ensure asset safety and security, as well as integrity-checking throughout a product’s lifecycle in this ever-evolving landscape, is critical,” said materials scientist Dorina Sava Gallis, who leads the research.

New inks reveal sophisticated patterns under certain light

Dorina’s team invented a transparent material that, like invisible ink, can mark

authentic goods with a special pattern or signature that only emerges under certain kinds of light. A light-sensitive marking is also called an optical tag.

The difference is that Sandia’s high-tech inks have complex signatures that are difficult to imitate or reverse-engineer.

For example, shining an ultraviolet light on a Sandia-designed ink might cause one pattern to become visible, while also revealing a second, hidden pattern that can only be seen with an infrared camera. The patterns can even morph, revealing a signature animation instead of a static image.

After publishing their research on the materials development in several major scientific journals, including [Angewandte Chemie](#), [ACS Applied Materials & Interfaces](#) and [Nature Communications](#), the Sandia team is now seeking partners to help make it a commercial product. Several patent applications have been filed.

Research has been funded by Sandia’s [Laboratory Directed Research and Development program](#). The work was performed, in part, at the [Center for](#)

[Integrated Nanotechnologies](#), a scientific user facility operated by Sandia and Los Alamos national laboratories for DOE’s Office of Science.

Hard-to-counterfeit inks created by positioning atoms with exactness

To create and test the new inks, Dorina leads a team of control freaks in the best sense of the words. With world-class precision, they move atoms into exact

positions in materials called metal-organic frameworks. This precision enables them to tailor exactly how long, how bright and what colors their materials shine under different conditions.

Lauren Rohwer, an expert in luminescent materials, studied how the ratios of the various light-emitting metal ions in the new inks affect how long it takes for their photoluminescent signatures to fade. The timing is important for designing dynamic signatures.

“In this work, the lifetime measurements, sometimes referred to as decay time measurements, involve exciting the sample with short pulses of ultraviolet laser light and recording the resulting photoluminescence as a function of time,” Lauren said.

Only the right amounts of certain metals placed in the proper atomic arrangement and ratios will produce a given image. With such particular recipes, Dorina said, Sandia’s optical tags can be authenticated in at least three distinct ways: detecting the signature under light, measuring how that signature changes with time and analyzing the chemicals that make up the ink.

“We are pushing the boundaries of made-to-order materials and how much complexity we can encode,” she said.

Potential uses in medical industry, national security

The team is exploring more potential uses for their optical tags.

“One of my major interests is the intersection of materials and biology, and how we use materials to enhance biosafety,” said Kim Butler, an expert in nanomaterials sensing and imaging on the team. “Counterfeit medicines and vaccines, as



STUDYING THE DATA — From left to right, Lauren Rohwer, Kim Butler and Dorina Sava Gallis look at characterizations they have done in the lab for their optical tags project.

Photo by Craig Fritz

well as medical devices and food additives, can have a major impact on health and are a growing problem.”

Hard-to-counterfeit tags provide a method to authenticate these, as well as other items.


Kim helped study an additional sensor component on optical tags to indicate if temperature-sensitive packages were mishandled during shipment. Combining multifactor authentication with information on shipping conditions could be applied to many areas but would be particularly important in the medical field. Certain vaccines, for instance, have to be kept cold.

“This would be an additional signature that would not compromise the tag features

but would turn on if the temperature was too high during shipment,” Kim said.

Sandia has a long history of developing anti-tamper and anti-counterfeit technologies, with work related to treaty verification dating back to the 1980s. Advanced tags and seals invented at the Labs have been used to help ensure compliance with international treaties that limit nuclear weapons by ensuring monitored items, such as containers of spent nuclear fuel, are not diverted by a state to establish a clandestine nuclear weapons program.

Although not funded under the same program, Sandia’s new optical tags could potentially help nuclear inspectors ensure

the safeguards and security of radiological materials, or protect vital national security assets from being infiltrated with fraudulent or tampered components. 

Collaboration opportunity

Researchers and organizations interested in partnering with Sandia in the development of metal-organic framework optical tags are invited to visit sandia.gov/working-with-sandia or email partnerships@sandia.gov for more information.

Satellites

CONTINUED FROM PAGE 1

While current research aims to connect up to about a dozen satellites, researchers say that further development could lead to connecting much larger networks.

“The ultimate idea is to scale up to constellations that might cover virtually the entire globe — and to potentially coordinate data collection even with non-space assets,” like sensors on the ground or on planes, said Sandia’s Drew Woodbury, a senior manager in Sandia’s space programs.

