



S A N D I A

LABNEWS

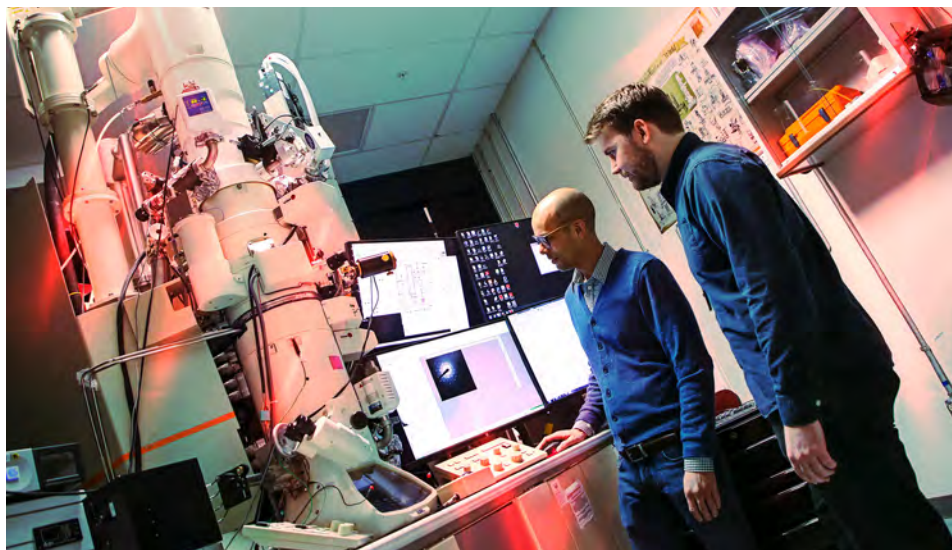
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Scientists chip away at a metallic mystery, one atom at a time



NO CASE TOO SMALL— In this photo from 2020, Christopher Barr, right, a former Sandia postdoctoral researcher, and University of California, Irvine, professor Shen Dillon operate the In-situ Ion Irradiation Transmission Electron Microscope. Barr was part of a Sandia team that used the one-of-a-kind microscope to study atomic-scale radiation effects on metal.

Photo by Lonnie Anderson

It's no secret that radiation weakens metal. Uncovering how is complicated work.

By **Troy Rummler**

Gray and white flecks skitter erratically on a computer screen. A towering microscope looms over a landscape of electronic and optical equipment. Inside the microscope, high-energy, accelerated ions bombard a flake of platinum thinner than a hair on a mosquito's back. Meanwhile, a team of scientists studies the seemingly chaotic display, searching for clues to explain how and why materials degrade in extreme environments.

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Sandia Science & Tech Park continues to strengthen local economy

Report highlights successes

By **Manette Fisher and Troy Rummler**

A new, independent report concluded that the Sandia Science & Technology Park continues to be a major contributor to Albuquerque's regional economy. Since it was established in 1998, companies and organizations in the research park have paid nearly \$7.2 billion in wages and generated more than \$4 billion in taxable personal consumption, which refers to consumer spending on goods and services that are taxable in New Mexico.

"Sandia is proud of the park's continued economic impact on Albuquerque and the surrounding area," Labs Director James Peery said. "It creates jobs, attracts talented professionals to our state and

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CROSSROADS OF INNOVATION — The Sandia Science & Technology Park, associated with the Labs and located adjacent to Kirtland Air Force Base, continues to be a major contributor to Albuquerque's regional economy, according to a new, independent report. Photo by Linda von Boetticher

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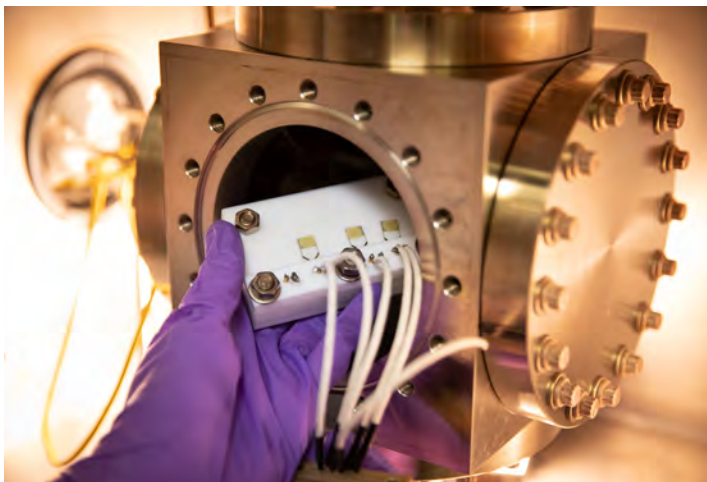
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LABNEWS Notes

Lab News may contain photos shot prior to current COVID-19 policies. Individuals in photos followed all social distancing and masking guidelines that were in place when photos were taken.

