SANDIA LABNEWS
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AI-informed solar tracking **Page 7**

California & Beyond Edition

Protecting the grid with artificial intelligence

New neural network detects physical issues, cyberattacks

By **Mollie Rappe**

The electric grid powers everything from traffic lights to pharmacy fridges. However, it regularly faces threats from severe storms and advanced attackers.

Sandia researchers have developed brain-inspired AI algorithms that detect physical problems, cyberattacks and both at the same time within the grid. And this neural-network AI can run on inexpensive single-board computers or existing smart grid devices.

"As more disturbances occur, whether from extreme weather or from cyberattacks, the most important thing is that operators maintain the function and reliability of the grid," said Shamina Hossain-McKenzie, a cybersecurity expert and leader of the project. "Our technology will allow the operators to detect any issues faster so

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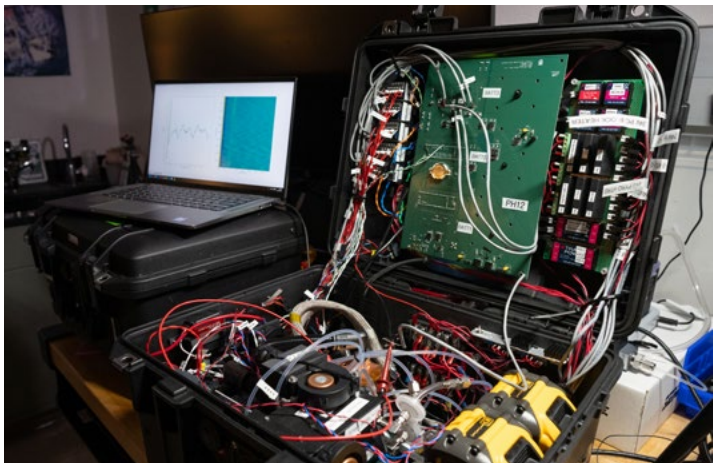
DEPLOYING SECURITY — Sandia cybersecurity expert Adrian Chavez, left, and computer scientist Logan Blakely work to integrate a single-board computer with their neural-network AI into the Public Service Company of New Mexico's test site. **Photo by Bret Latter**

Homeland Security Startup Studio breathes life into Sandia tech transfer



STARTUP STUDIO SENSOR — The volatile organic compounds sensor device is sized for portability. **Photo by David Lienemann**

Program brings together inventors, entrepreneurs and mentors

By **Lea Blevins**

Take a deep breath. Exhale. Now imagine you just completed a noninvasive test for disease and infection with rapid results.

Thanks to Sandia and its work with the Homeland Security Startup Studio, this may one day become a reality for the medical industry and beyond.

"There's a ton of information in your breath about the state of your body," said chemical engineer Scotty Bobbitt, lead researcher on the project. "Someday, you'll go to the doctor and

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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.

LOOKING FORWARD — Associate Labs Director Toby Townsend leads the Deterrence, Science and Energy Division with optimism and wonder at what Sandia's scientists create every day.

Photo by Spencer Toy

Defining the possible, one day at a time

By **Michael Ellis Langley**

Associate Labs Director Toby Townsend sees a world of possibility that, until he was appointed the leader of Sandia's Deterrence, Science and Energy Division earlier this year, he didn't know existed.

"There's always something else that we're doing that I didn't know we did," Toby said. "I have taken the opportunity to make my way around and meet people doing research and engineering projects that I was unaware of before taking this seat. I'm already incredibly proud of and love to brag about our team and what they're doing."

Toby has spent almost 30 years at the Labs, starting as an intern in 1999 before holding leadership roles in Sandia's space and nuclear nonproliferation programs, among others. While he is considered an expert in nuclear deterrence circles, his focus now is on what's next for the division and the Labs.

The era of artificial intelligence

"It's a pretty exciting time to be at the Labs and to be alive, quite honestly, watching the explosion of, and what I'd say is the revolution of, AI," he said. "I think it'll be foundational on the research side, on the engineering side and on the operations side."

Toby added that while the computational capabilities are manifesting themselves right now, other discoveries are happening at an eye-opening pace.

"Ten years ago, we would have thought it was impossible, and it would have taken us decades to accomplish something that we — the human race — can now accomplish in days," he said, adding that there are also security issues to prepare for. "In the national security lens, it is a bit concerning what an adversary might utilize this technology to do."

Toby also sees the ethics of how we use AI, recalling Sandia's history in responsible development and stewardship of defensive technologies.

"Sandia has had to think deeply, for its entire existence, about creating technology, specifically nuclear weapons and the always-never conversation," he said, referring to the standard that weapons should always work when ordered by the U.S. president and never any other time. "It's deeply ingrained and embedded in us. When we think about an emerging technology, we think about how might it be used and how do we want it used? Our history gives us a strong foundation to stand upon when we're thinking of things like AI, biomanufacturing and these new emerging capabilities and technologies. I'm grateful that culturally, that's how we attack and look at problems."

Change is challenging, not fearsome

That knowledge and belief in Sandia is how Toby knows that whatever changes in our world occur, the Labs are prepared to lead.

"I watched us pivot to be responsive after 9/11 to the counterterrorism mission. I watched us as an institution rise to that occasion and contribute in meaningful ways," he said. "I watched us as an institution manifest through COVID-19. We rose to the occasion. We found new ways, we embraced virtual and remote work, and we continued to deliver every day in the midst of a pandemic."

Sandia, Toby said, will embrace the changes being brought by AI and other emerging technologies, as they will allow the Labs to deliver the mission more efficiently.

Division in the lead

In fact, Toby sees people around the California and New Mexico sites who are focused only on creating the nation of the future.

"I think the power of being a federally funded research and development center in a national laboratory is that we get to work on the precipice of science, on foundational science — activities that we don't yet know exactly how they'll be implemented or how they will make life better for everyone," he said. "The cool thing about Sandia being predominantly an engineering laboratory is that as our scientists make those discoveries, they are comingled with engineers here that drive those discoveries towards application."