Teaming satellites to save taxpayer dollars

Working together, an autonomous group of satellites could reduce the risk of relying on any one satellite and diminish downtime while engineers on the ground try to resolve



UNITED FRONT — Satellites react to a malfunctioning member of the group in this artist’s rendering of what an autonomous constellation could look like. Sandia is supporting the Air Force Research Laboratory project. **Image by Eric Lundin**

technical difficulties. If one machine in the network stops working, others could automatically redirect their sensors to fill the gap or reroute communications around it.

“Overall, the intent is to build in resiliency so that the mission continues,” Drew said.

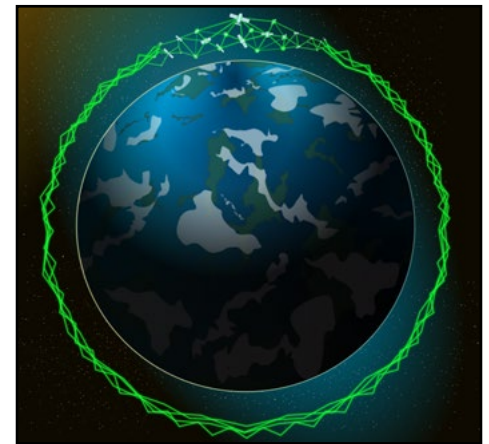
Sandia has been heavily involved in the project, developing machine learning and autonomy algorithms, radar sensors, computer models, communications protocols and flight software. Researchers have been building specialized hardware for space, where budgets for size, weight and power are commonly tighter than on the ground. They have adapted distributed software to operate on multiple satellites without conventional, land-based communications.

“We want applications to seamlessly communicate without worrying about where other applications are located or how messages are physically routed between them,” said Ryan Hess, a Sandia manager in communications technologies.

Many uses for autonomous, multisensor response

The beauty of satellite autonomy, Drew said, is that it could be useful for many applications. These could potentially include automatically turning a group of telescopes to study a fleeting burst of gamma radiation emanating from somewhere deep in the cosmos.

“The fundamental smarts of the system are just designed to look for information, however that information is defined,” Drew said. “These capabilities can be used to




GLOBAL SECURITY — “The ultimate idea is to scale up to constellations that might cover virtually the entire globe,” Sandia senior manager Drew Woodbury said. **Image by Eric Lundin**

figure out in real time where a system should look and not just look where a human told it to look.”

While these new applications have not been tried in space, team members are testing them on electronics and communications systems that have.

“We are doing this to prove these applications can fit in the resource-constrained environments of a spacecraft,” Ryan said.

Nicolas Bikhazi, a Sandia manager over radar research, said, “The system model can be used to perform lab experiments and trade studies with various sensor constellation configurations to see which sensor constellations work best.”

This way, researchers are exploring future architectures and designing their satellite dream team. 

Researchers successfully test heat-powered system

Power could be used to monitor carbon sequestration efforts thousands of feet deep

By **Mollie Rappe**

Capturing carbon dioxide and pumping it deep underground could be an important part of mitigating the effects of climate change. However, ensuring the carbon dioxide stays trapped away from the atmosphere, where it serves as a heat-trapping greenhouse gas, is critical.

Sandia researchers recently designed, built and lab-tested a device that can use the temperature difference caused by periodically pumping carbon dioxide down a borehole to charge batteries to someday power underground sensors.

“Ideally, you would have continuous underground sensing, with several different types of sensors, that would tell you how the carbon dioxide is moving, if it is reacting with the groundwater or the minerals,” said Charles Bryan, a Sandia geosciences engineer and leader of the project to develop the device. “You could demonstrate that it’s not moving out of the reservoir. However, it’s difficult to run power down a borehole: You can’t just have wires running down a working borehole.”

As heat flows from the hot earth through the device to the cooler carbon dioxide, it creates a voltage that can be used to charge a battery and eventually power sensors. The Sandia-developed device works similarly to the radioisotope thermoelectric generators used to power NASA [space probes](#) and even [Mars rovers](#), said Ramesh Koripella, a Sandia materials scientist on the project.

While NASA’s radioisotope thermoelectric generators use the temperature difference from hot plutonium pellets and the cold

of space to produce power, Sandia’s thermoelectric generator device uses the temperature difference from the hot Earth thousands of feet down and the carbon dioxide being pumped down. This technology is not nearly as efficient at producing electricity from heat as the internal combustion engine in most cars, Ramesh said. However, it has no moving parts that could jam, making it ideal for hard-to-reach places such as space and deep boreholes.

Building a heat-powered generator

The device is a multilayered tube with an array of 1-by-1-inch-square thermoelectric generators, Charles said. Each of these thermoelectric generators can turn the heat flowing through them into a voltage and then power, Ramesh said.

