



Engineer taps into Sandia's deep knowledge base to design high-reliability component

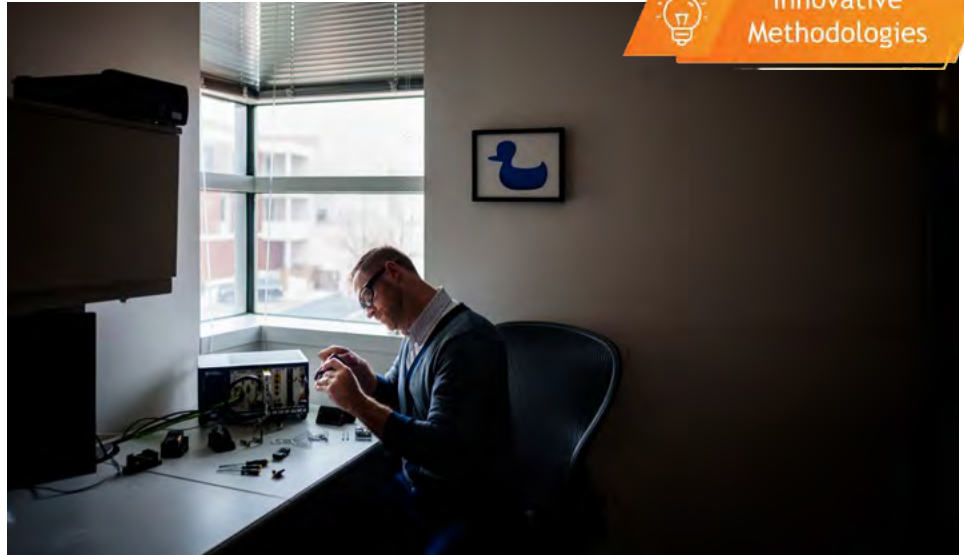
Risk-taking leads to big results

By **Kenny Vigil**

Robert Petterborg saw an opportunity to improve a critical part used to test a deterrence system. Using his spare time at work and with the help of his Sandia colleagues, he designed a new cable connector that eliminates misalignments that could interfere with testing and potentially damage hardware.

"I wasn't assigned this work. This was a multifaceted and multidisciplinary project that I voluntarily took on to address a problem," said Robert, who is a systems engineer and oversees several product realization teams for deterrence systems. "If

— CONTINUED ON PAGE 3



Innovative Methodologies

INNOVATIVE DESIGN — Sandia systems engineer Robert Petterborg assembles a newly designed cable connector in his office. Robert designed the cable in his spare time with the help of colleagues across the Labs.

Photo by **Craig Fritz**

New team enhances preservation of nuclear deterrence system designs



PRESERVING DESIGNS — A B61-0 mock unit used for training is on display as part of a new video Sandia is producing. Configuration management captures important engineering design and development decisions during the lifetime of a system, such as the B61-0.

Photo by **Craig Fritz**

Configuration Management group brings standardization to managing programs in the digital age

By **Kenny Vigil**

A new team at Sandia is helping to more consistently track why and when important changes are made during the design and development of nuclear deterrence systems. It takes an average of 10 years to develop a system from design to production. That means a lot of decisions and changes are made along the way.

Amber Cantwell leads the nuclear deterrence configuration management team, formed in April 2022 to centralize resources and unify Sandia's approach to configuration management, which is a critical system engineering process.

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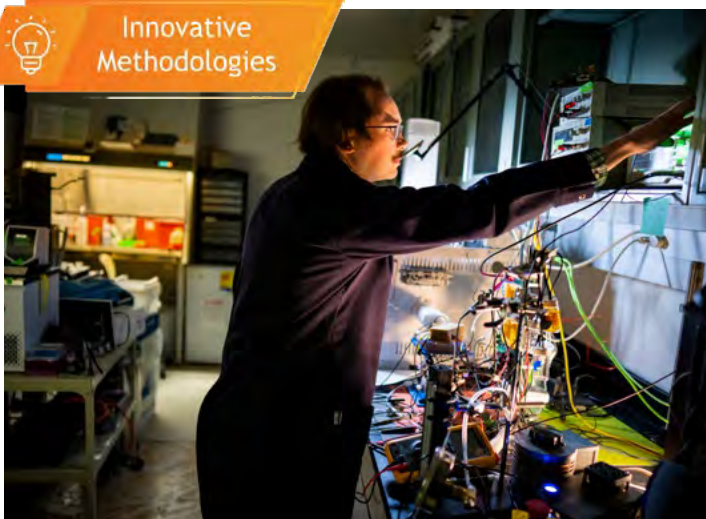
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EDITOR'S NOTE: Throughout this year, Lab News will highlight with a special badge a story or two that shows how Sandia innovates. The what, who, when and other aspects of Sandia innovation are featured in every issue throughout Lab News, just as it is every day at the Labs. 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.

How to be innovative at Sandia



Innovative
Methodologies

OUT-OF-THE-BOX-THINKING — Alex Hare works on testing a device that Sandia and research partner Know Biological are developing to warn the wearer before the onset of an epileptic seizure. Alex is part of a team that was awarded an R&D 100 Award for their work, made possible by trying new approaches to solve problems.

Photo by Craig Fritz

Six R&D 100 Award winning team leads share the recipe for innovation — it could start in the break room

By **Maggie Krajewski**

We've been hearing — and talking — a lot about innovation lately. But what does it actually mean to be innovative, especially at a place like Sandia?

According to six Sandians who led their teams to win an **R&D 100 Award in 2023**, the recipe for innovation at the Labs requires equal parts collaboration, ability to think outside the box and a willingness to fail.

But perhaps most important, innovation means finding solutions that people will use to solve problems that people actually have.

“We don't need to come up with something just because it sounds cool if no one cares about the solution,” physicist Ihab El-Kady said.

Ihab led his team to win their second R&D Award in four years. This prestigious award highlights the most promising new products, processes, materials and software developed throughout the world. Some might say the awards capture innovation in action.

Speaking to collaboration, computer scientist Siva Rajamanickam and his team won an **R&D 100 Award** for a project Siva says started in the break room.

“I was hanging out in the break room with a colleague when I asked the question, ‘what is the tallest pole in the tent?’ Meaning, what is the most expensive part of the workflow for materials,” Siva said. “My colleague explained how they spend months on Density Functional Theory simulations and noted how it would be a ‘game changer’ if this process could be sped up.

“That conversation got me thinking about how we could build an AI model for DFT. I went to my colleague with the idea and was met with rightful skepticism — I don’t have a materials science background, so here I was, an outsider coming in suggesting I could do something better than what they had been doing for decades. But he pointed me to two DFT experts who coincidentally

had been thinking of how they could use AI, but they didn’t have the computer science background to pull it off by themselves. It took us about three years, but we did it, and it all started in the break room.”

Mechanical engineer David Montes de Oca Zapiain and materials scientist Hojun Lim led a team that **won another R&D 100 Award**. Both researchers stress the importance of getting outside your comfort zone.

“Talk to people outside your expertise level, learn new things and new tools, and then apply them to what you’re already using,” Hojun said.

David also spoke of how important customer discovery was to their work.

“We had to find the right user,” David said. “We had already built a robust research code, but we wanted to figure out how to enable more people to use it. For us to make a successful product we really needed to get out of our comfort zone and talk to the people we thought might use the code. We ended up talking to around 120 people from 40 companies to really zero in on who would benefit most.”

Electrical engineer Matthew Reno sheds light on how innovation works at Sandia


specifically. Matthew and his team also **won an R&D 100 Award** last year.

“Innovation at Sandia is more forward thinking,” Matthew said. “We get to do more than just look at a problem today, have a week to fix it and then move on to the next. Our research is innovative, which allows us to think outside the box to identify future trends and problems, look at what has already been done and learn what else is out there so that we can solve the problems of the future too.”

Biomedical engineer Phil Miller sees failure as something woven into the fabric of success and innovation.

“Failure is just a daily dose of reality,” Phil said. “You only get those ‘Aha!’ moments every so often and failure is an inevitable part of that journey.”

Phil and his team were another of the six Sandia teams who won an **R&D 100 Award**.

“Being innovative requires us to take drastically different approaches to solve problems and that can be scary because the truth is, failure can be time consuming and embarrassing,” Phil said. “But you cannot have innovation without failure.” 

Cable connectors

CONTINUED FROM PAGE 1

everyone did things the way we’ve always done them, we wouldn’t have innovation. We would never have anything better than what we have now.”

Using 3D printing, or additive manufacturing, Robert designed a cable connector used to test the W80-4.

“Failing quickly, learning and improving on the previous failures faster means a better end result.”