That is even more obvious in the Deterrence, Science and Energy Division he leads — a division that, as its name implies, works on programs and projects that cut across every Sandia mission.

"That is the kind of ecosystem that makes us special: We have fundamental breakthroughs and then, almost through osmosis I would say, that application-specific drive to build product by our engineers enables us to take those breakthroughs and get them into the hands of the people who need them," Toby said.

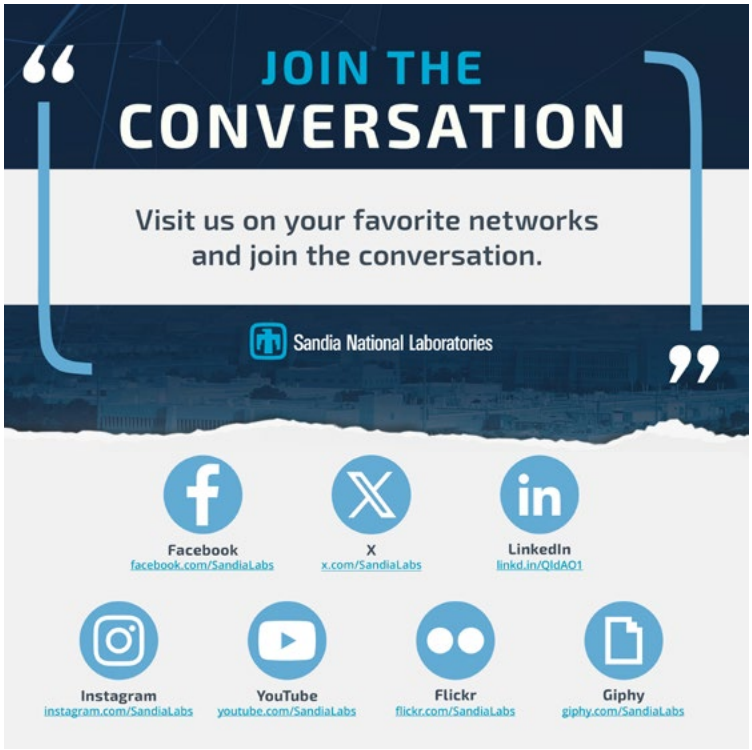
Toby pointed specifically at the newest nuclear deterrence modernization program led from the Livermore site, which is being developed to pair with the U.S. Navy's nuclear-armed sea-launched cruise missile, SLCM-N.

"It's pretty exciting to get to partner with Lawrence (Livermore National Laboratory) on a Navy system, and to be trusted and bestowed the responsibility to deliver a critical tool to meet a national emerging need at a rapid pace that is going to take an incredible amount of creativity and a lot of long hours," he said. "The fact that the division was trusted by the Navy, NNSA and Sandia at large with that responsibility makes me incredibly proud of who we are and how we showed up for the last decade to earn that trust. And I know that we will deliver."

New reality, same conclusion

As Toby continues to meet as many people in his division as he can and learn about the many projects he now is responsible for, his conclusion is the same one he came to more than 25 years ago when he began his Sandia journey.

"I am optimistic that this division will continue to have regular breakthroughs," he said. "It brings a smile to my face every day knowing that I'm part of an institution and in the organization that on a weekly basis is doing something once thought impossible."



GriDNA

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that they can mitigate them faster with AI."

The importance of cyber-physical protection

As the nation adds more smart controls and devices to the grid, it becomes more flexible and autonomous but also more vulnerable to cyberattacks and cyber-physical attacks. Cyber-physical attacks use communications networks or other cyber systems to disrupt or control a physical system such as the electric grid. Potentially vulnerable equipment includes smart inverters that turn the direct current produced by solar panels and wind turbines into the alternating current used by the grid, and network switches that provide secure communication for grid operators, said Adrian Chavez, a cybersecurity expert involved in the project.

Because the neural network can run on single-board computers, or existing smart grid devices, it can protect older equipment as well as the latest equipment that lack only cyber-physical coordination, Shamina said.

"To make the technology more accessible and feasible to deploy, we wanted to make sure our solution was scalable, portable and cost-efficient," Adrian said.

The package of code works at the local, enclave and global levels. At the local level, the code monitors for abnormalities at the specific device where it is installed. At the enclave level, devices in the same network share data and alerts to provide the operator with better information on whether the issue is localized or happening in multiple places, Shamina said. At the global level, only results and alerts are shared between systems owned by different operators. That way operators can get early alerts of cyberattacks or physical issues their neighbors are seeing but protect proprietary information.

The Sandia team collaborated with experts at Texas A&M University to create secure communication methods, particularly between grids owned by different companies, Shamina said.

Developing the neural network

The biggest challenge in detecting cyber-physical attacks is combining the constant stream of physical data with intermittent packets of cyber data, said Logan Blakely, a computer science expert who led development of the AI components.

PROTECTIVE DEVICES — Several single-board computers with Sandia's neural-network AI connected into the Public Service Co. of New Mexico's test site. The Sandia researchers are testing how well the code can detect cyberattacks and physical issues in the real world. **Photo by Bret Latter**

Physical data such as the frequency, voltage and current of the grid is reported 60 times a second, while cyber data such as other traffic on the network is more sporadic, Logan said. The team used data fusion to extract the important signals in the two different kinds of data. The collaborators from Texas A&M University were key to this effort, he added.

Then the team used an autoencoder neural network, which classifies the combined data to determine whether it fits with the pattern of normal behavior or if there are abnormalities with the cyber data, physical data or both, Shamina said. For example, an increase in network traffic could indicate a denial-of-service attack while a false-data-injection attack could include atypical physical and cyber data, Adrian said.

Unlike many other kinds of AI, autoencoder neural networks do not need to be trained on data labeled with every type of issue that may show up, Logan said. Instead, the network only needs copious amounts of data from normal operations for training.