The inner tube is built to withstand the temperatures and pressures from carbon dioxide being pumped through it, while the outer tube is built to withstand the temperatures and pressures from being deep underground, Charles said. In the area between those two, reside the electronics to capture and convert the voltage from the thermoelectric generators to charge a battery. Former Sandia mechanical engineer Adam Foris came up with the original design for the tubelike device, he added.

Ramesh selected the right commercially available thermoelectric generators for the device and led the development of a small circuit board that converts and evens out the energy from the generators so that the device can charge a battery without damaging surges, Ramesh said.

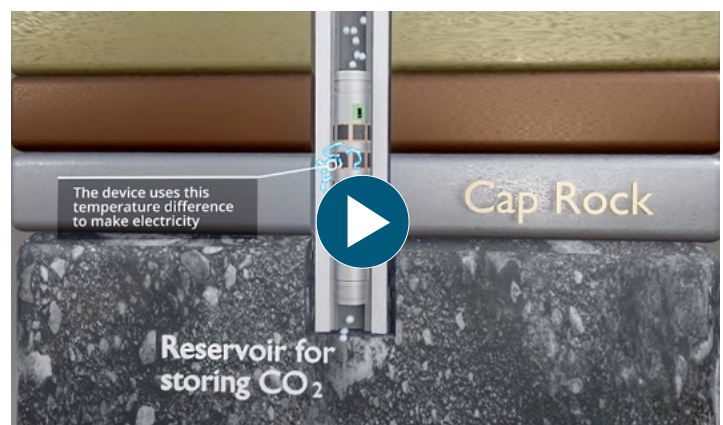
He added that it was quite a challenge to find batteries that work above 160 degrees Fahrenheit, which is the typical temperature downhole at the depths used for carbon sequestration.

Power generation by the initial, footlong prototype was tested in the lab by Sandia geosciences engineer Tom Dewers. He also used thermal imaging and computer modeling to look at how the temperature changed around the device when hot or cold fluid flowed through it, Tom said. The modeling and tests helped the team refine the prototype for an in-the-field test.

Refining the device design

The field-test prototype, which ended up being slightly more than three feet long, was developed by Sandia mechanical engineer Jiann-Cheng Su, who introduced several innovations and improvements to the design, Charles said.

The team made several improvements in the second prototype to ensure the thermoelectric generators had good contact with the inner and outer shells, and that the heat could not take a shortcut around the generators through the rest of the device, Ramesh added. For the field-test prototype, they added thermal insulators around the device and replaced the heat-highway metal screws



POWER FROM PUMPING — Click to watch an animation of how Sandia’s device could produce electricity at a carbon dioxide storage reservoir.

Animation by **Ray Johnson**

that held the thermoelectric generators together with spring-based clamps, he said.

Sandia geosciences engineer Jason Heath gathered data on an active carbon dioxide injection site to inform the building of the device for field conditions and led the selection of a site for the field test. Ultimately, the team selected the [APS Technology Drilling Test Facility](#), Charles said.

“They have an amazing array of facilities for designing, building and testing downhole tools,” said Tom, who went to the site for the field testing. “They were an ideal company for us to work with. The APS folks were great and patient with us and had a lot of good suggestions.”

Successful underground testing

For the first field test, Tom inserted the field-test prototype into a shallow borehole in one of APS’s testing rooms. The researchers lowered the device to a depth of 62 feet. Then they pumped 170-degree water through the interior tube of the device to test the thermoelectric generators and the rest of the system. Unfortunately, during the test the device sprung a leak, damaging the power conditioning board and battery, Tom and Charles said. Working with Tom, APS was able to find and fix the leak location, dry out the device and replace the damaged parts. The second test, a repeat of the first,

was a success.

The team also tested how well the field prototype could survive high-pressure environments. They subjected the inner shell of the device to pressures 400 times atmospheric pressure and the outer shell of the device to pressures 34 times atmospheric pressure. They also heated up the device inside the pressure chamber and measured the current from the thermoelectric generators, ensuring they worked under pressure.

“We successfully generated sufficient current to power downhole sensors with limited current draw,” Tom said. “In that respect, it was a successful device, but it was limited in terms of how long we could deploy the device.”

Future improvements and tests

To test the device for longer times, they need to install more memory, Tom and Charles said. Additionally, Ramesh would like to rebuild the power conditioning board so that it will work with higher temperature differences and possibly add a diode so that the board can charge the battery regardless of whether hot or cold fluids flow through the device, he said.


Before the device is ready for a long-term field test at a carbon sequestration site, Charles would like to collaborate with downhole sensor researchers

to ensure that the power conditioning board can provide the right power for their sensors. The ultimate test of the thermoelectric device would be to see if it can power hardwired sensors downhole.