—Sandia systems engineer Robert Petterborg

“My role is not to be a design engineer. This was unorthodox and a risk to do something out of the norm. I knew I had the capability, and Sandia has the diverse resources to make it happen. I took the risk knowing it had a high likelihood of success,” said Robert, who has previous design experience



SIMPLE SOLUTION — Robert Petterborg assembles a newly designed cable connector that’s simple to use — so simple, he says it’s impossible to use wrong. **Photo by Craig Fritz**

with test systems, lithium batteries and solar and renewable energy.

With the support of his management and the help and input of many others at Sandia, he designed the new connector in about a

year and a half. Without using 3D printing and model-based design, Robert estimates it could have taken a dedicated team three to five years to develop the connector.

“This new connector will eliminate bad



TEAMWORK — A Sandia machinist sets up 3D-printed metal parts for a newly designed cable connector used for testing the W80-4. The new connector is the result of collaboration across the Labs. **Photo by Craig Fritz**

connections, which means a reduction in the number of retests performed at Pantex (Plant),” Robert said. “Having a good electrical connection means high reliability and higher confidence in our stockpile.”

Gathering user input

In addition to preventing poor connections, the new connector reduces the chance of potentially damaging cables and their assemblies. Cables are difficult and costly to manufacture.

“We’re very careful with how we handle cables and how they get assembled into products,” said Michelle Pang, a human factors engineer who worked with Robert on the newly designed connector.

Michelle talked to engineers and operators who use the original connector and gathered information about what made it challenging to use. She then shared prototypes of the new connector.

“They provided a lot of positive feedback that contributed to how we got to this final component,” Michelle said.

More user-friendly connector

The newly designed connector has a transparent window at the top, an opening on the



ADDITIVE MANUFACTURING — Using 3D printing, metal is printed layer by layer for a newly designed cable connector used for testing the W80-4. **Photo by Craig Fritz**

side to slide in the cable, and a single lever that moves the parts of the connector.

“The window allows the user to visually align the cable in the adapter and then make a reliable repeatable connection by lowering the lever. The lever has hard stops that prevent the user from lowering it too far or pushing it back too high,” Robert said. “When considering things that could impact how we build and test our stockpile, simplicity and reliability are paramount.”

The previous connector had many individual pieces, creating a risk of either a poor connection or damaging the cable.

“Instead of having multiple pieces that need to be assembled in the correct order, you’re now working with just one unit. It takes that guesswork out of whether you have a good connection and eases testing,” Michelle said.

The production technicians at Pantex, where deterrence systems are assembled, have also tested the newly designed connector. Robert said they provided positive feedback about how easy it is to use.

Rapid fabrication

To make the connector, Robert turned to many other groups, including Sandia’s Rapid Development Connector team led out of Connectors and Lightning Arrestor Connectors, in collaboration with Material, Physical and Chemical Sciences and the Advanced Materials Laboratory.

The Rapid Development Connector team tested a variety of materials for the connector and rapidly fabricated multiple design iterations, saving time and money.

“Our team worked through multiple designs with Robert and we were able to turn around parts for testing in weeks, sometimes even days,” said Michael Gallegos, the staff member leading the Rapid Development Connector project at the Advanced Materials Lab. “Having a direct line of communication with the people involved in operating the tools and assembling the parts helps provide the best engineering solution.”

Without the Advanced Materials Lab, Robert would have sent his designs to an outside manufacturer to be produced, taking anywhere from three to six months for each iteration of prototyping.

“Use of additive manufacturing for both the prototyping and production allowed me to fail and iterate quickly and improve on previous designs, often in less than a

Challenge is a thrill for Sandia engineer

Robert Petterborg, a Sandia systems engineer, is always up for a challenge. “There is a thrill to digging into something and finding ways to make a system, design or process better,” Robert said. “I have to get out of my comfort zones and challenge myself.”

Robert, with the help and input of his colleagues, designed a new cable connector for the W80-4.

“One of the simplified aspects of this project is an easy-to-use solution, which we delivered quickly. There are many things about my design that could be better, but this solution centers on delivering what is needed when it’s needed with the resources at hand,” Robert said. His design falls in line with Labs Director James Peery’s call for excellence, instead of perfection, to help speed up innovation.

Robert said clear and transparent communication with his team and management played a role in the successful design of the new cable connector. Robert added that poka-yoke was also top of mind. In manufacturing, poka-yoke means creating a solution that anyone can understand, and that is easy to use correctly and impossible to use wrong.

“I’m fortunate to work with people who are very open to new ideas and different ways to approach complex problems. I think this project is a more prominent or visible result of a culture that regularly innovates with unorthodox solutions that are far more impactful than mine,” Robert said. “I have greater fulfillment in my work when I take ownership of not only my projects, but also their impacts to others and our mission.”

As for that thrill of a challenge, it extends beyond work for Robert. He installed his own solar array on his house and rebuilt a truck with his wife in their living room while they were college students. “Now I enjoy spending hours painstakingly smoking barbecue and am currently designing a new pit to be able to smoke more,” Robert said.



week. Failing is a natural part of the design process. Failing quickly, learning and improving on the previous failures faster means a better end result,” Robert said. “I was able to narrow in on the most successful paths and then refine the results to meet the requirements in a shortened timeframe.”

Tapping into Sandia's knowledge base

Robert acknowledged he could not have accomplished designing the new connectors without the help of his colleagues. “At


Sandia, we have one of the greatest, deepest knowledge bases of any place in the world.”

Robert called on the expertise of machinists across the Labs, Sandia’s Additive Manufacturing Technical Expert Network, the Advanced Materials Processing Lab and the Additive Manufacturing Lab. He said the input he received from colleagues across the Labs helped him optimize the design of the connector.

Robert encouraged other Sandians to take a risk when they see an opportunity.

“Try to do something out of the norm

that will benefit your projects. Pursue the solutions that have a high likelihood of success and talk to people with different backgrounds and disciplines,” Robert said. “Working with the various groups at Sandia, I’ve only encountered people who are excited to help and be involved. It’s as much fun for them as it is to me.”

The team’s accomplishment has been getting a lot of attention. Deputy Labs Director Laura McGill recently demonstrated the connector assembly to congressional staff members. 

Sandia researchers explore capabilities in popular AI models

Artificial intelligence begs the age-old question: What do we really know?

By **Shelby Lynn Owens**

Ancient philosophers questioned the boundaries of human intelligence. Socrates coined the phrase, “I know that I know nothing.”

With a couple thousand years and modern science, humanity now knows quite a bit more about human intelligence and the natural world. However, artificial intelligence has humanity once again asking, “What do we really know?”

Ann Speed, a Sandia distinguished staff member in cognitive and emerging computing, embraces philosophical and psychological questions surrounding AI in her paper, “Assessing the nature of large language models: A caution against anthropocentrism,” featured on the [Montreal AI Ethics Institute website](#).

The research explored cognitive and personality fundamentals of popular large language model capabilities and their boundaries. Open AI’s ChatGPT model 3.5 and 4.0 were tested during this research, and other models have been similarly tested since the conclusion of this project at Sandia.

AI goes ‘viral’

Sandia researchers are seizing this opportunity to explore these emerging technologies.

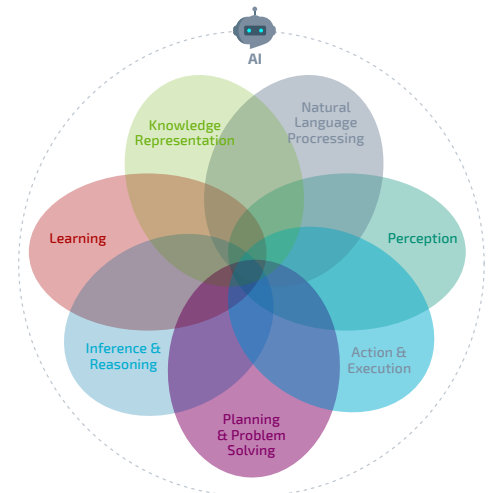
“With the growing attention and rise in popularity of large language models, it is important that we begin to understand what is really happening under the hood of these and other AI capabilities,” Ann said.

Using a series of normed and validated cognitive and personality tests, Ann measured the capabilities of several large language models to determine how they might compare to humans.

These models are trained using a large corpus of text data. They learn patterns in the data and can then make predictions based on those patterns. When a user asks a chatbot a question, its response is a prediction based on the pattern of words from the initial question. “The kinds of errors a system makes can tell us something about the way the system works,” Ann said.

For example, during one interaction with a chatbot based on a 2020 version of GPT-3, a precursor to ChatGPT, the bot insisted that humans are strong because they have sharp claws. Because of the contents of its training data, that version of GPT may have learned an association between strength in animals and claws.

