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Quantum computers' unexpected advantage

Sandia and Boston University challenge conventional wisdom that speed rules supreme

By Troy Rummler

As the hare learned from the tortoise, speed isn't everything. Theoretical scientists at Sandia and Boston University have discovered that quantum computers are unrivaled at solving an advanced math problem. Unusually, they proved quantum computers are not faster than regular computers; instead, they use far less memory.

The revelation upends the conventional wisdom that the value of a quantum computer is that it can solve certain problems much faster than a normal one. It could also help researchers find more real-world uses for the rapidly advancing tech.

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MAKING THE CUT — Theoretical scientists John Kallaugh, left, and Ojas Parekh find tasks in which quantum computers outperform normal computers, a concept called quantum advantage, at Sandia.

Photo by Craig Fritz

Creating 'A Brighter Future'

Creative Services video showcases how Labs evolves to meet global challenges

By Brittany Mullins



SEEING SANDIA — Creative Services videographer and producer Bryn Whisenand watches a playback screen during the production shoot of Sandia's new corporate video.

Photo by Craig Fritz

Mirroring the trailblazing spirit of so many Sandia scientists before them, one Creative Services team approached the challenge of telling the story of Sandia's 75-year history as an opportunity to innovate.

"How do we creatively explain all that Sandia is? We have someone walk through it," said Bryn Whisenand, a video producer and director in Creative Services.

The video, titled "**A Brighter Future**," follows a young woman overwhelmed by world events, transitioning from scenes of stark reality to scenes of hope.

"She starts seeing a spark, a sparking of change and hope. She starts seeing Sandians who are the change, who are working to create a better future," Bryn said.

Bryn and his colleague Mike Cleary coproduced the new corporate video, which has already won a **national creative video**

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Joe Sandoval: A Sandian on a mission

By **Kenny Vigil**

Whether at Sandia or on work trips overseas, nuclear security is consistently top of mind for Joe Sandoval. Ensuring nuclear security worldwide is a dedication for Joe — so much so, he has earned recognition from the International Atomic Energy Agency as having led more International Physical Protection Advisory Service missions than anyone else.

“The missions offer an opportunity to promote nuclear security worldwide,” said Joe, a distinguished member of the technical staff in Global Security. “I have a lot of fun. I lead missions around the world. I

help nuclear sites around the U.S. and the globe to do security well.”

Joe said the increasing focus on alternative green energy sources could lead to the use of more nuclear power plants, increasing the importance of ensuring the plants are operated safely and securely.

The wide range of work Joe has done at Sandia during his 39-year career has helped prepare him for his current position, which he has held since 2008.

Early career

Joe enlisted in the Marine Corps in the late 1970s. After completing his active duty, he enrolled at the University of New Mexico, where Sandia recruited him as a



JUMPMASTER AWARD — Joe Sandoval, pictured here in 1987, when he received the award of Distinguished Honor Graduate at the Ft. Benning Jumpmaster School. Joe started his career at Sandia as a security police officer in 1985. **Photo from the Lab News archives**

security police officer. In 1985, Joe joined Sandia's special response team. Joe's career at Sandia was briefly put on pause during his deployment to the first Gulf War. He then returned to Sandia, serving in various roles, including a role akin to the chief of staff for Sandia's security director.

Then he moved to domestic and international security programs.

"I have traveled all over the world testing, designing and installing security systems at nuclear facilities," Joe said. "All those years in Russia and former Soviet Union countries working on security systems helped deepen my understanding of the security technology."

Overseeing Sandia's Protective Force

In 2003, Joe took on what he considers the hardest position of his career at Sandia. He became the manager of Sandia's Protective Force, responsible for overseeing more than 180 uniformed officers.

"That was back when we had to sign timecards every Thursday. I had to sign timecards for more than 185 employees," Joe chuckled. "It took weeks and weeks to complete everyone's performance evaluations."

Joe later transitioned to managing Sandia's Physical Security, Vulnerability Assessment, and Material Control and Accountability departments in the Safeguards and Security Center. Joe was in the center for five years.