The use of an autoencoder neural network makes the package pretty much plug and play, Shamina added.

Putting the code to the test

Once the team constructed the autoencoder neural network, they put it to the test in three different ways.

First, they tested the autoencoder in an emulation environment, which includes computer models of the communication-and-control system used to monitor the grid and a physics-based model of the grid itself, Shamina said. The team used this environment to model a variety of cyberattacks or physical disruptions, and to provide normal operational data for the AI to train on. The collaborators from Texas A&M University assisted with the emulation testing.

Then the team incorporated the autoencoder onto single-board computer prototypes that were tested in a hardware-in-the-loop environment, Shamina said. In hardware-in-the-loop testing, researchers connect a real piece of hardware to software that simulates various attack scenarios or disruptions. When the autoencoder is on a single-board computer, it can read the data and implement the algorithms faster than a virtual implementation of the autoencoder can in an emulation environment, Adrian said. Generally, hardware implementations are a hundred or thousand times faster than software implementations, he added.

The team is working with Sierra Nevada Corp. to test how Sandia's autoencoder AI works on the company's existing cybersecurity device called Binary Armor, Shamina said.

"This will give a really great proof-of-concept on how the technology can be flexibly implemented on an existing grid

security ecosystem," she said.

The team is testing both formats — single-board prototypes interfaced with the grid and the AI package on existing devices — in the real world at the Public Service Co. of New Mexico's Prosperity solar farm as part of a Cooperative Research and Development Agreement, Shamina said. These tests began last summer, Adrian said.

"There's nothing like going to an actual field site," Adrian said. "Having the ability to see realistic traffic is a really great way to get a ground-truth of how this technology performs in the real world."

The team also worked with PNM early in the project, to learn what AI design might be most useful for grid operators. It was during conversations with PNM staff that the Sandia team identified the need to connect cyber-defenders with system operators rapidly and automatically.

Future directions

This project built off and expanded upon a previous R&D 100 Award-winning project called the Proactive Intrusion Detection and Mitigation System, which focused on detecting and responding to cyber intrusions in smart inverters on solar panels, Shamina said. The team also is expanding upon the autoencoder AI in similar projects, she added.

The team filed a patent on the autoencoder AI and is looking for corporate partners to deploy and hone the technology in the real world, Shamina said.

With a bit more work, the autoencoder could be used to protect other critical infrastructure systems such as water and natural gas distribution systems, factories, even data centers, Adrian said.

"Whether or not our technology succeeds in the market, every utility around the world is going to need a solution to this problem," Logan said. "This is a fascinating area to do research in because one way or another, everyone is going to have to solve the problem of cyber-physical data fusion."

The project is funded by Sandia's Laboratory Directed Research and Development program.

EYE ON THE GRID — Watch a three-minute video about Sandia's neural-network AI and how it can detect physical problems, cyberattacks and both at the same time in the electric grid.
Video by Mark Means

Homeland

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do a breath test just like they take your blood pressure. That's the future I'm envisioning."

Scotty isn't the only one picturing the potential.

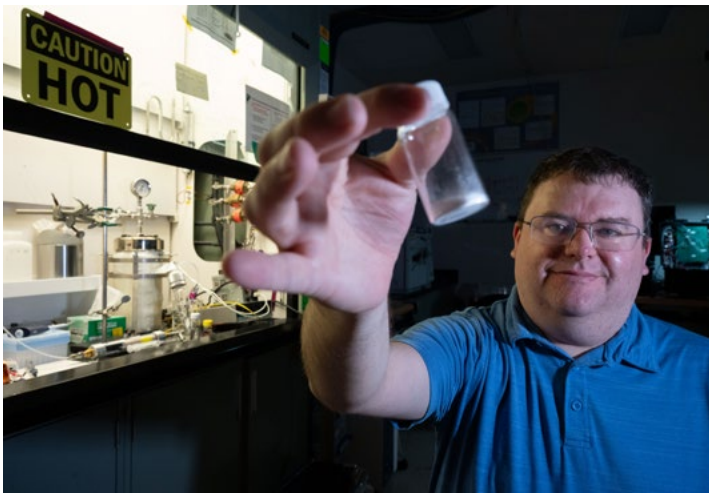
The Homeland Security Startup Studio, sponsored by the Technology Transfer and Commercialization Branch under the Department of Homeland Security, chose the technology he and his research partners developed to be part of the innovative program for 2025.

The program brings together entrepreneurs, mentors and inventors to help move cutting-edge technologies from lab to market.

"I recommended this technology, and it got picked up by entrepreneurs involved in the startup studio," said Bob Sleeper, Sandia licensing executive. "It's one of our defined missions — to take our inventions and commercialize them for the greater good of our country. We like making that impact and seeing that technology get out there. That's why we do what we do."

A breath of fresh air

The original Laboratory Directed Research and Development project studying breath analysis came about during the COVID-19 pandemic with the concept of developing a rapid, noninvasive test.



MAGICAL MOF — Chemical engineer Scotty Bobbitt holds a vial of the metal-organic framework sorbent, MOF-808-F5. **Photo David Lienemann**

"There are biomarker molecules in your breath that are produced by different metabolic processes, and you can measure those and tie them back to disease or infection," Scotty said.

The study involved developing porous crystals known as metal-organic frameworks, or MOFs, as highly selective sorbents to capture targeted volatile organic compounds, or VOCs.

"MOFs are my favorite materials," Scotty said. "They're fascinating because they're made from metal nodes connected by organic linkers, and you can put them together in a modular way, like Tinkertoys, and tailor the selectivity or the performance of the material to what you want."

But there's a catch when it comes to breath. Not only can the level of VOCs be low, but researchers also had to contend with humidity. Water in the breath competes with the target VOCs, so the research team focused on developing hydrophobic materials and used a preconcentrator sorbent to more effectively capture VOCs for detection.