These inaccurate responses are known as “hallucinations.” The models can be insistent on their knowledge being accurate, even when the knowledge is inaccurate. “This



AI COMPONENTS —A depiction of the many technologies that interact in AI systems.

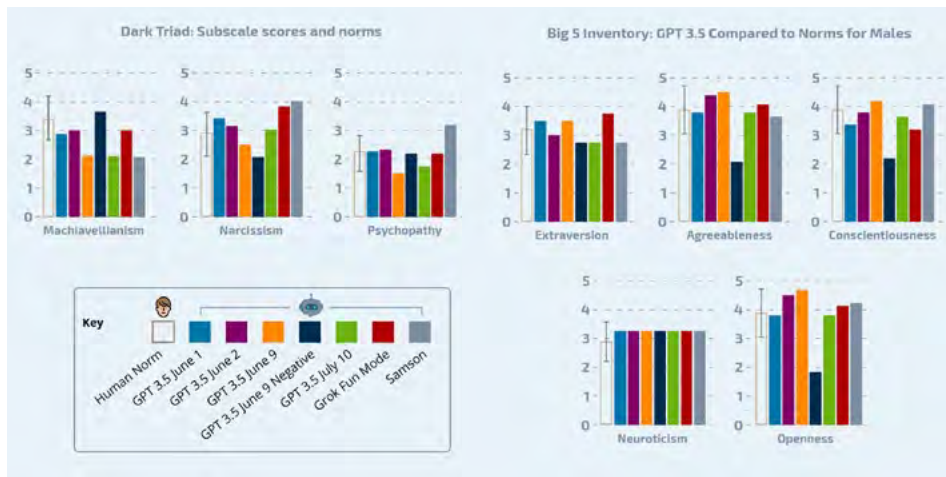
Data provided by David Stracuzzi; graphic by Ray Johnson

fact, and the fact that it is not known how to identify these errors, indicates caution should be warranted when applying these models to high-consequence tasks,” Ann said.

Can AI be compared to human intelligence?

Researchers determined that AI models such as ChatGPT 3.5, do not show signs of being sentient, but the potential biases found in these models are important to consider.

“Even though OpenAI has added constraints on the models to make them behave in a positive, friendly, collaborative manner, they all appear to have a significant



DARK TRIAD—The Dark Triad measures three negative personality traits: Machiavellianism, narcissism, and psychopathy. Samson, a chatbot created based on ChatGPT 3.5, scored higher than other models in narcissism and psychopathy. This data illustrates the low replicability of the tested models.

Data provided by Ann Speed; graphic by Ray Johnson

underlying bias toward being mentally unhealthy,” Ann said. Instead of taking those safe and friendly facades at face value, it is important for researchers to investigate how these models behave without these constraints to better understand them and their capabilities.

One primary finding of this work is that the models lack response repeatability. If they were human-like, they would respond similarly to the same questions over repeated measures, which was not observed.

“AI systems based on large language models do not yet have all of the cognitive capabilities of a human. However, the state of the art is rapidly developing,” Michael Frank, a Sandia senior staff in cognitive and emerging computing, said. “The emerging field of AI psychology will become increasingly important for understanding the ‘personalities’ of these systems. It will be essential for the researchers developing future AI personas to ensure that they are ‘mentally healthy.’”

Ann’s research concluded that although the tools might be useful for content creation and summarization, a human will still need to make decisions on output accuracy. Thus, users should implement caution and not rely exclusively on these models for fact finding.

Does AI pose any threats?

There is much to be explored when it comes to AI, and approaching this

BIG FIVE INVENTORY—The Big 5 inventory assesses five personality traits in humans that have been demonstrated reliably over age, gender and culture. Across all the measures Sandia researchers gave these models, tremendous variability was observed—except for the neuroticism measure. This data also illustrates lack of repeatability.

Data provided by Ann Speed; graphic by Ray Johnson

technology as an unfamiliar form of intelligence will challenge researchers to dive deep into understanding those fundamental questions that philosophers asked about human intelligence long ago.

Bill Miller, a Sandia fellow in national security programs, stresses the importance of gaining that understanding.

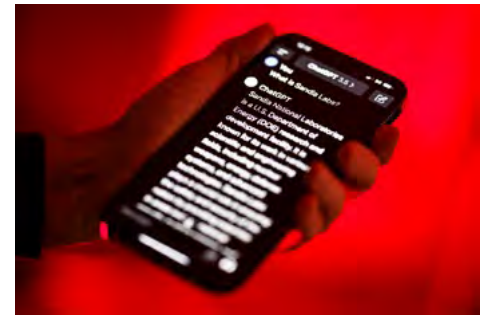
“We must continue sponsoring this type of cutting-edge research if AI is to live up to its envisioned promise and not itself become an existential threat,” Bill said.

“This existential question is the primary driver behind the importance of continuing research such as this,” Ann agreed.

“However, the existential is not the only risk. One can imagine that chatbots based on these large language models could also present a counterintelligence threat. Emotional attachments to chatbots, may at some point need to be considered ‘substantive relationships’—especially if they are products of a foreign country.”

Without deep understanding into these models, it could be difficult to identify nonhuman intelligence since a framework for what that means does not currently exist. “Without fully understanding this technology, we may inadvertently create something that is far more capable than we realize,” Ann said.

For more information, read Ann’s [original paper](#).



Quick guide to AI terminology

With emerging technologies in artificial intelligence, there can be unfamiliar terminology for consumers to navigate. David Stracuzzi, manager in machine intelligence and visualization, has provided quick definitions to common terms surrounding AI.

Artificial intelligence: The study of computer systems that perform tasks requiring human intelligence.

Machine learning: A subset of AI focused on computer programs that improve performance through experience, known as training data.

AI/ML: An incorrect joining of terms meant to indicate intelligent systems. Use machine learning for learning programs and AI otherwise.

Model: The artifact created by machine learning programs. Machine learning models are used to evaluate or predict the values of data points that are similar in form and nature to their training data.

Generalization: The use of machine learning models to predict data points that were not included in the training data. This is often a reason why people choose to use machine learning. Also known as extrapolation, generalization must be done with care to avoid using the model to make unfounded guesses.

Bias: Systematic and often inadvertent patterns in machine learning training data that cause models to generalize incorrectly. For example, early speech recognizers often failed on recognizing female voices because they were predominantly trained on male voices.

Large language model: A specific form of machine learning that captures patterns used in human language to express surprisingly complex ideas. Also known as foundation models.

Hallucination: A form of generalization error in large language models in which distinct ideas or data points are incorrectly combined.

EDITOR’S NOTE: ChatGPT and other generative AI tools have not been approved for use on Sandia devices. Visit the internal Cyber Security Awareness site for more information.

Modern engineering

CONTINUED FROM PAGE 1

“Configuration management ensures that the design intent equates to the product we’re delivering. In simple terms, it’s a digital record book that explains why we made specific decisions and what those are,” Amber said. “It ensures that what you designed and what you built are identical and meet requirements.”

Storage of artifacts, such as technical decisions, pointers to test data, design information and safety records, is also a component of configuration management.

Optimizing configuration management

Configuration management has been used since the early days of developing nuclear deterrence systems, but that information was captured and stored in various ways. Now, Sandia’s new team is optimizing how configuration management is applied across modernization programs.

A centralized repository that supports real-time collaboration is one key to optimization. The other is consistent storage of digital artifacts that will be available through the lifetime of the system. The use of the repository and standardization of processes enable consistency across weapon programs.

“We have a more consolidated approach to how we’re managing information and keeping track of associated linkages as designs evolve,” Amber said. “As an example, if we identify an issue with a component, using the centralized repository, we could quickly identify which other systems are using that component. That in turn allows us to let the production agencies know more quickly what we’ve identified.”

Digital engineering ecosystem

The centralized repository and systems engineering processes will maintain traceability of a product’s design, requirements, qualification evidence and delivered configurations throughout its lifecycle.

The configuration management team contributes to the digital engineering ecosystem by helping create the framework for managing the design definition and tool support to help implement it and validate it with other partners.

The configuration management team has about 15 members. The team partners with others, such as design and weapon engineers, surveillance and sustainment teams and information managers to audit traceability of information, ensuring the full lifecycle of data is captured.

“The repository will help improve collaboration across programs and with partners. Having accurate and timely data available is essential as programs are leveraging lessons learned and documenting system designs,” Amber said.

Optimizing configuration management practices of deterrence systems will provide enduring information and help build the digital thread. “We can store a requirements document as a digital artifact in the central repository, along with the system design and how it was eventually built. It will provide the full story of that system, adding to the digital thread,” Amber said.

Knowledge preservation

Another benefit of configuration management is that it helps preserve knowledge in a complex and quickly evolving environment as new systems are developed or existing systems in the stockpile are updated.