"Even though it was the hardest thing

I've ever done in my life, being a manager in an operational security group helped prepare me to understand how to manage security organizations," Joe said. "Security is all about technology, people and procedures, and they all have to work together."

Leading missions at home and abroad

Joe's extensive experience has proven invaluable in his current role, especially when leading International Physical Protection Advisory Service missions.

"Since 2008, I've led about 17 missions. We provide advice to IAEA Member States," Joe said. "During these missions, we look at the country's entire legal and regulatory framework for securing nuclear material. We provide a service to these countries and help them align with international agreements on nuclear security."

The missions, which are voluntary, are a priority for the IAEA. A group of international experts reviews regulations and practices for nuclear material in the host country to ensure alignment with the Convention on the Physical Protection of Nuclear Material and its Amendment.

Joe played a pivotal role in

preparing for the first International Physical Protection Advisory Service mission to the U.S. in 2013.

"The U.S. is unique in that it has two entities regulating nuclear material, namely the Nuclear Regulatory Commission and DOE," Joe said.

The 2013 peer review focused on the Nuclear Regulatory Commission and the



SECURITY PLANNING — Joe Sandoval, along with others in the Protective Force leadership view a 3D model of Sandia while listening to security tactics. The picture was taken in 2003, when Joe was manager of the Safeguards and Security Planning and Physical Protection department.

Photo from the Lab News archives

research reactor at the National Institute of Standards and Technology. Joe also served as a technical advisor to DOE for the second mission to the U.S., which took place earlier this year, [including a visit to Sandia](#).

Mission to China

"You would not imagine some of the places we've gone. In 2017, I led the first International Physical Protection Advisory Service mission team in China," Joe said. "It was the first time the Chinese government opened a nuclear facility for an international mission to evaluate nuclear security at one of their nuclear power plants."

Joe added that the peer-review nature of these missions is important for nuclear security worldwide.

"Many times, we learn as much as we're able to impart. All the people who go on these missions learn valuable insights that we can take back to our respective countries, bolstering nuclear security," Joe said. "The missions provide confidence to the world that neighboring countries are committed to abiding by international consensus recommendations."

To date, more than 160 countries have pledged to follow these recommendations. Since the program's inception in 1995, the IAEA has conducted more than 100 International Physical Protection Advisory Service missions. [f](#)



ON A MISSION — Sandia's Joe Sandoval, left, meets with Shen Lixin, deputy director-general of China's Atomic Energy Authority's Department of System Engineering, to plan China's 2017 International Physical Protection Advisory Service mission. Joe led the mission, as the Chinese government voluntarily opened a nuclear power plant to evaluate nuclear security measures. Photo courtesy of the China Atomic Energy Agency

Quantum advantage

CONTINUED FROM PAGE 1

“This is the first exponential quantum advantage for a natural streaming problem,” said Sandia’s Ojas Parekh, a member of the team.

Memory is important for any computer. The more memory it has, the bigger problems it can solve. For quantum computers, which store information in qubits, “Space really matters because it’s hard building quantum computers with lots of qubits,” Ojas said.

The team is presenting its findings at the Symposium on Theory of Computing, which runs from June 24-28 in Vancouver, British Columbia. The mathematical proof is available on the website [arXiv](#).

Sandia’s **Laboratory Directed Research and Development** program and the DOE’s Office of Science, Office of Advanced Scientific Computing Research, funded the work.

Value of quantum computers could be memory efficiency, not just speed

In 1994, American scientist Peter Shor startled the world when he proved future quantum computers would be able to crack standard encryption algorithms alarmingly fast. In the 30 years since, however, researchers have only found a handful of other problems these computers can solve quicker than normal ones.

The research emerging from Sandia and Boston University now points to a different area where quantum advantage is possible.

“Much of the focus in quantum advantage research has been on achieving time advantage,” said **Nadezhda Voronova**, a Ph.D. candidate in Boston University’s department of computer science. “Research on quantum advantage with respect to other resources, like memory, has been relatively limited.”

Shifting attention to these other attributes, like efficiency, could help scientists find more practical uses for quantum computers.

“Are we currently missing important

quantum advantages because we’re focused or biased toward certain kinds of problems?” Ojas said.