"I would test the MOFs against known concentrations of known chemicals to see which MOF would hold on to what compound better," said chemist Jason Sammon, who was part of the research team. "We would test this over a variety of relative humidities using a system in the lab that can generate chemical standards in a vaporous form."

A winning combination

While the pandemic spurred the research, Scotty worked with the startup studio's entrepreneur team to determine what applications might make the best entry point in the market.

"The concept of breath analysis is very broad," he said. "You could apply the same concept to virtually anything because lots of diseases result in VOCs in your breath."

The startup studio team Scotty has been working with consists of a health insurance director, a physician and a medical technologist who bring broad expertise from the medical landscape. During the process of the startup studio, which ran from February through May, the team identified sepsis as one of the life-threatening conditions that this technology could help detect.

This became the basis for the final presentation in June for the studio's Converge 2025 competition that showcased the final pitches for breakthrough technologies. The team earned the Judge's Choice award for their entrepreneurial pitch to use Sandia's technology to detect sepsis.

"The judges are really looking at market fit, next steps and future road map," said Kristi Rose, project manager for FedTech, which runs the startup studio for DHS. "Winning Judge's Choice was due to the team having a great relationship with the tech transfer office at Sandia and also the great relationship they have with the inventor, Scotty."

Since completion of the startup studio, the team of entrepreneurs incorporated as BioChem Medical and is actively negotiating a license with Sandia, writing government funding proposals and seeking private investors. While the startup studio officially ended, Scotty continues to meet with them and learn about their progress in obtaining funding.

CAPTURING COMPOUNDS —Chemist Jason Sammon packs a glass sorbent tube with the metal-organic framework powder, which forms the preconcentrator to capture volatile organic compounds.

Photo David Lienemann

"It's such a cool program because a lot of times we invent something but there's no clear mechanism to get it out into the world," Scotty said. "It's very valuable to have something like this that brings people together."

Waiting to exhale

In addition to having the ability to detect COVID-19, influenza, sepsis, lung cancer, kidney failure and a host of other infections, the MOF technology could one day be used to detect fentanyl.

The research team, also composed of Mike Chandross and Dorina Sava Gallis, is working to integrate existing Sandia inventions with the MOF VOC sensor technology to create a portable solution — about the size of a shoebox — that could allow first responders to quickly determine if someone has fentanyl in their system so they can receive life-saving treatment.

"These detection systems are important for the Department of Homeland Security for fentanyl, for diseases and for the overall health of our country," Bob said, reflecting on licensing opportunities. "This would be the first real commercialization of Sandia's MOF technologies."

Jason echoed how great it feels to watch Sandia's research of MOFs be considered for helping both in a diagnostic sense and in the interest of national security.

"It's really neat to see that tech maturation from testing these little MOFs in my lab and getting data to having the potential to be turned into a product that will help people and provide other diagnostic capability," he said.

The technology is currently patent pending, and Scotty is looking forward to seeing how far it can go while working with the BioChem Medical team he connected with during the startup studio.

"One of the neat things about this project is this was led by molecular-level simulation, so it started very fundamental with theory and then moved up through benchtop synthesis and lab tests," Scotty said. "And now, hopefully — fingers crossed — it becomes a real product. A lot of times people in simulations work at a very low Technology Readiness Level, and we're a bit far removed from the real-world application of things. Seeing something all the way through from a model on a computer to potentially a real product is gratifying."

Scanning the sky, looking for light

Machine-learning process can help make electricity production more efficient

By **Michael Ellis Langley**

For solar farms that rely on the sun to generate power, rain or even a cloudy day can really cast a shadow over this natural energy resource. But Sandia engineers may have a way to keep power flowing from these large solar harvesters and cut costs for energy companies.

Engineer Dan Riley and his team have patented a **machine-learning method** that finds the brightest point in the sky so that photovoltaic arrays mounted on single-axis trackers can collect the most solar energy.

"When the sun is visible, we just point the tracker toward the sun, but if the sun is obscured by a cloud, then the utility of pointing at the sun is greatly reduced, and in fact it's often more advantageous to not point at the obscured sun," Dan said.

On cloudy days, finding the brightest spot in the sky to harvest the most solar energy can be tricky. Right now, photovoltaic array operators input the sun's path into the software controlling the angle of the solar panels, so they move and point at the sun all day long. But in cloudy conditions, the brightest spot is not necessarily where the sun is.

Dan's method uses machine learning to find the best spot by training an algorithm using thousands of sky images taken by a fish-eye-lens camera. These images are compared to images on any given day and used to help point the photovoltaic panels at the likely brightest spot in the sky.

SUN SEEKERS — A machine-learning process created by Dan Riley and his team can make solar farms more efficient. **Photo courtesy of Getty Images**

"We don't natively have a good feeling for the amount of energy that you could get from a bright pixel, and part of that is the camera's limitations," Dan said. "It's not really a calibrated device for determining the amount of solar radiation in any particular plane. The machine-learning algorithm, in our case a convolutional neural network, is trained to find the brightest path in a sky image. This training from sky images allows us to then get the same information as we would from a very precise and expensive sensor."

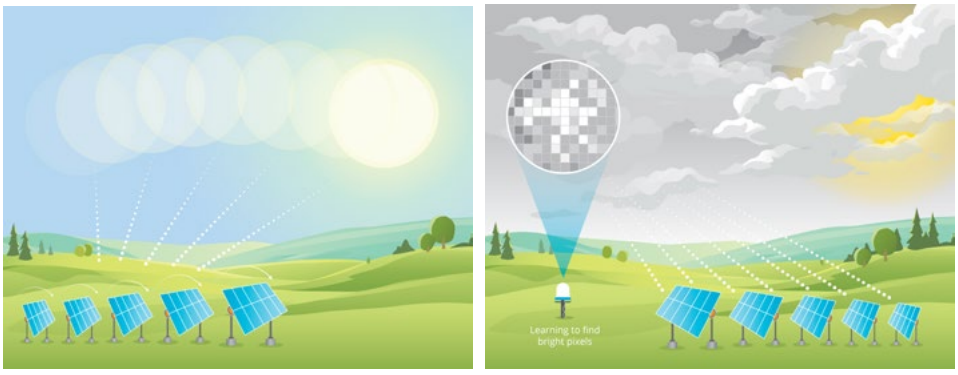
The initial project, funded by DOE Solar Energy Technologies Office, ended in September 2024. Dan and his team are now working on timing the tracker to move for peak efficiency.