EDITOR'S NOTE: Please send your comments and suggestions for stories or for improving the paper. If you have a column (500-800 words) or an idea to submit, contact Lab News editor Katherine Beherec at kgbeher@sandia.gov.

Sandia team wins \$25K through DOE technology transfer program



GATHERING DATA — The nDETECT sensors undergo testing at Sandia. Money from DOE's Energy I-Corps program will help the technology advance toward commercialization.

Photo by Craig Fritz

Winners will use funds to improve sensor technology

By **Manette Fisher**

A Sandia team working on commercializing a sensor to help munitions remain safe and reliable won \$25,000 from the DOE **Energy I-Corps program**. The money will help the team further develop the technology.

Energy I-Corps is a key initiative of the DOE's Office of Technology Transitions, which sends teams through an intensive two-month training where researchers define technology value propositions, conduct stakeholder discovery interviews and develop viable market pathways for technologies.

The winning Sandia team was part of the 14th cohort to graduate from Energy I-Corps which took place virtually this

year. Sixteen teams from nine national laboratories participated, including four teams from Sandia. The winning team included principal investigator Mara Schindelholz, business management professional Wendy Rue and industry mentor Rob DelCampo from the University of New Mexico.

“Being able to dig in and learn about the problem space and the type of environment that our sensor would need to function in has helped us in terms of structuring our upcoming relevant environment testing that we’re going to perform on the sensor,” Mara said.

The sensor, nicknamed nDETECT for the Energy I-Corps program, could be used by the military for monitoring degradation of nitrocellulose and nitroglycerine-based propellants, which are used by the Army as the energetic material that provides the propulsive force in their munitions, such as rocket motors.

“This type of propellant is known to degrade with time, especially when exposed to extreme environmental conditions and will begin to emit nitrogen oxides. Our sensor would give the military an indication that the propellant, or by extension the weapon, is degrading,” Mara said.

The sensors would be mounted near the weapons. Current commercial options for nitrogen oxide detection can require higher temperatures to collect a measurement or operate at room temperature but are easily fouled. The Sandia-developed sensors are composed of an interdigitated electrode with a nanoporous adsorbent layer. The nanoporous material can be tuned to selectively adsorb gases, and the electrical response directly correlates to gas concentration.

“Current chemical sensor technologies are expensive, have a short lifespan and can require extensive maintenance,” Mara said. “Our chemically selective nanoporous-based electrical sensors are cost-effective and low power. They use 1 millionth the power consumption of current chemical sensors and require minimal maintenance.”

Mara said data from the sensors will better inform safety decisions regarding weapons and help identify trends in evolution and absorption of off-gassing products to improve estimates of remaining useful life and degradation performance.

The Sandia team, which includes Sandia co-principal investigators Tina Nenoff and Leo Small, plans to continue to advance the technology through development of future prototypes with their partners at the Kansas City National Security Campus. They plan to produce a prototype sensor and continue discussions with businesses interested in licensing the technology with money won from Energy I-Corps.

Mara and Wendy said outside of interest from government and military partners, they envision the sensor could be of interest to the private sector. For example, auto, coal, air quality and environmental monitoring industries need sensors to effectively – and ideally efficiently – detect gasses, too.

On path to commercialization

Mara and Wendy spent the first week of Energy I-Corps in information sessions, then met once a week with the entire

cohort and once a week with instructors.

As part of the Energy I-Corps program, Mara and Wendy conducted 75 customer discovery interviews over eight weeks.

“We are very proud that the most recent Energy I-Corps session winners are from Sandia,” said Mary Monson, senior manager of Technology Partnerships and Business Development at Sandia. “The program is a huge commitment, and all teams work hard to learn about commercializing technology. Learning the value of technology transfer can change the trajectory of a researcher’s career and help inspire goals that could benefit government entities, industry and the public.”

Prior to Energy I-Corp, Mara and Wendy hadn’t met and they instantly clicked. Coming from the technology



NEW SENSOR — Principal investigator Mara Schindelholz, center, Leo Small, left, and Stephen Percival invented a sensor nicknamed nDETECT that could be used by the military for monitoring degradation of munitions.

Photo by Craig Fritz




WINNING TEAM — Principal investigator Mara Schindelholz, left, and business management professional Wendy Rue are the winners and graduates of the most recent Energy I-Corps program.

Photo by Craig Fritz

partnerships side of Sandia, Wendy said she enjoyed learning more about the work of a principal investigator.

“Our researchers develop amazing technologies but many of them don’t know how to get their idea out of the laboratory,” Wendy said. “Energy I-Corps explored that entire path of commercialization, and that’s valuable training for anybody who wants to learn how they can get their technology out there in the world.”