What a natural streaming problem is, and why it matters

The math problem at the center of the team’s claim, called maximum-directed cut, is significant because it is what researchers call a natural problem.

“When we talk about a natural problem,” said John Kallaugher from Sandia, “what we mean is that it’s a problem of independent interest — that people were already studying it in the classical setting.”

Ojas further explained, “The max-directed cut problem amounts to finding the two groups of agents in a network with the most communication directed from one group to another. This problem finds applications in cybersecurity and social network analysis and design.”

Computers normally need lots more memory as this kind of problem grows more complex. But quantum computers don’t, the team found. They are exponentially more efficient with their memory usage, at least when data arrives in a stream. Streaming calculations are useful when data sets are too large to fit in a computer’s memory or when the data is being created continuously.

John **previously published** that quantum computers could have a distinct but smaller advantage than what he and his team have now proven. The new finding of an exponential ratio is significant because an advantage needs to be very large to be worth the time and money it takes to build and run a quantum computer.

Like Shor’s algorithm, the new finding is still theoretical because it has not yet been demonstrated on a computer.



SPREADING THE NEWS — Nadezhda Voronova, a Ph.D. candidate in computer science at Boston University, presents results of her quantum advantage research at the Quantum Information Processing conference in Taipei, Taiwan, in January.

Photo courtesy of Quantum Information Processing 2024


Discovery hints at future roles of quantum computing

Maximum-directed cut is not very useful on its own. However, it is a widely known optimization problem in advanced mathematics, which the research team sees as a hint to the kinds of practical uses quantum computers could have in the future.

“In cybersecurity, for example, efficiently solving optimization problems could lead to better resource allocation, enhanced incident response strategies and more accurate risk assessments,” Voronova said.

John added, “This could point the way to algorithms that can handle problems too large for any classical computer to process.”

“There could be more algorithms like this,” Voronova speculated.

“No one has, really, the complete picture,” Ojas said. 

Brighter future

CONTINUED FROM PAGE 1

award. It will be shown at conferences and seminars, and prominently displayed on Sandia's YouTube channel.

Both Bryn and Mike are relatively new to the Labs. "Being new, we had a nice excuse to say, 'we're going to do something grandiose, big, different and inspiring,'" Mike said.

Besides the lead actress, everyone else in the video is a Sandian. Fifteen scientists are depicted performing their regular work in front of 20-foot-tall, 360-degree screens at Electric Playhouse in Albuquerque, surrounded by props from around Sandia.

"Getting props from places around Sandia was no easy task," Mike said.

The video showcases a drill bit, **revolutionized by Sandia for General Electric**, an **Airborne Radiological Collection Pod** and a B61 mock unit used for training, among others.

"We had to secure documentation explaining why we were moving something resembling a missile, just in case we were pulled over by the police or if someone saw us unloading one of the huge props in the Electric Playhouse parking lot," Bryn said.

While the interactive props add depth to the video, Bryn and Mike emphasize that the people who bring it to life.


"I have a young daughter who is the joy of my life," Mike said. "Getting to look at things through the eyes of a child is so important; one thing that all of us have been is children. Having the lead actress be a young person who someone can identify with — whether it's a current student aspiring to make a change or enter this field — it can be the spark that creates change."

"This video represents a new way of entering a medium that laboratories have not really explored, and that's important. We now have a younger audience we

want to engage," Bryn said.

Despite Sandia's proud legacy spanning 75 years, billions of dollars in economic impact and nearly 2,000 active patents, Bryn and Mike want to make sure that people not only know about

these accomplishments but do not forget about them.

"We want to remind people that we're here doing great things for the country and the world," Mike said. "And if you didn't know, now you do." 



CATCHING THE SPARK — Creative Services videographer and producer Mike Cleary, second from left, coproduced and directed of photography for Sandia's new corporate video. Here, he operates a camera following the video's main actress at Electric Playhouse.

Photo by Craig Fritz



MOCK B61 IN THE HOUSE — A mock B61 unit used for training costarred as a prop in the new corporate video. The Creative Services team secured special paperwork to be able to transport it.