The kinds of sensors the device could power include pressure sensors, sensors to detect microseismic events, and those to monitor the health of the borehole, such as whether [carbon dioxide is leaking up](#) from the reservoir through the borehole, Charles said.

Charles added that the same thermoelectric technology could also be used to power sensors for other underground applications such as monitoring oil and gas exploration and production, but this would require periodically pumping hot or cold fluid down the borehole to maintain a temperature difference between the inside and outside of the device.

“I think the design is really innovative, really clever,” Charles said. “We had to overcome several obstacles; it was much harder than we thought to get this done. We were all excited when the field test was successful.”

This project was funded by the DOE’s [Office of Fossil Energy and Carbon Management](#) through the [National Energy Technology Laboratory](#). The team is current pursuing additional funding to continue their research. 

Sandian named Scientist of the Year

A true story of the American dream

By [Kim Vallez Quintana](#)

“I was the only farm worker who had a calculus book in his car,” Sal Rodriguez joked when I asked him about his upbringing.

But it was no joke. The son of immigrants, Sal grew up in the tiny town of Calexico, California, and worked in the fields to put himself through college. “My

dad instilled in us a work ethic and my mom always believed in education. They wanted us to get good grades and that is what I did.”

But Sal went far beyond getting good grades. He has earned three master’s degrees and two doctorates, has 240 publications to his name along with multiple patents and copyrights, and has won countless accolades in his nearly 30-year Sandia career.



DYNAMIC ROCKET — Sal Rodriguez showing the dimpled rocket he helped create as part of a 2022 fluid dynamics project with the University of New Mexico. **Photo by Jennifer Plante**

HENAAC Scientist of the Year

Great Minds in STEM, which recognizes America's top engineers and scientists from the Hispanic community, will honor Sal as Scientist of the Year at its annual Hispanic Engineer National Achievement Awards Conference. It's a first for a Sandian. "I am out of my skin here. I'm thinking this can't be real, you know? I am still pinching myself," Sal said.

While Sandia initially nominated Sal for the Outstanding Technical Achievement Award, the committee elevated his nomination to Scientist of the Year. Scientist of the Year and Engineer of the Year awards are the highest of the conference's honors, reserved for individuals who model excellence and leadership, making profound contributions to industries, STEM fields, communities and the nation.

In 2012, Sandia radar systems manager Steven P. Castillo received the the conference's inaugural **Engineer of the Year Award**. The Scientist of the Year category was also added that year.

A long resume

Sal has quite the resume, encompassing 38 years of experience in design, safety and analysis of nuclear, non-nuclear and aerodynamic systems. His expertise spans computational fluid dynamics, advanced high-temperature refractory high-entropy alloys, turbulence, aerodynamic drag reduction through surface modification, advanced manufacturing, swirl and heat transfer. He has designed and modeled gas, water, molten salt and heavy-water-cooled reactors. However, Sal talks most passionately about some of his recent projects.

One was a collaboration with a University of New Mexico student involving fluid dynamics. They reduced drag on a rocket and a Ford Mustang by 40% and 25%, respectively, by dimpling their surface, similar to the concept of putting dimples on a golf ball to make it fly farther. Another project involved advanced high temperatures in molten salt reactors.

Sal believes his team holds the record

for running molten salt corrosion experiments at the highest temperatures ever, 965 degrees Celsius, while leaving no visible corrosion of the materials. Sal is also proud of his recent work to promote small modular reactors, helping countries like Estonia, Armenia and Slovenia transition from shale energy to nuclear energy to become energy independent.

But one of his proudest achievements is the fluid dynamics and turbulence book he authored, "Applied Computational Fluid Dynamics and Turbulence Modeling," which is currently used worldwide.

The power of perseverance

Sal is one of those success stories that proves the power of perseverance. Sal's dad, Salvador Rodriguez Sr., came to the U.S. from Guanajuato, Mexico, when he was just 17 years old. Deciding to make something of his life, he crossed the border illegally with very little food and water and traveled through more than a hundred miles of desert. He later married Juana Barboza, also a Mexican immigrant. The couple was determined to raise a family in the U.S., prompting both to earn their U.S. citizenship. "That is the best inheritance that I have gotten," Sal Jr. said.

While his parents instilled a work ethic in Sal and his siblings, Sal pursued it far beyond their expectations. During his sophomore year in high school, some students from UCLA visited his geometry class and talked about careers in engineering. "I looked at the list, and I saw the words nuclear engineering, and I was like, 'wow, I want to be that!' I was 16. That is what opened my eyes, and ever since then that was my dream."