Mara said she picked up business skills that will help throughout her career.

“The program helped me professionally and personally,” she said. “I now feel like I can speak the language of tech transfer and commercialization.” 



nDETECT DEVELOPMENT — From left to right, business management professional Wendy Rue, principal investigator Mara Schindelholz and co-principal investigator Tina Nenoff show an nDETECT sensor during development at Sandia. **Photo by Craig Fritz**

Metallic mystery

CONTINUED FROM PAGE 1

Based at Sandia, these scientists believe the key to preventing large-scale, catastrophic failures in bridges, airplanes and power plants is to look — very closely — at damage as it first appears at the atomic and nanoscale levels.

“As humans, we see the physical space around us, and we imagine that everything is permanent,” Sandia materials scientist Brad Boyce said. “We see the table, the chair, the lamp, the lights, and we imagine it’s always going to be there, and it’s stable. But we also have this human experience that things around us can unexpectedly break. And that’s the evidence that these things aren’t really stable at all. The reality is many of the materials around us are unstable.”

But the ground truth about how failure begins atom by atom is largely a mystery, especially in complex, extreme environments like space, a fusion reactor or a nuclear power plant. The answer is obscured by complicated, interconnected processes that require a mix of specialized expertise to sort out.

The team recently published in the academic journal [Science Advances](#) research results on the destabilizing effects of radiation. While the findings describe how metals degrade from a fundamental perspective, the results could potentially help engineers predict a material’s response to different kinds of damage and improve the reliability of materials in intense radiation environments.

For instance, by the time a nuclear power plant reaches retirement age, pipes, cables and containment systems inside the reactor can be dangerously brittle and weak. Decades of exposure to heat, stress, vibration and a constant barrage of radiation break down materials faster than normal. Formerly strong structures become unreliable and unsafe, fit only for decontamination and disposal.

“If we can understand these mechanisms and make sure that

future materials are, basically, adapted to minimize these degradation pathways, then perhaps we can get more life out of the materials that we rely on, or at least better anticipate when they’re going to fail so we can respond accordingly,” Brad said.

The research was performed, in part, at the [Center for Integrated Nanotechnologies](#), an Office of Science user facility operated for DOE by Sandia and Los Alamos national laboratories. It was funded by the DOE’s Basic Energy Sciences program.

Atomic-scale research could protect metals from damage

Metals and ceramics are made up of microscopic crystals, also called grains. The smaller the crystals, the stronger materials tend to be. Scientists have already shown it is possible to strengthen a metal by engineering incredibly small, nanosized crystals.

“You can take pure copper, and by processing it so that the grains are nanosized, it can become as strong as some steels,” Brad said.

But radiation smashes and permanently alters the crystal structure of grains, weakening metals. A single radiation particle strikes a crystal of metal like a cue ball breaks a neatly racked set of billiard balls, said Rémi Dingreville, a computer simulation and theory expert on the team. Radiation might only strike one atom head on, but that atom then pops out of place and collides with others in a chaotic domino effect.

Unlike a cue ball, Rémi said, radiation particles pack so much heat and energy that they can momentarily melt the spot where they hit, which also weakens the metal. And in heavy-radiation environments, structures live in a never-ending hailstorm of these particles.

The Sandia team wants to slow — or even stop — the atomic-scale changes to metals that radiation causes. To do that, the researchers work like forensic investigators replicating crime scenes to understand real ones. Their *Science Advances* paper details an experiment in which they used their high-powered,

highly customized electron microscope to view the damage in the platinum metal grains.

Team member Khalid Hattar has been modifying and upgrading this microscope for over a decade, currently housed in Sandia's [Ion Beam Laboratory](#). This one-of-a-kind instrument can expose materials to all sorts of elements — including heat, cryogenic cold, mechanical strain, and a range of controlled radiation, chemical and electrical environments. It allows scientists to watch degradation occur microscopically, in real time. The Sandia team combined these dynamic observations with even higher magnification microscopy allowing them to see the atomic structure of the boundaries between the grains and determine how the irradiation altered it.

But such forensics work is fraught with challenges.

"I mean, these are extremely hard problems," said Doug Medlin, another member of the Sandia team. Brad asked for Doug's help on the project because of his deep expertise in analyzing grain boundaries. Doug has been studying similar problems since the 1990s.

"We're starting from a specimen that's maybe three millimeters in diameter when they stick it into the electron microscope," Doug said. "And then we're zooming

down to dimensions that are just a few atoms wide. And so, there's just that practical aspect of: How do you go and find things before and after the experiment? And then, how do you make sense of those atomistic arrangements in a meaningful way?"

By combining atomic-scale images with nanoscale video collected during the experiment, the team discovered that irradiating the platinum causes the boundaries between grains to move.