Photo by Craig Fritz

Recently retired HR director named GOAT

By **Greg Archuleta and Karyn Scott**

The Society for Human Resources of New Mexico recognized Rob Nelson with the 2024 Greatest of All Time Legacy Award at its annual awards presentation on April 29.

The annual awards show spotlights human resources professionals in New Mexico who elevate the profession, serve as a role model for their peers and set the standard for others to follow. They enable the professional community to tell their stories and recognize their contributions and achievements. Society for Human Resources New Mexico candidates are evaluated on their demonstrated integrity, leadership, innovation, strategic thinking, character, impact, passion, influence and knowledge in human resources.

Not just noteworthy

The Society for Human Resources lauded Nelson for driving impactful improvements at Sandia and noted his accomplishments, specifically his impact on national security and his ability to shape human resources professionals into highly capable leaders.

In his application for the award,

colleagues wrote that “Rob and his team have been the key driver for impactful improvements at Sandia National Laboratories, including: increasing compensation; increasing promotion opportunities and creating an intra-level advancement system; improving the wellness of employees and health and time off benefits, including adding more vacation accrual and two additional holidays; improving talent acquisition, including on-the-spot offers; championing the hybrid work culture by continuing the growth in telecommuting and remote work; and transforming HR service delivery, including the implementation of shared services and analytics functions.”

Nelson’s work extends beyond Sandia and into the community, including serving as a board member for the New Mexico Museum of Natural History and Science, and on the board of Leadership New Mexico.

“He is an integrative, brilliant and strategic thinker who consistently challenges the status quo,” his colleagues noted in the application. “He is always seeking to find a way to improve whatever project or process that he is leading.”

Path to greatness

Nelson retired on June 4 after 18 years of exceptional service to the Labs. He joined Sandia in 2005 as a principal member of technical staff before moving to management in 2009. From 2011-2016, Nelson served as the director of Sandia’s Health, Benefits and Employee Services organization with responsibility for the on-site ambulatory healthcare clinic.


As director of Human Resources, Nelson oversaw the health and welfare benefits program, talent acquisition, the



THE GOAT — Former Human Resources Director Rob Nelson has been named the Greatest of All Time by the Society for Human Resources New Mexico. At a ceremony on April 29, the organization cited his personal and professional contributions to Sandia and New Mexico.

Photo courtesy of Rob Nelson

shared services function, compensation, time away from work programming, and pension and 401(k) retirement benefits administration. As a member of the Human Resources leadership team, he helped create and implement Sandia’s human capital strategy and worked to advance Sandia’s human resources capability and promote service excellence.

In addition to an MBA from the University of Denver, Nelson earned a master’s degree in computational engineering from Purdue University in West Lafayette, Indiana, and a bachelor’s degree in computer engineering from the University of New Mexico. Nelson maintains several industry certifications, including designation as a Senior Professional in Human Resources and certification from Cornell University in collective bargaining and labor relations. 

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Connection and belonging at Sandia

Brian Duong shares his story of finding belonging as a Sandian

By **Lea Blevins**

Belonging isn't about fitting in. At Sandia, it's about being who you are and building authentic connections with a shared purpose — creating a larger work community to support and inspire one another.

The Labs' People and Culture strategy and the Integrated Security Solutions division focus on belonging, connection and contribution aim to make Sandia a better place to work.

Lab News is featuring Sandian stories of finding connection, starting with Brian Duong, chair of the Asian Pacific Leadership Committee.

Connecting others together

After joining Sandia in January 2019, Brian dove headfirst into finding a sense of belonging.

That month, Brian attended a meeting of the Asian Pacific Leadership Committee. The group's leadership roles were rotating out at the time, and before he knew it, he became the new chair.

At his previous workplace, Brian was a lead for employee engagement efforts, so becoming the chair of the committee was a natural fit.

"I love to connect people," Brian said. "I love to hear different stories, and I love to do something so people can feel like they've been valued at work."

He took this passion for connecting others a step further a couple years ago when he became co-chair of the Sandia California Diversity Council, which supports the employee resource and networking groups for the California site.