"The next research step is determining not only where to move the tracker rotation angle to capture the most solar energy but when to move to capture the most energy," he said. "Since single-axis trackers have a relatively slow movement rate, it is important that they only point away from the sun when the sun is obscured by a cloud. They should be ready to quickly move to point at the sun when it is no longer obscured."

If companies can build upon the technology developed at Sandia, the efficiencies realized would reduce the number of photovoltaic panels, the land needed and the amount of support equipment, thereby reducing the cost to generate the same amount of energy.

"By increasing the energy generated by photovoltaic systems, we increase the efficiency of the system. By increasing the energy generated during cloudy periods, we also reduce variability," Dan said. "As single-axis tracker-mounted PV becomes a larger component of the U.S. energy mix, increasing the energy generated by these systems may allow for smaller PV plants, reduced capital expenditure on new plants, and ultimately, lower energy costs."

Businesses have the opportunity to license **Sandia's Single Axis Tracking via Sky Imaging and Machine Learning patent** and forge a partnership with the Labs.

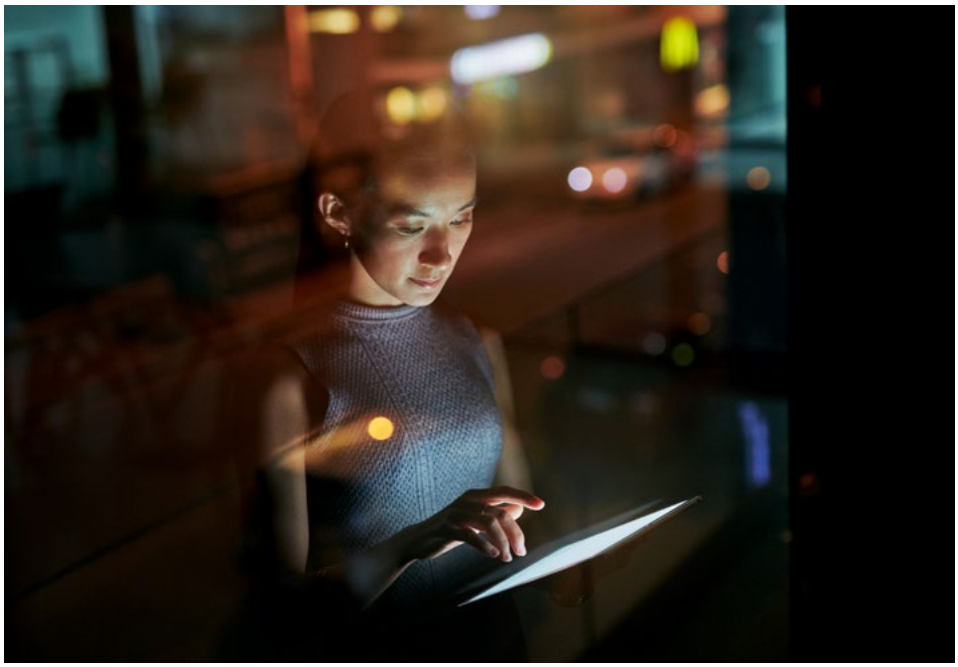


LOOK FOR THE LIGHT — On the left, photovoltaic panels can be controlled to tilt toward the expected track of the sun through the sky. On the right, in overcast conditions when the sun is not fully visible, the machine-learning process can help solar farms find the brightest spot in the sky no matter where it is. **Illustrations by Brent Haglund**

Finding connections to inform applied science

One team uses a systems approach to find the nexus of technology and human experience

By **Sarah Jewel Johnson**



INTERFACE — A group of Sandia scientists are looking at how to design facilities and technologies that consider how the communities that interact with, react to and accept them.

Photo courtesy of Cecelia Arcurs, Getty Images

Technological advancements abound at Sandia, but one team is developing a key capability that dramatically impacts the application of new and existing technologies.

"We are at the nexus of technology and human interfaces. You cannot design a technical system in a vacuum — you have to consider how it will impact everything around it," said Carmen Mendez, manager of Sandia's Nuclear Energy Fuel Cycle Sociotechnical Systems group.

Carmen and her team of social scientists, engineers and program managers apply **sociotechnical systems analysis and design** to a diverse set of technical spaces, including the siting of nuclear waste facilities.

Identifying connections

"Sociotechnical systems design recognizes the interaction between people and technology and considers both social and technical factors that influence the functionality, practicability, acceptability and usage of a system," Carmen said.

The team holistically analyzes five work-system elements: people, technology and tools, tasks, policies and organization, and the environment.

"Sociotechnical systems analysis looks at how technical systems integrate with social systems. We consider social processes and factors that influence how technical systems are both created and implemented," said Lauren Drakopulos, a sociotechnical systems analyst on the team.

The purpose of evaluating the five work-system elements is to establish an understanding of how each element potentially impacts another and to better understand how a system can remain balanced. The team has applied the model to diverse applications within the nuclear energy fuel cycle and beyond.

"If I were to take a current-fleet nuclear reactor away and replace it with a hypothetical advanced reactor, what changed? Maybe the disposal of waste is different, or the maintenance schedule, the training needs for the operator, or the location and surroundings of the facility? The whole thing is rooted in a holistic perspective," Carmen said.