Sal worked in the fields with his grandmother picking strawberries and raspberries during summers and helped his




A FAMILY ADVENTURE — Sal Rodriguez with his wife and three kids in the Arctic Circle, one of the family's many adventures traveling around the world. **Photo courtesy of Sal Rodriguez**

dad irrigate to earn money. It was on one of those days that Sal's dad told him, "OK, now that you're 17, about to graduate from high school, either you join the military or you get a job, but you're on your own. What are you going to do now?"

Sal remembers that when he told his dad about his plan to go to UC Santa Barbara, to get a bachelor's degree in nuclear engineering, his dad responded with a simple "OK, good," not grasping the significance until years later.

Not done yet

Sal continues his work at Sandia while raising three kids with his wife of 26 years. Two of his kids are in college, pursuing careers in engineering like their dad, while the youngest, who is still in high school, is earning awards for chemistry. In his free time, Sal works with middle and high school kids from underserved minority populations through the Sandia Science Club he founded, and with Manos, Sandia's hands-on science and engineering program for Hispanic students. He also loves to cook traditional family recipes, has a black belt in Okinawa-style karate and plays ranchera and rock bass guitar with a band.

It's clear that Sal not only has a passion for his work but for life. He says being recognized for that passion is amazing. "When I found out that I was the first Sandian ever to get this award, that is pretty humbling. Yet I will say, the best of me is not yet out there." 

Mileposts



Todd Bowling 30



Linda Carrillo 30



Jonathan Custer 30



Eric Keiter 25



Dana Grisham 20



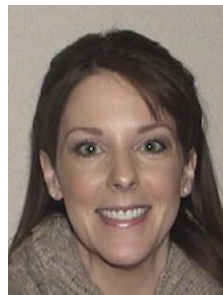
Jason Jarosz 20



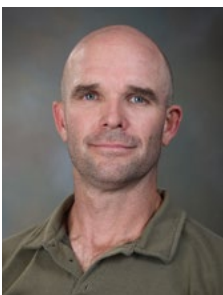
Jesse Lai 20



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Stuart Flicker 15



Mollye Wilson 15

Recent Retirees



Tammy Eldred 31

2023 HISPANIC HERITAGE

Diversity Event Day

Thursday, Sept. 21
11 a.m.–1 p.m., Hardin Field
Kirtland Air Force Base

11–11:05	Opening comments from Hispanic Outreach for Leadership and Awareness Chair Roberta Rivera
11:05–11:30	Musica Latina by DJ Bob and Steve
11:30–11:45	Presentation of the colors, national anthem by Sandia Singers
11:45–Noon	VIPs: Rita Gonzales (Sandia); Daryl Hauck (Sandia Field Office), and Col. Michael Power (377th Air Base Wing Commander)
Noon–1	Education/Awareness in Cultural Music: Albuquerque High School – Mariachi San Jose

- Food provided by Thunderbird Café (preorder), Hangry Jalapeno Food Truck, El Dorado Café
- Thunderbird Café will feature a special main dish each week of Hispanic Heritage Month
- Educational awareness information from outreach and networking groups
- Winning art from the 2022 student art contest
- Car show display

INSIDE SANDIA PODCAST

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Visit podcast.sandia.gov for more.

Weapon Intern Program celebrates 25 years

Senior mentor tells graduates
'national security is our business'

By **Kenny Vigil**

The atmosphere in the Steve Schiff Auditorium felt a bit different on the afternoon of Aug. 24 than one might experience at the venue's typical events. Instead, this "all hands" gathering was composed of families, friends and loved ones who assembled to support and cheer for this year's 22 graduates of Sandia's Weapon Intern Program.

Established 25 years ago, the program aims to accelerate knowledge transfer to the next generation of the weapons workforce. The yearlong program is geared toward employees in the national security enterprise with a Q clearance and one to 10 years of experience in nuclear weapons.

"We have a very clear and tangible mission: ensuring the U.S. nuclear arsenal is safe, secure, reliable and can fully support our nation's deterrence policy. National security is our business," said Carla Busick, a retired Sandia senior scientist who now serves as a senior mentor for the program. "Today is the start of feats to come. Your WIP credential is a passport to success."

Busick encouraged this year's graduating class — marking the 28th in 25 years — to stay in touch with their mentors and seek opportunities to mentor others. "Don't forget to express gratitude for those who helped get you here," she said.

Carolyn Buckley, a Weapon Intern Program graduate and Sandia employee, was chosen to speak on behalf of her classmates. Acknowledging the complex geopolitical landscape,



CONGRATULATIONS, GRADUATES — 2023 Weapon Intern Program graduates Benito Martinez and Anna Deberry congratulate one another at this year's graduation ceremony at the Steve Schiff Auditorium. Martinez and Deberry are among the 22 students who completed the program this year.