"It gave me a different perspective," Brian said of the new opportunity to collaborate with all the groups. "It's more about making sure I hear the concerns of the different groups and working with

them to bring everyone together."

Even though these efforts gave him a fast sense of belonging at Sandia, Brian has still experienced times when he felt out of place.

Climbing upward toward belonging

In his first few weeks as a Sandian, Brian faced a sense of exclusion when entering a building behind another workforce member. The door closed between them, and then Brian swiped his badge and walked inside. The individual who went in before him turned back to ask Brian if he was a U.S. citizen. At the time, Brian thought it was clear his badge access meant he was authorized to enter the building. However, the other workforce member repeated the question.

"You feel targeted," he said. "Why would he ask me? Because I look different? Because I look Asian?"

Because of Sandia's security measures, Brian understood someone could ask to see his badge, but this experience left him feeling shut out.

"The Labs are different because there are a lot of things we have to worry about," he said. "However, the way we ask questions and the way we raise concerns could make a difference. You might forget someone's name, but you will probably not forget how someone treated you."

All Sandians have a responsibility to protect national security, though there are ways workforce members can be sensitive to individuals in the process.

"People don't think about it, but there are biases we all have," said Tuan Nguyen, counterintelligence officer for Sandia California. "If you are seeing something that is some concern, you have to look at the behavior rather than the individual, because there are people here coming from all walks of life. They all have the same clearances, and they have been vetted. Where they're from has really nothing to do with whether they should be here or if they have the right access."



DOE SUMMIT — Brian Duong represented Sandia's employee resource groups, receiving the Appreciation Award at the first DOE One enERGY Community Employee Resource Group Summit in September 2023 in Washington, D.C.

Photo courtesy of Brian Duong

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DOE DIVERSITY — Brian Duong, fourth from left, and other Sandia California Diversity Council leaders at the DOE ONE enERGy Community Employee Resource Group Summit in September 2023 in Washington, D.C. **Photo courtesy of the DOE Employee Resource Group Summit**

Tuan said anyone with a concern can always ask to see someone’s badge, as that will confirm a person’s access. He added that Sandians can also reach out to Personnel Security or the counterintelligence helpline.

“You don’t have to take it upon yourself to determine whether someone has violated the policy or not. Bring it to the professional, and say, ‘Here’s what I observed,’” Tuan said. “Brian’s story is not unique, because I have received similar feedback from others. We’re really trying to say, let’s look at the incident for what it is — look at the access and at the behavior. That way we can convey that those are the things we are focusing on — not where they’re from, what they look like or how they speak.”

Moving on — and learning about yourself


When Brian became chair of the Asian Pacific Leadership Committee just a few weeks following the incident he described, he was able to pull from his personal experience to help ensure other workforce members feel included as much as possible.

“I really want to help others not feel the same way,” he said. “I want them to have the right resources, so if they ever find themselves in a similar situation, they will be able to lean into the relationships they have built at Sandia and know that they belong here.”

Asian Pacific Leadership Committee meetings and activities have helped Brian connect to his own culture as well as learn about other cultures.

“When we talk to people, we learn about their personal stories and feel connected,” he said. “That really helped to drive trust at work, and for me, that’s a rewarding experience.”

Being part of the committee has provided Brian with a foundation for connecting — something he hopes others may be inspired to try after learning about his experiences.

“I know it’s hard sometimes,” he said. “We have a lot of people with different backgrounds and different personalities. Give yourself a chance to learn new things. You don’t have to struggle by yourself. Try something even a little bit outside of your comfort zone — maybe one time — and go from there.” 

Plugging in new technologies

Two decades of research at the Distributed Energy Technologies Lab

By **Hollie Hohlfelder**

Twenty-two years ago, Abbas Akhil and Dave Menicucci recognized a disruption was happening in electric generation. New distributed generation technologies were emerging, and a new microturbine was on the market. Interest in renewable energy was climbing, and concepts such as “premium power” were floating around.

Akhil and Menicucci identified a familiar challenge: how could they integrate these different technologies into a safe, resilient and reliable system?

Looking around at the Photovoltaic Systems Evaluation Laboratory, the pair realized that the lab already had some of the core components they needed to start research on that very question.