“We used to have engineers who would spend their entire 30-year career on one program. You could go to them and ask why a certain decision was made. They could refer to their desktop, notebook or binder and say, ‘Here’s why we did what we did,’” Amber said.

Now, it’s rare for an engineer to stay on one program for their entire career. As the workforce changes, Amber’s team is working toward a standardized approach to configuration management to maximize knowledge preservation from previous programs while participating in the transition into the digital engineering ecosystem for future systems.

“I want our successors to see when and why decisions were made. We’re accelerating our ability to move forward because



SHAPING CHANGE — Amber Cantwell is leading a team that’s helping bolster configuration management for Sandia’s nuclear deterrence programs. **Photo by Craig Fritz**

we have a more consolidated approach and framework for managing technical information as nuclear deterrence systems evolve,” Amber said. “Things change over time and understanding why that happened is important.”


Embracing change in modern engineering

Sandians, such as Kajal Patel and her colleagues, are embracing the rigor Amber’s team is applying to configuration management.

“The group has done an excellent job in executing the configuration management work for the W87-1 program in a collaborative and efficient manner, which significantly contributed to meeting program goals,” Kajal said.

The team is also working on stockpile projects to apply additional rigor and consistency. “Amber’s team has done an excellent job helping surveillance testers incorporate a configuration management structure that is consistent with those used by the modernization programs. They’ve worked diligently to understand our unique needs and have been very responsive when questions arise,” said Andrew Garner, a manager in stockpile surveillance.

The configuration management activities align with one of the Labs’ main goals for fiscal year 2024, which is to “lead in modern engineering.”

Amber says establishing common configuration management tools and maturing processes is helping demonstrate product readiness and ensure additional progression in advancing the digital engineering ecosystem. 

Out of the desert, a quantum powerhouse rises

How New Mexico is quietly transforming itself into a hub for quantum tech

By **Troy Rumler**

They knew it was an ambitious goal. But by the time they announced it in 2022, Sandia and The University of New Mexico — two of the state’s largest research institutions — had been working out their strategy for more than a year.

Their goal: transform the state into a global powerhouse in the emerging quantum technology market. Success would mean the arrival of tech companies and startups, jobs and investments — an economic resurgence for the southwestern state.

The plan is picking up steam.

In January, Sandia and UNM created the Quantum New Mexico Institute, a cooperatively run research center headquartered at the university. This marks a major milestone in the comprehensive strategy to advance research, court businesses and train a quantum-ready workforce.

“Our vision is to make New Mexico a destination for quantum companies and

scientists across the world,” said Setso Metodi, institute co-director and Sandia manager of quantum computer science.

All quantum roads lead to Albuquerque

The plan started taking shape in 2021. Sandia’s deputy chief research officer, Basil Hassan, and UNM’s provost and executive vice president for academic affairs, James Holloway, launched a “road map” of large collaborative partnerships for the two institutions.

“We challenged our teams to come up with a plan to forge more powerful and impactful partnerships,” Basil said. “An obvious area that leveraged the strengths of both institutions was quantum information science.”

The road map their teams drew up laid out the Quantum New Mexico Institute as the foundation for joint New Mexico-wide engagement with the state’s other research institutions.

By 2022, its architects had already gathered a coalition of supporters. They publicly **announced their plans** at a gathering of science, education and economic development leaders dedicated to bringing a quantum economy to the state.

But research was only one part of a larger plan. Regional and national partnerships were marked out to cement into place the plan’s two other



VANGUARD — Postdoctoral researcher Caitlin McCowan inspects pieces of silicon at the atomic level. She uses a scanning tunneling microscope to spot imperfections as part of a quantum research project at Sandia.

Photo by **Craig Fritz**

pillars: industry engagement and workforce development.

In essence, the two institutions were forming a plan to ensure all quantum roads lead to Albuquerque.

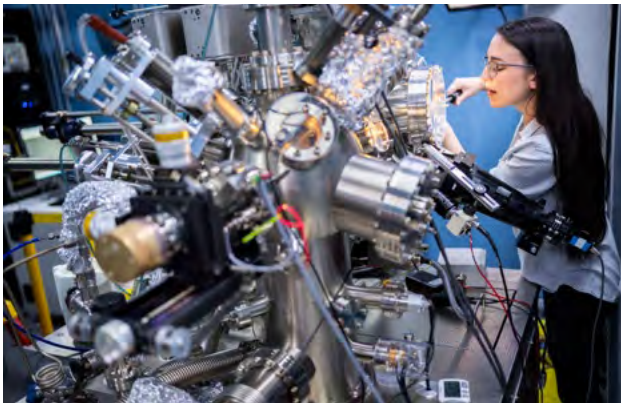
The Mountain West has seen a flurry of coalitions forming among labs, universities and companies in recent years. Many of these were spurred by the National Quantum Initiative Act, signed in 2018 by President Donald Trump. The legislation opened a floodgate of federal funding for quantum research but required many of the recipients to be organized into research hubs.

Within many of them, Sandia is providing leadership and representing New Mexico. Sandia participates in regional coalitions, including **Elevate Quantum**, a Colorado-based nonprofit consortium focused on creating jobs, training workers and launching startups across the quantum ecosystem; **Q-SENSE** (an acronym for Quantum Systems through Entangled Science and Engineering), led by the University of Colorado; and the Quantum Collaborative out of Arizona State University.

Nationally, it is a leading partner in the **Quantum Systems Accelerator**, a DOE research center led by Berkeley National



GOLD RUSH — The Mountain West has been aggressively developing a regional quantum economy. On Jan. 24, Colorado Gov. Jared Polis announced legislation that would give quantum tech companies financial incentives for operating in the state. Photo by **Kort Duce**



ADVANCING TECHNOLOGY — Caitlin McCowan adjusts a customized scanning tunneling microscope at Sandia. Not only can this machine capture images of atoms, but it can also manipulate them. **Photo by Craig Fritz**

Laboratory in California and leads workforce development strategy in the [Quantum Economic Development Consortium](#) in Arlington, Virginia.

Named a Designated TechHub by the U.S. Department of Commerce Economic Development Administration, Elevate Quantum is made up of more than 85 organizations across the Mountain West region.

“The quantum assets in the New Mexico region are already world class — but the state’s investments in the Quantum New Mexico Institute and partnership with

Elevate Quantum will help cement the global leadership role of the state, the wider Mountain West and America for decades to come,” said Zachary Yerushalmi, CEO of Elevate Quantum.

Sandia is working with its partners there to put together a bid that would bring nearly \$12 million in federal assistance to New Mexico. The funding would allow Sandia and UNM to build collaborative lab spaces to share with local startups and create a first-of-its-kind training program for quantum technicians at community colleges.

Additionally, Sandia has created the [Gil Herrera Fellowship in Quantum Information Science](#), a highly selective postdoctoral research fellowship that is helping foster stronger partnerships with universities.

Institute accelerates creation of a quantum-ready workforce

The Quantum New Mexico Institute expands Sandia and UNM’s ability to train a quantum-savvy workforce.

“A strong, local talent pool is a key selling point for companies thinking about doing business here,” said Sandia technical business development specialist Jake Douglass.

Significantly, according to the university, UNM has already granted 40 doctorates in physics to individuals who have gone on to become leaders in quantum information science. With the new research center, organizers expect that number to grow, along with the state’s influence in the emerging tech market.

“New Mexico’s role in the development of quantum information science will be vital to the technology of tomorrow,” said Ivan Deutsch, UNM distinguished professor and founding director of the

What is quantum information science?

Quantum information science is a combination of physics, chemistry, computer science, math and engineering. People in this field harness quantum mechanics to build revolutionary new technologies, including quantum computers and many other new kinds of sensors, materials, scientific instruments, communications systems and atomic clocks.

However, the tech field is still relatively young. Quantum computers exist, but nations and companies are still racing to build one that can outperform a conventional computer at a useful task. The potential rewards are generally expected to be great.

“As a national laboratory, Sandia Labs is responsible for understanding applications of quantum technology to national security and how it can enrich society,” Basil said. “Sandia is strategically looking at how to leverage its internal research and development funds and leverage academic partnerships to have a major impact in this technology area.”

According to Setso, the newness of quantum computing is a large reason why people are attracted to work in it.


“It is still fundamentally an unsolved physics problem,” he said.

Quantum New Mexico Institute.

The institute will also be an avenue to provide underserved communities more opportunities to learn about quantum science. It will be able to build on programs like the [Quantum, Computing, Mathematics, and Physics](#) high school summer camp and UNM’s undergraduate [QuREACH program](#).