Photo by **Lonnie Anderson**

she said there is a lot of pressure on those working in nuclear deterrence. "What happens next is up to us," Carolyn told her classmates.

Knowledge transfer

More than 200 instructors, senior mentors and experts from across the national security enterprise share their knowledge and experiences about nuclear deterrence with the students. The intern program consists of two phases. The first six months include coursework, visits to various Department of Energy and Department of Defense sites and research projects. In the second phase, participants are embedded in an organization to work on a nuclear deterrence project. The program culminates with each participant developing a final presentation about their project for their classmates and the program management team, who then provide feedback.

In addition to Sandia employees from New Mexico and California, this year's class also included employees from the Kansas City National Security Campus, Pantex, the National Nuclear Security Administration, Y-12, Savannah River Site, the U.S. Air Force and the Air Force Nuclear Weapons Center.

With the program completed, the graduates now return to their home organizations and sites. More than 580 participants have completed the program since it was established in 1998. Students have already been selected for the 2024 class, which starts Sept. 18. [i](#)



COMMENCEMENT ADDRESS — Carla Busick, senior mentor for the Weapon Intern Program, speaks to the class of 2023 during a graduation ceremony on Aug. 24 at the Steve Schiff Auditorium. Photo by **Lonnie Anderson**

Interns support critical mission work beyond summer break

By **Erika Bonilla**

As summer nears its end, hundreds of Sandia interns return to their respective high schools, undergraduate, graduate and doctoral programs, taking their on-the-job learnings with them.

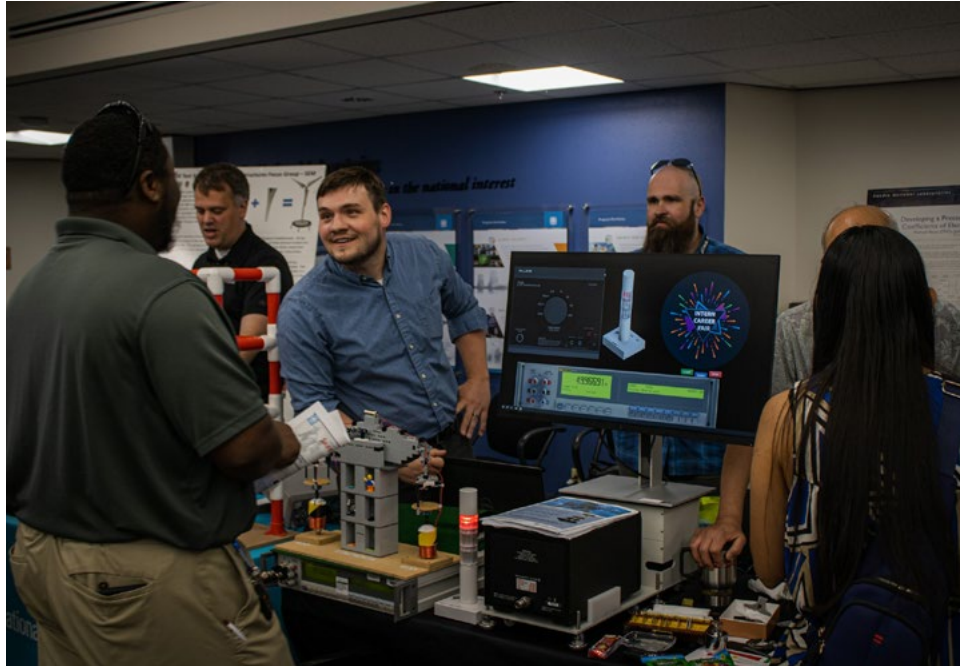
Many people begin their internship journeys during the summer but stay with the Labs, as interns, part-time or full-time staff, for years. Throughout 2023, Sandia had 1,915 interns across its sites, with 586 completing internships this summer. Last year, more than 62% of eligible students converted to full-time employment in 2022, much higher than the industry conversion rate averaging 50%.

“Our student intern programs aim to offer interns unparalleled resources in hopes of paving a seamless pathway for the next generation,” said Tally Lobato, manager of employment, staffing and



RECRUITING TOP TALENT — “As a student ambassador, having the ability to help my peers and classmates with internship opportunities that could potentially lead them to a career at Sandia is the most rewarding experience that I have ever been a part of,” year-round undergraduate intern Sadie Wicks said. In her role as a student ambassador, Sadie attended a recruiting fair this year at Georgia Tech, which is part of Sandia’s Academic Alliance Program.