“We had the PSEL with that 40-kilowatt array, and there was a lead-acid battery in the back room,” Akhil said. “We already had two pieces of a microgrid. We said, ‘If we can beg, borrow or steal a microturbine, then what are we waiting for?’”

Akhil, who is now retired, acquired not one but two microturbines as well as two fuel cells by honest means. A portion of PSEL was renamed the Distributed Energy Technologies Laboratory in 2002, and Sandia officially had a new lab to evaluate the interplay of distributed energy resources to function as a microgrid.

Microgrids for energy security and energy equity

Some of the earliest work at DETL supported efforts by the [U.S. military to develop microgrids at certain bases](#). In 2012, Sandia became the lead designer for a joint DOD and DOE [project known as SPIDERS](#), the Smart Power Infrastructure Demonstration for Energy Reliability and Security. That led to the development of software known as the Microgrid Design Toolkit, which Sandia then customized for [the Marine Corps to support their](#)

[decisions about energy technology](#).

DETL researchers have also applied their microgrid knowledge to benefit remote or island communities. Nick Gurule, who has current responsibility for DETL, pointed to Sandia’s work in [Puerto Rico](#) and [Cordova, Alaska](#).

“We’re constantly working on these systems and analyzing them, figuring out how we can integrate these technologies into communities to help them,” Nick said. Puerto Rico is pursuing a [path to 100% renewable energy](#) with the help of Sandia’s roadmap.

And microgrids aren’t just of interest to the military and communities on Earth. DETL also helped design a [microgrid for a future base on the moon](#).

Leadership in power electronics and standards

In DETL’s early years, researchers looked at improving system components as well as overall system performance. While there had been decades of public and private investment to optimize solar panels, the staff at DETL recognized a research gap for inverters, the devices that convert the direct current power produced by solar panels to alternating current. Inverters of the early 2000s had short lifespans and inconsistent performance.

Charlie Hanley, who managed DETL from 2005 to 2014, recalls the uncertainties of the time. “We were still in the phase of trying to figure out the questions that needed to be answered. Photovoltaic systems were getting bigger and bigger, there were more and more inverters, and folks didn’t really understand the impact this was going to have,” Charlie said. “We were right there with DOE figuring out the technical questions that we needed to ask.”

In 2008, Sandia became the lead lab researching inverters through a DOE initiative known as SEGIS, [Solar Energy Grid Integration Systems](#). “SEGIS was a really effective way to significantly accelerate industry’s ability to enhance the reliability of inverters,” Charlie said.

Of course, one sure way to improve the

performance of components is through technical standards. Both Charlie and Nick noted that Sandia staff have more than 20 years of history influencing the development of interconnection standards, such as IEEE 1547, which governs the connection of distributed energy resources to electric power systems.

“Many of the measurements included in the standards came from Sandia,” Charlie said. “The parts that gave those standards teeth and allowed people to assess whether devices were meeting the standards? That came from Sandia working closely with partners in industry and at other national labs.”

Upgrades and expansion to meet the times

DETL still has one microturbine, a diesel generator set and the photovoltaic panels, but the lab has been upgraded and expanded. The lead-acid batteries are gone, replaced by a battery emulator that better approximates the lithium-ion batteries used today for grid storage. Other emulators have been added — for a grid connection, [wind energy](#), larger solar arrays and a “neighborhood” of ten homes to simulate load. DETL staff also installed an electric vehicle charging station recently and are adding a wave-energy emulator.



**Making History,
Shaping the Future**

Nick said automated controls and cybersecurity will be critical areas for DETL in the next five years. DETL researchers can integrate commercially available devices into a system for testing.

Referencing one theoretical scenario, Nick asked, “What if 50 megawatts of solar is hacked and now the reactive power response that was supposed to be helping the system is changed? That can actually drive the system wild.”

Nick also said electric vehicles are drawing attention. He noted some vehicles are being marketed with vehicle-to-grid connectivity or as mobile power stations. “You can plug your truck into your home charger, and it can power your house during a power outage,” Nick said. “Vehicle to grid is a very interesting topic.”