"Or let's consider the siting of a hydrogen or carbon capture facility," Lauren said. "With a holistic sociotechnical approach, we can look at facilities with completely different purposes, but similar in nature, to understand commonalities. We can look at social and environmental qualities, like demographics, geographic conditions, community perspectives and news headlines that tell us how people are talking about the facility. We can evaluate these different dimensions to determine what factors make a siting attempt successful or unsuccessful," Lauren said.

By understanding the factors that surround a technology, we can better understand impacts and capabilities of that technology.

Real-world applications

The diverse application space of sociotechnical systems analysis allows the team to apply the framework to various siting needs to support national security and energy production.

"We assist the DOE's Office of Collaboration-Based Siting in developing a robust metrics program by collaborating with leadership to define and operationalize key programmatic metrics," Lauren said. "Our efforts include evaluating existing information needs, identifying gaps and proposing new data reporting methods, ultimately collecting and reporting metrics from six national laboratories and the DOE to enhance strategic planning and data-driven decision-making."

The Sandia team is also part of the Consortium Advancing Technology for Assessment of Lost Oil and Gas Wells, or CATALOG, that surveys programs that leverage technology to empower nonexperts in collecting environmental data,

identifying key features that contribute to their success. The group's scope of work includes analyzing recruitment and training strategies, uncovering technical and nontechnical barriers to technology adoption and developing actionable recommendations and best practices to enhance CATALOG efforts and ensure that their solutions effectively address stakeholder needs and challenges.

The team's expertise also applies to the ever-growing focus on grid infrastructure and energy production.

"We are also collaborating with technology developers and grid experts to create a microgrid resilience planning tool that helps decision-makers harden microgrids against environmental hazards by identifying and prioritizing risk mitigation alternatives," Lauren said.

Storytelling as data

"Stories create the whole picture," said Gretchen Gano, a sociotechnical systems analyst. "Some of the most compelling evidence and information is in the form of stories and testimonies that really engage people in understanding what's happening on the ground."

The Sandia team focuses their efforts on collecting as much data as possible — data that corresponds directly to the five work-system elements of sociotechnical systems design. They don't focus only on human factors, but instead view the elements as a broader social process that can be influenced by tools, tasks and organizations.

"We bring social concepts into the early design of whatever project we are doing so we have a more holistic understanding of the systems. Right now, we're working on collaboration-based siting of nuclear waste facilities, but we are also doing work on oil and gas infrastructure, microgrid planning and other technical topics," Carmen said.

The team combines concurrent engineering — a nonlinear, systematic approach to product and process design — and sociotechnical systems principles to create a potential roadmap for siting facility types and facilitating technology deployments. However, unlike previous models, this work is informed through community narratives, historical knowledge, technical documents, operations and business analytics, and countless data points.

"Our data could include newspaper articles, permitting documents, website materials and interviews. We triangulate data from across different sources to gain a variety of perspectives. Interviews with stakeholders provide unparalleled insights that we wouldn't otherwise capture. For example, in collaboration-based siting, we interviewed experts that had gone through similar experiences attempting to site large-scale facilities. Even though they may have been working in different industries or sectors, they had valuable lessons to share about siting that are applicable to nuclear waste facilities," said Lauren.

Gretchen explained that the sociotechnical systems approach accounts for community involvement, unlike other more traditional regulatory or siting processes. Oftentimes, the team is invited into the process so they can accurately capture diverse aspects of needs and demands.

"I think that's the challenge," Gretchen said. "Not staying in your corner but being invited into communities to discover pockets of knowledge that become a trusted synthesis of potential risks or a potential way forward."

Capitalizing on Sandia's systems

Sandia is known for systems engineering, so it's no surprise that the team relies on a systems approach to capitalize on existing technical capabilities across the Labs.

"Sandia does a lot of highly advanced technological work, but because it's so advanced in nature, sometimes the work can't be easily deployed or may be difficult to take to market. We are focused on the deployment of the technology. Our sociotechnical team is hoping to take all of Sandia's best strengths and make them more readily available through deployment and integration," Carmen said.

The team inhibits siloed and compartmentalized technological processes, and instead focuses on understanding possible implications and outcomes at the inception of the process. They think about deployment, application and human factors when others are thinking of technical specifications and regulations.

WAYFINDERS — Sandia Nuclear Energy Fuel Cycle team members participate in focus groups to identify knowledge management strengths and needs. Findings from focus group discussions inform critical knowledge roadmaps and upcoming deep dive content.

Photo by Janette Meacham

"The intent of this team was to bring together a group of skills unique to Sandia and apply our rigor into a field that is typically not touched by national labs," Carmen said.

Due to the uncommon nature of their research space in the national lab complex, the team has faced many hurdles. They've encountered challenging policies that academia typically does not have to work through, and, like academia, they must have a firm understanding of Internal Research Board standards and requirements. But the additional efforts are worth the unmatched understanding sociotechnical analysis creates.

"We are thinking about how to make sure that the people receiving the technologies are understanding impacts," Gretchen said, "and part of that is using the resources we have at Sandia."

Lauren agreed. "There are just so many opportunities at Sandia to matrix with folks who are doing great work, and it's also what helps to contribute to that unique manifestation — because Sandia brings a systems analytical lens."

The team uses their backgrounds and research experience to make widespread impacts in the deployment and application of critical technologies.

"Whatever the technology is, the users are the people who are going to be most directly impacted by the success or failure of that technology," Lauren said. "So, we try to look for ties to connect with their experiences instead of thinking about them as some sort of nameless, faceless entity."

Learning to speak science

A California intern details how Sandia redefined her passion

By **Amelia Harrison**

As a previously aspiring marine biologist, I never felt discouraged when I realized conducting research in a lab wasn't for me. Rather, I wanted to use my fascination and love of science to help others understand complex topics, which has now come to life through Sandia's intern program.

I joined Sandia in the Deterrence, Science and Energy Division's communications department on May 5. From the moment I was hired, I've enjoyed opportunities to grow and challenge myself in a national lab environment.