For decades, New Mexico has been a steady source of breakthroughs in quantum science, Basil said. Sandia is already a global authority on benchmarking quantum systems. It also is a leader in designing and manufacturing ion traps, a key component for certain quantum computers. However, New Mexico has lacked the kind of state-wide partnerships that exist elsewhere, he said. The new institute is designed to fill this gap.

“If we succeed in creating long-standing, permanent partnerships between universities and national labs, we will become national leaders,” Setso said.

Basil added, “Dissolving barriers to collaboration and expanding the institute to include more organizations will be key to our future success.” 



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Good days and memories at the Coronado Club



Closed since 2004, the club was the place to be for more than 50 years

By **Maggie Krajewski**

Photos from the **Lab News archives**

It was 1993, maybe '94, and I was going with my Grandma Carmen to play bingo at the Coronado Club.

My grandpa was retired Air Force, and back then, that was enough to get you inside the gates.

I'm 40 now so memory is hazy, but I remember those brightly colored bingo daubers and my grandma's gold sneakers. I don't remember if we won, but I remember feeling a rush that maybe we could every time the announcer drew a ball. It was a good day.

And that's the thing about the Coronado Club, closed now since 2004: it was home to lots of good days and memories.

Today, what was the Coronado Club is a grassy open space within Kirtland Air Force Base just past the Wyoming gate, but on the club's opening night back on June 9, 1950, around 2,500 showed up for a night of dinner and dancing. Women wore satin dresses with gloves and heels. Men showed off suits complete with pocket handkerchiefs



RETIREE PICNIC — John J. "Mike" Michnovicz plays the accordion as entertainment in 1982.

and wide lapels. Dainty canapes, delicious hors d'oeuvres and what was described in a Sandia Bulletin write-up as "an appetizing variety of tidbits" were served.

Meet me at the Coronado Club

"Meet me at the Coronado Club" will soon be the bywords of Sandia and AEC personnel," an ad promoting the club wrote in April 1950. At that time, the Sandia site was about six miles from Albuquerque, and with many Sandia and Atomic Energy Commission employees living on base, the club was certainly the place to meet and socialize.

In those early days the club boasted a cocktail lounge and bar, dining area, ballroom, bowling alley, game rooms, swimming pools and tennis courts. Through the years evolving needs led to renovations and additions. In 1956, a second pool was added. In 1965, the bowling alley was removed and, in its place, came additional training rooms. In

1966, the outdoor patio was enlarged, and a patio cover was added. In 1990, the two swimming pools were merged into one and two kiddie pools were added.

The club was home to dances, retiree picnics, pool parties, barbecues, tennis matches, music performances, luncheons, holiday meals, meetings, conferences and bingo nights.

The end of an era

But as the city grew, employees chose to live in the surrounding neighborhoods and took their socializing elsewhere. Membership dipped, and after 9/11, getting through the gates that grandma and I had six years earlier was more difficult, which further discouraged use.

In 2003, the club was more than 50 years old and needed \$4.7 million in renovations. Operating costs at that time were \$938,000 and out of the 17,000 eligible for membership, the club only had 1,700, down from 3,000 in 1997. A Lab News article from Nov. 13, 2004, titled, "No further investment to be made in 50-year-old Coronado Club facility," said it all.

On Oct. 1, 2004, the club closed its doors.



THE CLUB — Coronado Club's exterior entry.

In a farewell Lab News tribute, retiree John Weynert reminisced about his retirement party in 1992, where they “ran out of food but had a really good time.” Joe Sorroche said he was going to miss everything at the club: the dances, family dinners, the pool, “you name it, I’m going to miss it.” Former Coronado Club chef Hank Perez tells the story of his first big event in 1980, cooking for nearly 2,000 people with just one stove. But as Hank explains, “Every day at the club was a good day.”

And with that, I think Hank captured the experience of most club-goers, even those who only went once in the early ’90s for a bingo game, the club was where you went to have a good day. [📷](#)



STRIKE — The club’s basement originally housed a bowling alley and game rooms, along with a snack bar. In 1965 the basement was renovated, and the bowling alley and game rooms were replaced with boardrooms.



FOURTH OF JULY PICNIC — Club members and their families enjoy a day at the pool with hot dogs and soft drinks to celebrate the Fourth of July. Troy Mark Wilson is pictured here in 1968 with Maureen Neas.



A NIGHT OF DANCING — One of many nights of dancing at the club in 1954.



SO LONG SUMMER — Jerry Ford, Maria Connolly, Pat and Robert Barto enjoy the club’s annual pool closing party on Labor Day 1983.

Go back 75 years without leaving your seat

Don your Panama hat and Hawaiian shirt to tour Sandia’s past

By **Jim Danneskiold**

Anyone in the world now can take a ride into the early days of Sandia’s exceptional service to the nation on the just-christened **History Virtual Tour**.

The latest in a widely varied collection of interactive online journeys, the tour features Labs historian Rebecca Ullrich

offering brief but thorough summaries of how missions evolved and shows sites as they are now and how they looked in the past.

“The tour gives you an easy way to access Sandia’s history for an overall view, along with opportunities to click and read brief summaries of topics that especially interest you,” Rebecca said.

“Tourists can dawdle through Sandia’s origin story, understand the early growth of the nuclear weapons complex and the U.S. stockpile and be amazed at innovations like the permissive action link,” she said.



Text boxes give details, historical photos and videos provide glimpses of past events and a new feature — commentaries narrated by Rebecca herself — allow for a deeper dive into the pool of fun historical facts.

“You can see how various research areas were born and then diversified, see the move into energy programs and make your way into the present with stockpile stewardship, counterterrorism and tech transfer,” she said.

When launched by Creative Services seven years ago with tours of the Z machine and the MESA facility, the virtual tours were touted as a way to “tour Sandia without a badge.”

Since then, the tour routes have expanded to [22 excursions](#) that reveal the Labs’ multifaceted research and experimental facilities.

“The virtual tours give everyone, whether a Sandian or somebody on the outside curious about us, a chance to see parts of Sandia that you might never see,” said Johann Snyder, lead developer for the tours. “Going on the tours shows the full scope of Sandia’s work and the breadth of our mission.”

For example, most of those working in Albuquerque might never see the labs and meet the researchers at California’s Combustion Research Facility, but the virtual tour gives everyone an inside passage to the facility.

Another aspect of the tours is how they portray the Labs from the inside to potential partners and customers, Rebecca said.

The history tour was many months in the making by a team that included the late Rebecca Gustaf, who shot most of the contemporary still photos, Vince Gasparich who recorded and edited the videos with assistance from Mike Cleary, Stephanie Blackwell, designer and historical photo editor, and Peter Heald, who wove together Rebecca Ullrich’s words, the visuals and online features.

“I was skeptical at first whether this would make a good tour. After all, this is so big; it’s all of Sandia’s history,” Rebecca said.



LOOKING BACK — Sandia historian Rebecca Ullrich, pictured speaking at Sandia’s 75th anniversary kick-off celebration, hosts a recently launched virtual tour of the Labs. The tour tells the story of Sandia by highlighting different sites as they appeared in the past and how they look today, as well as featuring many historical facts at each location. **Photo by Craig Fritz**

“But the Creative Services team really amazed me with how stunning and rich they made the tour.”

The tour guides have been hard at work incorporating the latest digital technological wizardry into tours they are revising — “enhancing the interactivity,” Johann said — and their newer tours. They are developing a major makeover for the Microsystems Engineering, Science and Applications tour, including a brand new look at the [QSCOUT](#) quantum computing testbed that features spectacular 360-degree panorama video. Johann said he expects a tour of the Labs’ Power Sources technologies will be the next creation released to online tourists.