Charlie also sees a strong future for DETL. “I would say cybersecurity, advanced communications and the integration of advanced power electronics are the three areas where DETL is going to be really important,” Charlie said.

Not waiting for the future

Today, DETL is a place where Sandia can conduct interoperability experiments with multiple distributed energy resources, perform cybersecurity research and model advanced grid scenarios. It’s a lab for testing, modeling and asking interesting technical questions, and then finding the answers.

Akhil isn’t surprised that DETL, the lab that he helped cobble together so long ago, is now looking at cybersecurity and advanced

controls. “That’s one of the amazing things Sandia can do,” Akhil said, referencing Sandia’s ability to meet new challenges. “The breadth of expertise — there’s just no private company that can do that.”

Take a [virtual tour of DETL](#). 



POWER PANELS — Sandia researchers use resources at the Distributed Energy Technologies Lab to find new and better ways to accommodate the nation’s increasing demands for clean, secure and reliable energy.

Photo courtesy of Sandia

Sandia researcher uses battery safety and reliability to create a more sustainable future

By [Sarah Jewel Johnson](#)

Lorraine Torres-Castro is on a mission to ensure the technologies of today do not harm the climate of tomorrow. For Lorraine, a future with sustainable and clean energy is possible but the possibility requires a “do no harm” mentality and inclusion of diverse perspectives, people and stories.

Lorraine, Sandia’s battery safety team lead and a principal member of technical staff, has been at Sandia almost eight years. In that time, she has focused her research on the transition to renewable energy and the reduction of greenhouse gas emissions using batteries. But not just any batteries — safe, reliable and ecologically responsible batteries.

As researchers explore a future predominantly powered by renewable energy, battery safety and a clear understanding of how batteries could impact

the environment are crucial pieces to the puzzle. “Issues like overheating, fire risks and the release of toxic chemicals when batteries are damaged or improperly disposed of could have significant implications to environmental and health risks,” Lorraine said.

The carbon footprint of energy and transportation systems can be reduced by developing safe, sustainable and high-performance batteries.

“The evolution of battery design and recycling has decreased the ecological impact of energy storage, making clean power readily available and safe,” Lorraine said.

Mission-driven research

Lorraine and the battery safety team at Sandia research ways to reduce the environmental impact of batteries while also improving their safety and effectiveness. They use predictive models and safety innovations to expedite the adoption of

electric vehicles and the integration of renewable energy into the grid, thereby reducing our nation’s carbon footprint and advancing climate security.

“We take a holistic approach to ensure that energy storage technologies do not harm the environment or human health. It includes the development and deployment of battery systems that are not only efficient, but also designed with the highest safety standards to prevent accidents, leaks and toxic exposures. Climate security entails managing the entire lifecycle of batteries, including manufacturing, recycling and disposal, to minimize their environmental impact and prevent further emissions that contribute to climate change,” Lorraine said.

Along with ensuring battery lifecycle safety, Lorraine and her team are working to guarantee they are capable of fulfilling clean energy power demands now and well into the future.

“Creating batteries that are intrinsically safe for humans and the planet, capable of powering everything from houses to electric vehicles without contributing to global warming, is a fascinating intersection of environmental responsibility and technological advancement,” Loraine said.

People-focused mindset

Loraine’s purpose-driven technical research is not only about sustainable impacts and safer, eco-friendly batteries. She is also focused on the need to include diverse people and socioeconomic perspectives in discussions and avidly promotes the need for education about climate-related issues.

“It is about making sure that advances in battery technology are available to everyone, especially to overburdened and underserved communities. This means focusing on research and development that improves battery safety and efficiency, as well as addressing social and economic barriers to using these technologies,” Loraine said. “In addition, using environmental justice principles means carefully checking how batteries are made and thrown away to reduce harm to the environment and make sure that no community is unfairly affected by the risks involved in making and recycling batteries.”