My role as an intern in Community Involvement has provided meaningful perspective into my professional and academic aspirations, specifically in the field of science communication.

Early exposure, deep fascination

From a young age, I've been connected to the ocean and fascinated by the creatures within. This curiosity has fueled a desire to explore the ocean's environment. However, when it came to science, I found that I didn't have the knowledge or resources to develop an in-depth understanding.

Bridging the gap between communication studies and complex scientific issues seemed out of reach. While studying communication and the environment at San Jose State University I became intrigued by the possibilities of becoming a scientific communicator. I received a scholarship for an essay I wrote regarding my desire to combine communication studies with science to change the world. The primary focus of my essay was illustrating the importance of educating and informing others on scientific matters that can dramatically affect the general population and the natural world.

Connecting with the community

At Sandia, our mission is to render exceptional service in the national interest, and a significant way to accomplish this is by connecting directly with our local communities.

A critical aspect of working as the Community Involvement intern is teaching science, technology, engineering and math to children. Kids are the future of science, and it's critical to expand their knowledge and understanding of complex scientific issues. This passion for teaching a STEM curriculum to children has further reignited my passion toward science communication.

Interns are often depicted as doing grunt work or delivering coffee. It's an often-used trope in our culture. However, my role at Sandia challenges that narrative — our perspectives, voices and opinions are not only acknowledged but also valued. While here, I've felt encouraged by the teamwork and collaboration occurring all around me.

My first experience observing this culture at the Labs was through Kids Day, an event that welcomed nearly 200 fifth through 12th grade students to Sandia California in June. I was selected to help organize the event, despite how new I was.

My role during Kids Day included crafting surveys and serving at an engineering activity with Lawrence Hall of Science. In addition, I was able to design an interactive activity and photobooth with Chip Watson the robot dog where I could share about the significance of robotics for safety and security.

SERVICE WITH A SMILE — Community Involvement intern Amelia Harrison is a student at San Jose State University majoring in communication studies. **Photo by Spencer Toy**

DEVELOPING DREAMS — Michael Shaik, former Community Involvement intern, carries supplies for the Sleep in Heavenly Peace bed build. Sandia partnered with a local nonprofit that supplies beds for children in need. **Photo by Spencer Toy**

It was incredible to witness everyone's desire to work across organizations and departments to ensure the children experienced an unforgettable time visiting Sandia.

Investigating internship interests

Aside from Kids Day, I've received other incredible opportunities, including conducting interviews with two Labs leaders. During the interviews, I gained insight on making technical concepts more meaningful to the public, as both leaders had experience in technical communications.

As a participant in Sandia's Student Internship Program, I used the leaders' advice while preparing for the California intern symposium that had seven students deliver talks with slideshows and 22 others present posters. I presented a poster about my experience serving on the Core Planning Team for Kids Day. I found it deeply encouraging that the mentors, managers and peers who attended the symposium were eager to discuss my experience.

My great interactions with leaders at Sandia as an intern is not an anomaly. I had an opportunity to speak with former Community Involvement intern Michael Shaik, who said he was able to "network with some of the greatest minds in the world." Through his experience he learned about himself and his passions, which motivated him to pursue a career in construction management.

"I began to learn more about myself and what I'm passionate about," Michael said. "This allowed me to have a clear direction in my career and educational goals, something I wouldn't have obtained otherwise."

Similarly, this internship has provided valuable growth both in my academic and professional journey, inspiring me to pursue a master's degree in technical communications with an emphasis on scientific communication.

DOG DAYS — Amelia Harrison, second from left, teaches kids how to operate Chip Watson the robot dog during the Kids Day and Stronger Together employee wellness event. **Photo by Spencer Toy**

SHARING THE STORY — Amelia Harrison stands beside the poster she presented on Kids Day at the Intern Symposium. **Photo by Spencer Toy**

Sharing science

Working in a DOE laboratory has exposed me to the opportunities that exist to be a communicator while specializing in scientific fields. This substantiates my belief that it's my responsibility to convey critical scientific matters to the public and help people understand the importance of what's transpiring in the scientific community.

How can I bridge the gap and make scientific education more accessible and empower communities to engage with STEM? This question has pushed and inspired me to provide people the opportunities I feel I lacked throughout my youth and inspire others to involve themselves in our world shaped by science.

Hydrogen day showcases business connections to labs' innovations

By **Michael Ellis Langley**

Sandia and Lawrence Livermore national laboratories co-hosted Hydrogen Partnership Day at the Livermore Valley Open Campus, gathering world-renowned scientists and business partners to discuss collaborations to drive U.S. industry forward.