Photo by **Scottie Beth Fleming**



MAKING CONNECTIONS — Interns engaged with Sandia employees on June 29 at the Intern Career Fair at the Steve Schiff Auditorium. Photo by **Taylor Bridge**

recruiting, said. “Interns are the heart of Sandia. As a former intern, I know that all students positively impact the mission.”

From research on enterprise security and industrial control systems to satellite electronics and administrative operational roles, all classifications including business, research and development, laborer, clerical, and technical interns contribute to a wide range of projects across all divisions supporting Sandia’s mission.

Behind the scenes, Student Intern Programs works year-round to offer students new programs and valuable networking resources, and to create opportunities for Sandians and retirees to support the internship community. Student Intern Programs introduces interns to Sandians of all backgrounds, provides professional development and mentoring, and links interns to a centralized **intern platform**.


Sandia’s annual **Intern Symposium** provides interns the opportunity to

present and showcase the work they conducted during their internship, while connecting and networking with Sandia leadership, technical and recruitment staff.

New programs and resources

This year, Student Intern Programs rolled out two online resources. The **intern housing and transportation** and **residential housing options** websites assist interns who seek housing, roommate and transportation accommodations in New Mexico and California. Sandians and retirees are encouraged to **post their rentals** for occupancy.

Sandia also offers the Student Ambassador Program, which trains interns to act as brand ambassadors for the Labs by offering specialized training to work directly with recruiting teams on their campuses to attract future talent.

Open internship and cooperative education positions are posted online on a rolling basis. 

National Intern Day celebrates Sandia's robust program

By **Lea Blevins**

Sandia California's Student Intern Program held a celebration to mark National Intern Day on July 27 as many closed out their summer stints with the Labs.

"We want interns to leave knowing Sandia is a great place to work, and we truly care about their professional growth and success," said Talent Acquisition Specialist Mariaelena Marcano, who leads California's Student Intern Program. "Many came up to our team to thank us for their experience this summer, so that is a testament they had a great time and felt our programming helped them find community while here at the lab."

About 70 interns joined the event, where they shared lunch, played games



BUILDING BLOCKS — Radman Zarback played giant Jenga with fellow interns at National Intern Day. Zarback, who was a research and development undergrad intern from Purdue University, said, "Research and development gives you a lot of autonomy and freedom, but also a lot of responsibility. The only person this wouldn't be good for is someone who doesn't want to be challenged. This is what you want engineering to be." **Photo by Spencer Toy**



TAKING SHAPE — Technical undergrad Avalon Keene started a year-round internship in July. A Diablo Valley College student interested in environmental science, Avalon is supporting the Environmental Safety & Health department. "I get to try out all these different things in the field I want to go into," Avalon said. "It's really cool. I would definitely tell someone to apply."

Photo by Spencer Toy

and took pictures in a photo booth. Attendees also learned about the **Critical Skills Recruiting Program**, which offers top graduates from technical bachelor's programs an opportunity to obtain a master's degree in a technical area relevant to Sandia.

Experiencing Sandia California

Sandia California hired about 100 interns during fiscal year 2023, in addition to students already in place with year-round internships. Mariaelena said California's team aligns programming with New Mexico to provide a consistent intern experience.

"Our events are generally more intimate due to attendance, so it allows us to have time to connect with interns on a personal level and connect them with colleagues and fellow interns," Mariaelena said. "Many of our interns come from out of state, so it is great to share resources and tips about living

in California and in particular the Bay Area. We encourage interns to connect early and find community while here in California."

Elanor Tang, who was an R&D graduate intern, marked the last day as an intern in late July. Tang learned about Sandia through a career fair where a recruiter knew other graduate students who interned with Sandia.

"This is the kind of internship that I looked for," said Tang, who is working on a master's in computer science. "This is research that's different than what I've done at the University of Michigan, so it was cool to explore that."

Working with interns

Sam Pollard worked with five interns over the summer and served as Tang's mentor. He was a Sandia intern for three years before becoming a full-time employee.

"I have a limited amount of time to pursue the topics I want to work on,



SPEAKING TO STUDENTS — Mariaelena Marcano, Sandia California's Student Intern Program lead, said the team coordinates with their New Mexico counterparts for a consistent intern experience. **Photo by Spencer Toy**

but an intern can get really focused and make a lot of progress on those things," Sam said. "Having someone to talk with about an idea really forces you to clarify and understand it better, and I enjoy that process."

Trying new things


Many Sandia interns work in R&D and technical positions, though interns take on business and clerical roles as well. Daniela Rodriguez started as an intern working with Human Resources on the Student Intern Program and transitioned to full-time staff coordinator for the program in June 2022.

"It was fairly easy because of my mentors," Daniela said. "They made a successful track for me to move over to my current role."