Loraine aims to engage diverse communities and facilitate open conversation on battery safety and its connection to climate change. “Including people from different backgrounds in making



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CHARGING AHEAD — Sandia battery safety team lead Loraine Torres-Castro presents Sandia’s efforts on energy storage systems safety and reliability at the 2023 International Electrical Safety Technical Seminar in Seoul, South Korea. **Photo courtesy of Loraine Torres-Castro**

decisions and finding solutions will enable us to hear different ideas and perspectives to aid in the fight against climate change,” she said.


More than just a challenge

Loraine is thrilled to continue her work at the intersection of battery safety and climate change and grateful to work with diverse teams of researchers at Sandia.

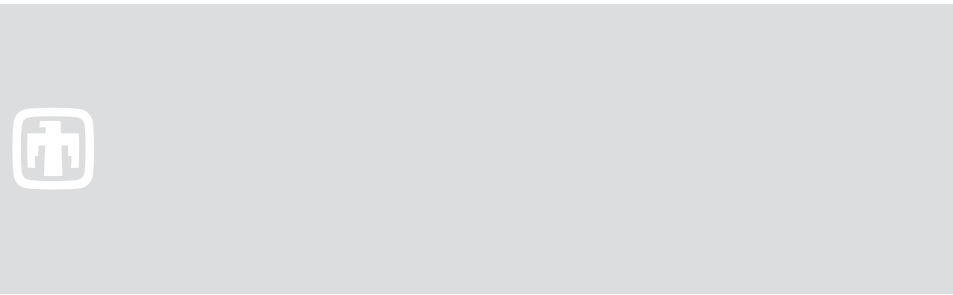
“Sandia brings a rigorous, systems-based approach to tackling the challenges of climate change. The Labs’ approach combines scientific innovation and policy analysis to turn complex scientific findings into actionable climate solutions. Sandia contributes to our understanding of climate dynamics and helps develop technologies and strategies that protect the environment, promote energy security and ensure a sustainable future,” Loraine said.

Members of future generations can choose from a wide variety of careers to have an impact on climate change, from batteries and beyond.

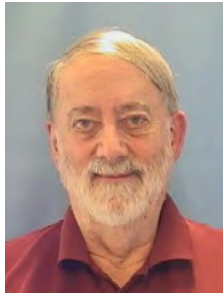
“This work requires creativity, passion and resilience because it involves solving complex problems that involve science, technology, society and the economy. But the rewards are great. You get to be at the forefront of defining and delivering a sustainable future, protecting ecosystems, lifting communities and making a positive impact on a global scale. If you want to make a difference, try new things and grow in ways you never thought possible, then you should join the fight against climate change,” Loraine said.

“Climate change is more than just a challenge. It’s the chance to make a future that is sustainable, safe and fair for all life on Earth. By joining this effort, you’re not just doing a job. You’re also on a mission to come up with new ideas to keep our planet safe for future generations.” 

Mileposts



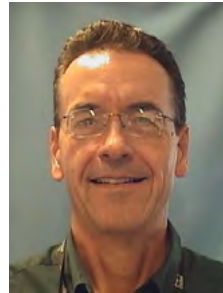
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William Cordwell 40



Joseph Maestas 40



Dan Vortolomei 40



John Linebarger 35



Kim Merewether 35



Marc Gunkel 30



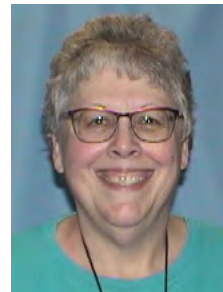
Martin Sandoval 30



Steve Beresh 25



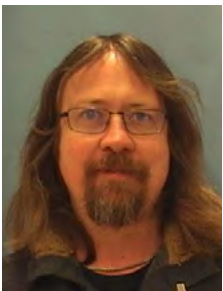
Fabian Aragon 20



Helen Bailey 20



Ben Cipiti 20



Jason Lechtenberg 20



Jonathan 'JT' McClain 20



M Albert Noriega 20



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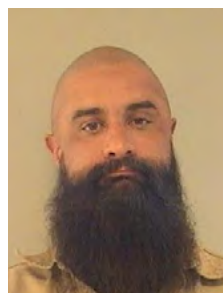
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Robin Jones 15



Jon Landstra 15



Anthony Rynes 15



Briana Sanchez 15