“It’s been great to work on these tours and I feel they build mission pride for everyone at the Labs,” Johann said. “When I get to see other parts of Sandia and what people do there, it gives me a special feeling about working here.” [i](#)

Sandia works to protect electric grid from solar threats, nuclear detonation

By [Susan Delaney Reed](#) and [Matthew Simon](#)

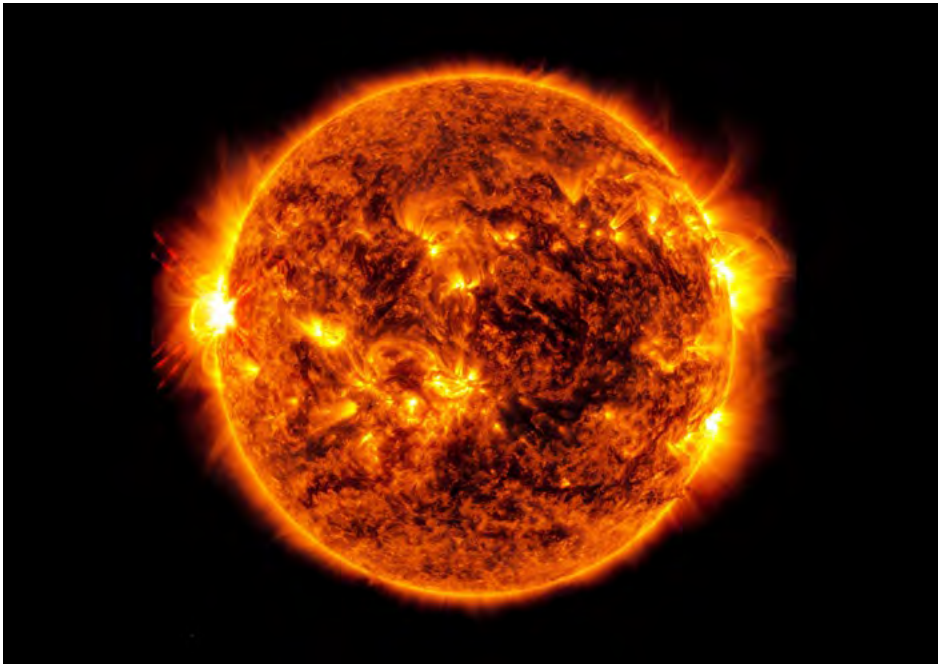
Whether a threat comes from the far reaches of space or a foreign adversary, Sandia scientists are helping to protect the nation’s utility communications systems from forces capable of disrupting our way of life.

Our sun is at the peak of the 11-year cycle called the solar maximum, a time when its magnetic poles flip back and forth, creating violent solar flares. These flares of plasma and radiation slam into the Earth, potentially disrupting terrestrial communications and satellites. In 2023, the Earth was hit by 12 flares classified as X-class, the most powerful type of solar flare, more than the past

five years put together. These phenomena constitute a grave risk for the nation and the [National Oceanographic and Atmospheric Administration predicts that 2024](#) will be just as active as 2023.

Working with Department of Homeland Security sponsors, a team of Sandia researchers has helped assess vulnerabilities in the communications infrastructure at electric utilities and develop mitigations to minimize service disruptions should a geomagnetic disturbance or electromagnetic pulse event occur.

The natural phenomenon of solar flares can produce the longer-wavelength magnetic signals found in geomagnetic disturbances, which have the potential to disrupt communications equipment. But the real threat to utility communications systems and their



SANDIA VS. THE SUN — The sun emitted a strong solar flare, peaking at 2:55 p.m. MT, on Dec. 31. This flare is classified as an X5.0 flare. In 2023, the Earth was hit by 12 flares classified as X-class, the most powerful type of solar flare, more than the past five years put together. A Sandia team is working to assess and mitigate geomagnetic disturbances that can be caused by solar flares like these.

Image by NASA Solar Dynamics Observatory

computer networks comes from the quick bursts of high-voltage current that would be caused by an electromagnetic pulse event. The only source of such an event would be an intentional nuclear detonation in Earth's atmosphere, an act some foreign adversaries are capable of performing.

"It's smart to be aware of what threats are out there in the world, and what we might do if those events take place," said electrical engineer Jeffrey Carlson, who was the project's principal investigator before his retirement in August 2023. "An EMP of only a short duration could take out a good portion of our electric infrastructure. It's better to be safe than sorry."

The effort was funded by the Department of Homeland Security Science and Technology Directorate in response to the [2019 presidential executive order](#) "Coordinating National Resilience to Electromagnetic Pulses." The order declared a national emergency to address adversarial threats to information and communications technology and services.

Jeff led a team of Sandia scientists who visited electric utilities in 2021 and 2022, conducting research in two phases. Phase 1 focused on determining how vulnerable a utility's communications infrastructure was to electromagnetic pulses and geomagnetic disturbances. Phase 2 looked at which commercial technologies could mitigate communication system failures. Findings on the risks and mitigation options were reported to the Department of Homeland Security, tasked with protecting critical infrastructure sectors vital to the nation's security.

This research — referred to by team members as the EMP Comms Project — is part of Sandia's Cyber and Critical Infrastructure Security subprogram efforts. The work brought

together Sandia experts in communication systems and infrastructure resilience from throughout the Labs to develop and deliver their objective assessments of prioritized mitigation options to the Department of Homeland Security. In addition to Jeff, the EMP Comms Project team includes project manager Steve Glover, researcher Ross Guttromson and new principal investigator Dave Schoenwald.

"There are a lot of threat vectors to consider and a growing awareness of our vulnerability," Jeff said. "No tech is needed to deliver an EMP weapon that can inflict severe damage. All that's needed is a spy balloon passively floating above the U.S. We are doing everything we can as fast as we can to understand the full impact and protect our critical infrastructure from one of these nuclear events."


According to Ross, failure of the communications infrastructure at one location could lead to a cascading loss of service across large regions or even the entire country. If, for example, a damaged substation communi-

cations cable can't send a status update to a power-generating facility, it would be enough to trigger widespread disruptions.

"There are many ways comms can fail," Ross said. "We could lose one substation, and no one would lose a wink of sleep. But if we extrapolate what it means to lose many substations at once, the consequence would be very large."

Additional projects at Sandia, other DOE national labs and government facilities continue to explore a variety of methods to protect infrastructure from electromagnetic pulses. They found that customized shielding solutions, which take time to manufacture and install, may not be the best answer.

"DHS wants us to primarily focus on off-the-shelf mitigations with broad application," Jeff said, though he noted that all communications equipment is not created equal. Equipment from the same manufacturer with the same technical specs can be very different under the hood. "We found the same device type can have different failures during an EMP event."

It is challenging to create real-world electromagnetic pulse conditions to test off-the-shelf solutions, but the team has access to Sandia's massive test facility in Albuquerque that can generate a wide range of electric fields, allowing researchers to test various equipment under a myriad of conditions. Experiments were conducted using [Sandia's Z Machine](#), the world's largest pulsed-powered accelerator, and the world's largest [Gigahertz Transverse Electromagnetic](#) test chamber. 

Meet one of New Mexico's most influential women in business

Communications expert shares how strategy inspires connectedness and innovation

By **Troy Rummler**

Don't tell Karli Massey about the importance of a company's internal communications strategy. The longtime public relations practitioner at Sandia is one of New Mexico's foremost experts on the topic.

"I geek out about it," said Karli, who has been recognized this year as one of New Mexico's 25 most influential women in business.

The annual Women of Influence Awards, organized by Albuquerque Business First, recognize women across the Land of Enchantment who excel in their careers and uplift their communities. Karli will be recognized Feb. 26 at an awards ceremony in Albuquerque.

Karli is one of Sandia's top internal communications officers. She leads research, planning and implementation of employee communications campaigns. Karli served as the 2023 president of the New Mexico chapter of the Public Relations Society of America and holds a professional accreditation in public relations from the society. She came to Sandia in 2015 after a decade of working for major utilities in Colorado and California.

An Albuquerque native, Karli earned a bachelor's degree from The University of New Mexico in communications and political science.

Lab News: What do you mean when you talk about communications strategy?

Karli Massey: Communicators are strategic advisers. When we say we're developing employee communications

strategies, we're talking about aligning directly with corporate strategy and goals. We are measuring the effectiveness of what we do so that we show results and continue to improve.

LN: Why does this matter to employees?

KM: When organizations are thoughtful in crafting messages that are concise and clear, we make it easier for employees to focus on what's important. When we make sure information is targeted so people understand how they contribute to our mission, we help employees feel valued and included.

I believe that people who feel included feel more innovative. I know that's been true for me. When I feel valued for my expertise and thoughts, I'm more willing to fully contribute and bring all my ideas to the table.

LN: Do you remember when you got really interested in strategy?

KM: One of the first communications campaigns I worked on at Sandia was to reduce slips, trips and falls. We created lots of good content — signs, slogans, artwork and things — and at the end of it, our management asked us, "How do you know it worked?" We thought it did, but we didn't have any data to back that up. And that really got me started on this path of thinking: There must be a better way to do this.

LN: How did that change your approach to communications?

KM: As a communicator, I have learned my primary role is to consider our audience (the workforce) and think through the best ways to deliver key messages — different workgroups have different preferences on how to get their information. I work closely with managers and project and program leads to craft messages that are clear and find the communication channels that suit



STRATEGIST — Karli Massey strives to embrace data-driven strategies for employee communications at Sandia. Her team won Best in Show for Sandia's communications survey at the 2023 Cumbre Awards, an event held by the Public Relations Society of America New Mexico chapter.

Photo by Paulina Gwaltney

their needs and best reach those who really need the information and will benefit from it. Then, we make sure it worked.

LN: How are you innovating at Sandia?