Daniela works with team lead Mariaelena as well as New Mexico to make Sandia's intern program as robust as possible. Mariaelena said the team

encourages managers to submit job postings early during the big recruitment season from August to November to keep up with Fortune 500 companies who are also recruiting for the following summer.

The team is constantly planning for the next year, and that includes making sure interns have a positive experience. Celebrations such as National Intern Day and other social gatherings help interns connect with one another and get involved with a variety of opportunities during their time with Sandia. Whether for a summer or a year-round internship, these experiences allow interns to work on real projects with top professionals in their field.

"My hope is that they get to walk away and say, 'Wow, I really learned so much and made the right decision by coming to Sandia,'" Mariaelena said. "If we can accomplish that, then we've won." 

A visit to the top of the world

By **Jeff Heath**

When I joined Sandia in April 2022 as the associate labs director for Infrastructure and Security Operations, I made it a goal to visit all the Labs' sites to better understand the activities happening at each facility and their specific operational challenges.

My most recent trip took place in July, when I traveled to "the top of the world" to see two Alaska sites managed by Sandians in the Integrated Security Solutions division. My travel companions included leaders from the Facilities Area Management organization responsible for obtaining and maintaining Sandia's remote facilities.

Oliktok Arctic Research Center

First up on our tour was the Oliktok Arctic Research Center at Oliktok Point, a cape that juts out into the Arctic Ocean. Sandia manages the site's special use airspace for the Department of Energy's Arctic Energy Office and other sponsors. I learned that this capability provides opportunities for terrestrial, marine and atmospheric research, including airborne studies and testing with platforms like tethered balloons and unmanned aerial vehicles.



MEETING MISSION COMMITMENTS — Jeff Heath, left, associate labs director for Infrastructure and Security Operations, and engineer Fred Helsel stopped at Oliktok Point to learn how the site is meeting its net-zero-emissions goal. **Photo by Matt Cattaneo**

Interested in reducing the site's environmental footprint, the team at Oliktok is actively working to achieve net-zero emissions at the site. We observed a wind turbine and **bifacial photovoltaic system** already installed by the team, in partnership with the photovoltaics and materials technology department, to provide clean, renewable energy. Going a step further, they are talking with the U.S. Air Force about the potential for shore power to further reduce dependence on fossil fuels.

North Slope of Alaska user facility

From Oliktok, we traveled west to the North Slope of Alaska user facility in Utqiagvik, Alaska. Utqiagvik is the northernmost point in the U.S. and **notoriously hard to reach**. Sandia has managed this Department of Energy Atmospheric Radiation Measurement user facility for **more than 25 years**. This site provides a broad network of scientific users with access to instruments and data — some of which were designed specifically for high latitudes — to gather data on cloud and radiative processes.

Our group witnessed the launch of a weather balloon and learned how switching the lift gas used in the balloons from helium to **hydrogen produced on-site** has reduced transportation costs and associated greenhouse gas emissions of transporting helium to the North Slope. Being at the site in person allowed me to better appreciate the thinking and measures that go into ensuring a safe launch. As explained by Andy Glen, manager of Sandia's atmospheric sciences research group and one of our tour guides, conducting research in the Arctic is very complex and is often 90% logistics and 10% science.



COOLER CLIMES — Melting snow and ice can present challenges to accessing some of Sandia's Arctic facilities. **Photo by Matt Cattaneo**


I also learned from Andy and the team that Alaska's North Slope is a prime location for studying climate change. These facilities give Sandia and the broader scientific community an advantage in being able to understand and address both science and security issues in the Arctic.

Sandia teamwork in the Arctic

While awed by the beautiful landscape, I was even more impressed by the teams that keep these Arctic facilities running effectively and efficiently. Their responsive, flexible approach to operating these sites ensures Sandia can meet mission commitments, even in the harshest of environments.

I want to take this opportunity to recognize and thank our Sandia team — Ben Bishop, Fred Helsel, Todd Houchens, Justin LaPierre and Valerie Sparks — and North Slope of Alaska site operators Jimmy Ivanoff, Josh Ivanoff and Craig Moore. Thank you also to my travel companions: Rafael Gonzalez, Todd Tillman, Matt Cattaneo, Andy Glen and Alicia Brown.

This visit provided me with great insight into how the Infrastructure and Security Operations and Integrated Security Solutions divisions can continue working together to strengthen Sandia's Arctic presence, now and in the future.

Not planning any travel to the top of the world? I encourage you to take a **virtual tour of the North Slope of Alaska user facility** to get a sense of the instruments used and the research made possible by our hardworking teams. 



GATHERING DATA — The group from Infrastructure and Security Operations observed the photovoltaic system installed atop a shipping container at Oliktok Point.

Photo by Matt Cattaneo