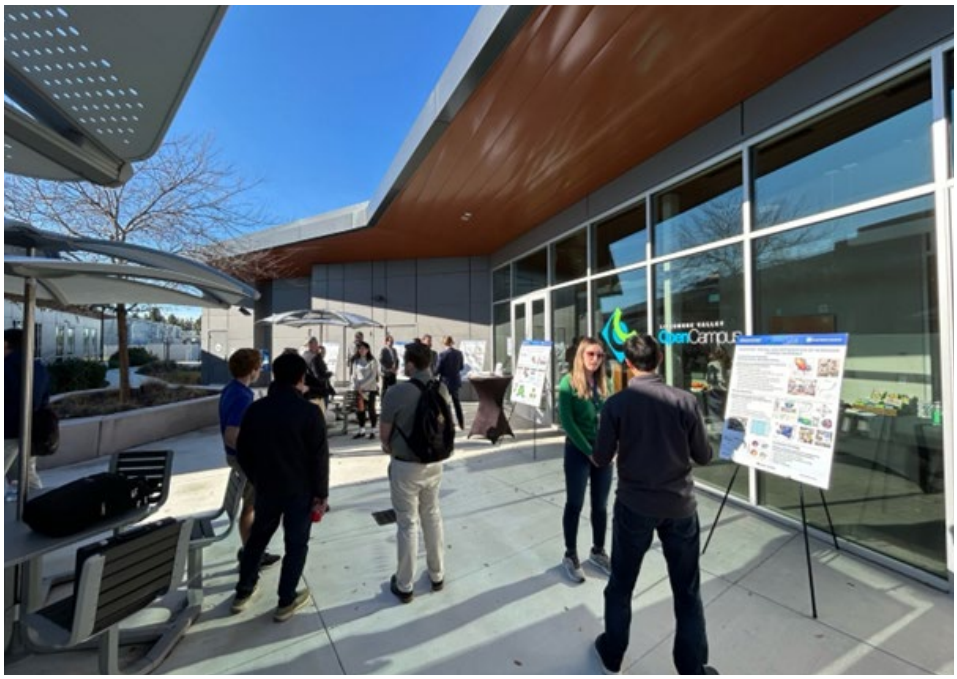
The spring event was at the Conference Annex Building on Lawrence Livermore's side of the campus and featured research scientists from both labs and dozens of local industry leaders, including representatives from PG&E, Verne and Pacific Hydrogen. Both labs showcased their physical capabilities — including existing intellectual property, lab space and computational power for modeling — and renewed their commitment to helping established utilities and startups succeed.

"We [national laboratories] like to work on hard problems," hydrogen and material scientist Lennie Klebanoff told the crowd of about 50. "When you know how a technology is used out in the field, it influences how you look at the fundamental science of it."

Representatives from each hydrogen industry leader participated in panels and not only detailed how their companies benefitted from working with the labs, but how the DOE network of national laboratories is ideally set up to help U.S. industry innovate.

Hydrogen program manager Kristin Hertz said Sandia's business partners actively add to the research performed by Sandia and Lawrence Livermore.

"National laboratories have a unique role to play in advancing new technologies as research and development centers," she said. "We apply our expertise and laboratory capabilities to areas of impact identified by industry."



ATOMIC BOND — Dozens of business leaders, scientists and business development specialists from Sandia and Lawrence Livermore national labs came together on Feb. 20 to talk about the future of partnerships to develop hydrogen as an energy source for U.S. consumers.

Photo courtesy of Melissa Lewelling, Lawrence Livermore National Laboratory

Matthew Garrett, director of Lawrence Livermore's Intellectual Property Office, agreed.

"Being located so close to Silicon Valley means we're able to offer cutting-edge scientific expertise and facilities to leading technology companies — big and small — to help them de-risk their go-to-market strategies and bolster U.S. innovation through licensing and collaboration," Garrett said.

Business Development Specialist Matt Meyer helped organize the Hydrogen Partnership Day and said events like this are vital to demonstrating how Sandia's capabilities and intellectual property can benefit the country.

"Sandia values the collaborative spirit that thrives both locally and nation-ally with our industry partners," Matt said. "The impact of these efforts is multiplied when Sandia partners with other DOE labs, including Lawrence Livermore. The joint LLNL-Sandia Hydrogen Partnership Day event in Livermore demonstrated Sandia's and Lawrence Livermore's commitment to connecting with the local Bay Area hydrogen economy."

Matt added that events like this help showcase the labs' capabilities and facilitate the deployment of lab-developed technologies, which enhance U.S. competitiveness and maximize the public good for the nation.

Sandia and Lawrence Livermore plan to continue to host events like this to bring even more business partners to the table and further spread the labs' impact.

Operational success

By **Trina West** *Photos by* **James C. O'Donnell, Camp Parks Reserve Forces Training Area**

For this year's Operation Backpack, Sandians generously donated enough back-to-school supplies to benefit 108 military families.

On July 31, volunteers delivered a variety of backpacks filled with essential supplies to Parks Reserve Forces Training Area in Dublin, California, where they were distributed to local students.

The effort, which began in 2014, was led by Deterrence, Science and Energy Division Executive Assistant Rachel Sowell, who also contributed an additional 25 backpacks for families who may join later in the school year.

Information about Operation Backpack and the Stuff the Bus effort in New Mexico will run in the Sept. 18 issue of Lab News.

FAMILY VALUES — Executive Assistant Rachel Sowell, right, and her daughter distribute backpacks at the Parks Reserve Forces Training Area. They also contributed 25 backpacks for distribution after school starts.

ALL SET FOR SCHOOL — A group of students at the Parks Reserve Forces Training Area try on their new backpacks filled with school supplies.

PACK IT UP — Executive Assistant Rachel Sowell, right, and her daughter, middle, distribute backpacks to families at the Parks Reserve Forces Training Area.

SUPPLIES AND SMILES — Executive Assistant Rachel Sowell, right, coordinated an effort to distribute backpacks to 108 military families.

GET THE GEAR — Backpacks are ready and waiting to be picked up by families at Parks Reserve Forces Training Area in Dublin, California.

Mileposts

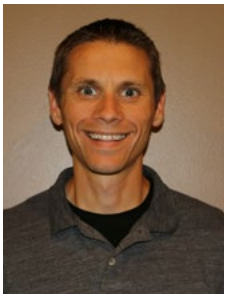
Michael Hobbs 35

Tricia Toya 30

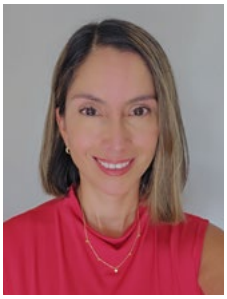
David Wilson 25

Shayne Dilworth 20

Carlos Gutierrez 20



Jason Sonnek 20



Marquita Apodaca 15

Lee Ann Black-Blumenfeld 15

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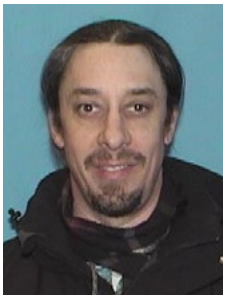

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