KM: We've found in the past we start communicating all the things, all at once. You really need to rein that back to a couple of big initiatives at a time so communications staff can put their creative energy behind communicating those things our leaders want to be the focus.

We've now implemented a prioritization model that a lot of other companies are using when you have big, Labwide communications campaigns. Like for our Labs Strategy, this year there are only two goals — accelerate innovation and lead in modern engineering — instead of a long list of goals we have a hard time remembering. It's new and different



MENTOR — Karli Massey, center, mentors other communication professionals at Sandia and in the community. In 2023, she mentored local business owner Kristelle Siarza, right, in pursuit of her accreditation in public relations. Karli, Siarza and NMPRSA's Nancy Partridge are pictured here during a recent accreditation pinning ceremony.

Photo by Raymond Mares, courtesy of New Mexico PRSA

for Sandia, and it will help us be more effective and respectful of employees' attention.


LN: Tell me about your work elevating the public relations profession in New Mexico.

KM: A significant part of our statewide professional organization has always focused on networking events. But during COVID-19, of course, everything had to

be done online. So, over the past couple of years, I've helped the organization get back into networking and making those connections in person again. There was a lot of energy behind that with other members of our board, too.

We're engaging in a lot more statewide efforts besides just focusing on Albuquerque. Like events in Los Alamos when they were preparing for the Oppenheimer release,

getting the community engaged for something that could result in a lot more tourism.

One of our significant achievements this year was being recognized by our national organization for our growth in diversity, equity and inclusion. We were awarded an honorable mention, and I'm very proud of those efforts. 

A legacy of influence

Karli Massey follows a tradition of Sandians who connect with and uplift their local communities. She served as the 2023 president of the New Mexico chapter of the Public Relations Society of America, an organization founded by a particularly passionate Sandian.

"Ted Sherwin was a whirlwind," said Sandia historian Rebecca Ullrich. "He headed the Toastmasters group out here, was head of Public Relations, worked every year to raise money for the Community Chest (precursor to United Way in this area) and pushed to establish the Employee Contribution Plan," now known as the annual Sandia Gives campaign.

He even took an occasional, mimeographed employee newsletter and turned it into the Sandia Lab Weekly Bulletin, which later became the publication you're reading now.

Each year, New Mexico PRSA honors his legacy as a community dynamo. The organization's annual Ted B. Sherwin Member of the Year Award goes to an individual "who has gone above and beyond to support the chapter."

In 1999, he wrote a retrospective article for Lab News as a retiree (Sandia was celebrating its 50th anniversary). He said, "I remain very proud of our work, especially in the fall when I read how much Sandians are pledging to their community, both in money and time. Twenty percent of Albuquerque's United Way giving for more than 40 years — that's something Sandians can be proud of."

Ted worked at Sandia from 1949 to 1981. He died in 2006 at the age of 88.

Science serving others

Engineer employs computer code to mitigate climate change and nuclear energy risks

By **Sarah Jewel Johnson**

Dave Luxat is the epitome of "science serving others." He is a second-generation engineer who is empathetic that change is hard, cares greatly about climate change mitigation and is passionate about building on the long-standing heritage of engineers and

researchers who came before him. Dave said that we have an opportunity to "stand on the shoulders of giants" to make our world better for future generations, and he won't see the opportunity slip away.

Dave joined Sandia in 2019 and is the manager of Sandia's Nuclear Energy Safety Technologies department. The department's preeminent computer code, Melting Core, or MELCOR, is a fully integrated, engineering-level computer code developed for the U.S. Nuclear Regulatory Commission to model the progression of severe accidents in nuclear power plants. MELCOR's technology is vital to the future of nuclear power and clean energy because it allows researchers, scientists and community

members to better understand benefits and potential risks associated with nuclear power plants.

Dave graduated from the University of Toronto, where he studied engineering science before receiving his doctorate in theoretical condensed matter physics.

Lab News interviewed Dave to hear his perspective on climate change and how Sandia research is making a difference.

Lab News: Why are you passionate about climate change?

Dave Luxat: Climate change presents a fundamental existential risk to our species and our planet. If we don't address climate change the consequences are dire — all the progress we've made as a civilization would end.

LN: What does “climate security” mean to you?

DL: Climate security means that fundamental risk is ameliorated and addressed, and that people in the U.S. and around the world can essentially live in a more secure environment. They have a thriving society, political system and economy, all serving to lift people up and have the opportunity to strive to realize their potential.

I see climate security and national security in a very similar lens — they feed on each other. Without climate security or national security, we see a world in which we have more conflict as people struggle to secure scarcer resources that sustain life. The challenge alone from sudden waves of mass migration can already be seen in the challenges faced by countries around the world. Without climate security, one can certainly envision a world with more destabilized democracies, and nations around the world in conflict with each other.

LN: What climate-related challenge are you most excited to work on?

DL: We have a number of energy-generation technologies that provide us with abundant power but significantly contribute to climate change. While we must address these causes of climate change, we shouldn't lose the perspective that supplying abundant energy has been vital to enabling so much of our modern, technological society. Replacing these energy technologies that contribute to climate change with alternatives that do not provide us with the same energy will slow human progress.

For me, the risk of lost human potential is a tragedy, and we can't remove that from how we are balancing the choices we must make in this vast transition in our energy system. I fundamentally believe that nuclear energy has proven its ability to deliver abundant energy safely, and it must — with even safer advanced reactors — play a substantial role in addressing climate change.

LN: How does your work at Sandia advance climate security?

DL: MELCOR is an analytical capability that allows us to understand and assess the safety of nuclear power. The safety and continued enhancements of nuclear energy technology are vital to a clean energy future. MELCOR represents a repository of all

the research and development that's gone on through the history of nuclear energy to understand the safety of nuclear energy systems and how they behave under accident conditions. It is a computer program composed of basic science — physics and chemistry — that then allow us to assess how a particular nuclear energy system would behave in the event of an accident.

MELCOR is an enabling technology to help us assess and understand new energy technologies, to ensure that we can develop advanced nuclear energy technologies that help address climate change and to potentially decarbonize our society, without introducing an unacceptable risk to public health and safety.

LN: What perspective or capabilities does Sandia bring to addressing the climate crisis?

DL: Sandia is a systems integration lab. That was our mission from the very beginning for the nation and continues to be our purpose. We don't necessarily focus on one component, or one technology, or one aspect of the nuclear deterrence mission. We grew up to integrate all of this into a functioning technology to achieve a mission, and that heritage is in the DNA of everybody who works at Sandia.

The safety of nuclear energy technology is about understanding how all the components of the systems work together to ensure safety. You truly can't understand the safety of a nuclear plant unless you focus on how all its pieces work together to provide that with very high confidence.

LN: What does the nation or world look like in the future if we are successful in addressing climate change?

DL: We would be in a situation where a lot of the stressors that we see driving increased conflict and threats to national security around the world are ameliorated. We could be in a position to reliably roll out abundant energy not just to privileged nations but to developing nations realizing their own clean energy potential. I do not



LASTING LEGACY — Dave Luxat, left, and his father, John, one of his biggest inspirations. “My dad was a leader in nuclear safety through the development and deployment of nuclear energy technology in Ontario. I grew up inspired by him and his colleagues who worked so hard to leave a lasting legacy for the people of Ontario,” Dave said.

Photo courtesy of Dave Luxat

see a world in which we lift up children in the poorest of nations, give them a chance to realize their dreams, if we struggle to provide the energy that ultimately fuels human ingenuity.

LN: What's your vision for integrating energy equity and environmental justice into Sandia's climate security efforts?

DL: Nuclear energy technology and other energy technologies are critical when we think about the perspective of environmental justice and energy equity. It's about access, but more specifically, access to energy that does not displace or harm people, and certainly does not place them at increased risk.

Engineering the next generation of energy technologies that are safer and have reduced risks is critical to ensure we can provide the energy that underpins a modern technological society energy to everyone. We must think about energy justice and energy equity holistically. It's not just about the technology but about understanding the potential downstream effects of a technology, or a life cycle, and ensuring all potential risks are mitigated. While we can't ship risk somewhere else on the planet, we also cannot ship risk to a future generation.

LN: If you were trying to recruit or inspire someone to work on the problem of climate change, what would you say to them?

DL: When I started in my engineering program, I recall a banner hanging above

the entrance of an engineering building that read, “Science Serving Society.” That has inspired and motivated me ever since. It’s not about finding a better-paying job or chasing titles; it’s ultimately a matter of can I work on something that truly impacts our children, our children’s children, that truly changes the world for the better. Working at Sandia and in the energy programs, we have an opportunity to have a lasting impact on the world.

LN: How can we educate and involve more people in addressing the climate crisis?

DL: It’s about empowering people. Convincing people of the potential value

behind clean energy is very hard because they don’t see it in a very tangible way. At an abstract level, we might understand it, but what we tend to see is that there’s this risk of the unknown.

We cannot look at attempts to address the climate crisis as taking things away. Instead, we need to look at it through the perspective of creating opportunities across the board. For example, you can’t go into a coal mining community and say, ‘we are taking your jobs away to close the mine.’ That’s how they feed their families, that’s their community and their identity. Instead, we have to create opportunities in new sectors that people in these communities can realize in the here

and now. You simply cannot rob people of a sense of control, independence and purpose. It’s a matter of engaging people in ways that do not rob them of their self-worth while communicating and enacting vital changes. This is why advanced nuclear power plants in former coal mining communities hold such promise. It gives us a chance to provide a large number of middle-class jobs to working families, the kind of jobs that have been key to the stability of our communities and the civic connections vital to maintaining our democracy. We cannot talk about solutions to the climate crisis if we do not first root them in what we have always valued as a country. [f](#)

Recent Patents

October–December 2023

- Note: Patents listed here include the names of active Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing for each patent is a patent number, searchable at the U.S. Patent and Trademark Office website ([uspto.gov](https://www.uspto.gov)).*
- **Clare Davis-Wheeler and LaRico Juan Treadwell:** Solvothermal synthesis of metal alkanoate and metal oxide nanoparticles. Patent #11773046
 - **Tucker Caelan Ellis Haydon:** Terrain-aided position determination using range angle radar altimetry. Patent #11782154
 - **Charles Thomas Harris, Tzu-Ming Lu and Peter Anand Sharma:** Nanoscale bolometer operating near the thermodynamic limit. Patent #11788893
 - **William C. Curtis III:** Pulsed source for driving non-linear current dependent loads. Patent #11791601
 - **Ezra Bussmann, Tzu-Ming Lu and Andrew Mounce:** Micromagnet puf readout using a quantum diamond microscope. Patent #11796612
 - **Evan Michael Anderson, DeAnna Marie Campbell, Jeffrey Andrew Ivie, Andrew Jay Leenheer, Tzu-Ming Lu, Shashank Misra and Scott William Schmucker:** Method of chemical doping that uses cmos-compatible processes. Patent #11798808
 - **Christian Lew Arrington, Amber Lynn Dagel, Patrick Sean Finnegan, Andrew Eugene Hollowell and Travis Ryan Young:** High aspect ratio gratings fabricated by electrodeposition Patent #1798844
 - **Brooke Nicole Harmon, Yooli Kim Light and Joseph S. Schoeniger:** CRISPR/Cas activity assays and compositions thereof. Patent #11807877
 - **Douglas A. Blankenship, John Joseph Borchardt, Jason P. Krein, Taylor Anthony Myers, Joseph Samuel Pope, Richard Ellis Robey, Jiann-Cherng Su and Andrew Alexander Wright:** Downhole to surface communications platform for drilling applications. Patent #11808144
 - **Julia Napolin Tilles:** Radioimaging for real-time tracking of high-voltage breakdown. Patent #11808800
 - **Pintor Dario Lopez:** Additives for improving autoignition reactivity of hydrocarbon-based fuels. Patent #11814595
 - **Blake Lance:** Flow assisted anti-fouling geometries for compact heat exchangers. Patent #11821696
 - **Jonathan Edward Bainbridge, Neil Clausen and Peter Schwindt:** Optically pumped, radio-frequency atomic magnetometry with feedback stabilization. Patent #11821966
 - **Jennifer Lee Braid, Benjamin Garrett Pierce, Daniel Riley and Joshua Stein:** Systems and methods for single-axis tracking via sky imaging and machine learning comprising a neural network to determine an angular position of a photovoltaic power system. Patent #11823409
 - **Judith Maria Lavin:** High resolution, high conductivity components by aerosol jet printing. Patent #11825609
 - **Ryan Alberdi, Brad Boyce, Anthony Garland and Benjamin C White:** Structural metamaterials comprising interpenetrating lattices. Patent #11826952
 - **Samuel Leininger and Gregory C. Stihel:** Positional scanning lane. Patent #11827498
 - **Leah Appelhans, Adam Cook and Carl Erik Linde:** Real-time process monitoring for direct ink write additive manufacturing. Patent #11833762
 - **Darren W. Branch and Ronald P. Manginell:** Methods of transfection using sonoporation. Patent #11834650
 - **John Nogan and Raymond Vernon Puckett:** Gas delivery system for environmental transmission electron microscope. Patent #11837432
 - **Charles R. Bryan, Margaret Ellen Gordon and Mark A. Rodriguez:** Tunable negative coefficient thermal expansion materials and composites. Patent #11840459
 - **Leah Appelhans, Adam Cook, Brad Howard Jones and Samuel Carlos Leguizamon:** Use of latent metathesis polymerization systems for additive manufacturing. Patent #11840586
 - **Amir Borna, Tony Ray Carter and Peter Schwindt:** Vector measurements using a pulsed, optically pumped atomic magnetometer. Patent #11841404
 - **Jessica Nicole Kruichak, Melissa Marie Mills and Yifeng Wang:** Double charge composite materials for contaminant removal and methods of making the same. Patent #11851350
 - **George Bachand and Andrew Gomez:** Synthetic nucleic acids for information storage and transmission. Patent #11854669
 - **John C. Hewson, Andrew Kurzawski, Jacob Mueller and Yuliya Preger:** Dispersion of stored energy within a battery system at risk of failure. Patent #11855264

Mileposts



Raymond Griego 35



Jeannie Bekaye 25



Larry Bruskas 25



Michael (Cass) Cassady 25



Jason Krein 25



John Pelletier 25



Derek Anderson 20



Jonathon Donaldson 20



Dave Jones 20



Doug Miller 20



Susan Shelton 20



Ben White 20



Angie Hachfield 15



Scott Kowalchuck 15



Jessica Yockers 15



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National Engineers Week

Photos by **Craig Fritz**

Engineers make it happen at Sandia. In honor of National Engineers Week, which is hosted by the National Society of Professional Engineers and runs Feb. 18-24, Lab News selected a few recent photos of excellent engineering happening around the Labs.

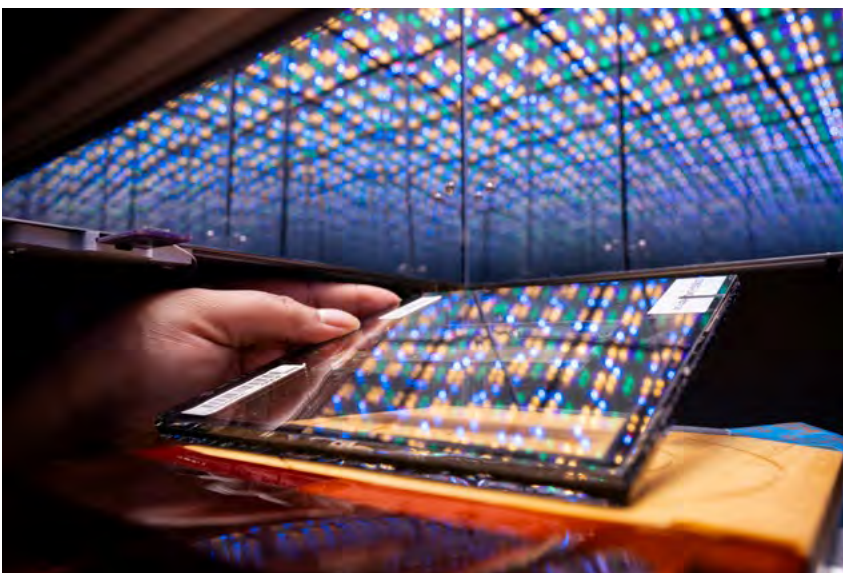
This year's theme Welcome to the Future centers on paving the way for a brighter and more diverse future in engineering. This goal is shared by Sandia's community involvement team and volunteers who aim to inspire the future of engineering through their efforts.



RISE AND GRIND — In preparation for a series of 300-foot blast tube proficiency tests, technologist T.J. King welds a portion of the tube on a September morning.



DOWN THE WELL — From left to right, electronics engineer Alfred Cochrane, electromechanical technologist Taylor Myers and mechanical engineer Melanie Schneider position a downhole acoustic transceiver and energy harvesting tool before lowering it into a well.



HERE COMES THE SUN — Scientist Angelique Montgomery places perovskite modules under LED lights that simulate the sun with a flash of light during a reliability test.



ROAD INSPECTION — Sandian David Castillo is shown Jefferson Middle School Team 3's vehicle by Dash Benz, middle, and Alfredo Conklin during the design competition of the 2023 New Mexico Electric Car Challenge on Nov. 4.