Computer simulations help explain cause and effect

After the experiment, their next challenge was to translate what they saw in images and video into mathematical models. This is difficult when some atoms might be dislocated because of physical collisions, while others might be moving around because of localized heating. To separate the effects, experimentalists turn to theoreticians like Rémi.


"Simulating radiation damage at the atomic scale is very (computationally) expensive," Rémi said. Because there are so many moving atoms, it takes a lot of time and processing power on high-performance computers to model the damage.

Sandia has some of the best modeling capabilities and expertise in the world, he

said. Researchers commonly measure the amount of damage radiation causes to a material in units called displacements per atom, or dpa for short. Typical computer models can simulate up to around 0.5 dpa worth of damage. Sandia models can simulate up to 10 times that, around 5 dpa.

In fact, the combination of in-house expertise in atomic microscopy, the ability to reproduce extreme radiation environments and this specialized niche of computer modeling makes Sandia one of few places in the world where this research can take place, Rémi said.

But even Sandia's high-end software can only simulate a few seconds' worth of radiation damage. An even better understanding of the fundamental processes will require hardware and software that can simulate longer spans of time. Humans have been making and breaking metals for centuries, so the remaining knowledge gaps are complex, Brad said, requiring expert teams that spend years honing their skills and refining their theories. Doug said the long-term nature of the research is one thing that has attracted him to this field of work for nearly 30 years.

"I guess that's what drives me," he said. "It's this itch to figure it out, and it takes a long time to figure it out." 

Sandia researcher wins career achievement award from Asian technical society

Hongyou Fan 'embodies the reason' for category

By Neal Singer

The Society of Asian Scientists and Engineers selected Sandia manager Hongyou Fan to receive its 2022 Career Achievement Award.

"It is evident that you embody the reason SASE created this category, and we are proud to present you this award," wrote the organization's CEO and Executive Director Khanh Vu in the society's notification message.

The strong endorsement is confirmed by Hongyou's many technical papers, awards and patents, appointment to scientific societies and outreaches to students.

Still, in an interview, he waves his hand dismissively at a list of his achievements, which include 138 published papers in his 25-year career. "Everything I've done has been done with the help of other people," he said. "You can't rely on just yourself."

As a case in point, he mentions his project to create new materials by using pressure-induced coalescence of different materials. Due to a chance meeting with

managers in another group and their subsequent willingness to support the project, the work went from a productive but time-consuming method — using pressure from diamond anvils to force atoms into place — to a rapid and more useful method by using the forces generated by Sandia's Z machine, the most powerful producer of the highest dynamic pressure on the planet, to in effect lock new structures into place. "Now, instead of waiting days as pressure from my diamond anvil takes effect, I can create new materials in 300 nanoseconds," he said.

The joint work leveraged Sandia's

pulsed power facilities to understand nanomaterial behavior across multiple length scales on the nanosecond time scale for the first time. The process mimics the embossing and imprinting manufacturing processes, but at ultra-short timescales.

The experiment's conversion began with a casual conversation between Hongyou and Z machine manager Mike Cuneo at a swimming pool where they met by chance during a group swimming lesson for their children. Later, manager Dawn Flicker, charged with scheduling research "shots" on Sandia's Dynamic Integrated Compression Experimental system, found a time slot to insert their experiment. The collaborative [work](#) ultimately was published in the journal

[Nature Communications](#) and won a R&D 100 Award.

"None of this would have happened without Dawn and Mike," said Hongyou. "So, while this accolade from SASE is a personal honor and a real career highlight for me, it is also a testament to the large body of work accomplished by the interdisciplinary team of Sandians, students, postdocs and others who have collaborated with me to achieve scientific success. I will humbly accept the award on their behalf as well as my own."

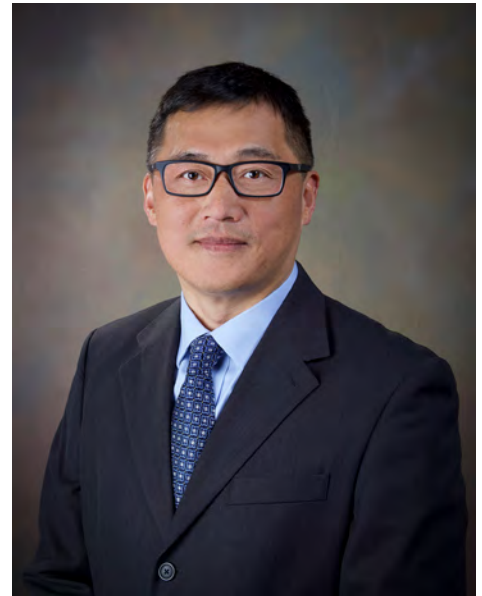
One of many achievements

Though he enjoys partnering, Hongyou is believed to be the only DOE national laboratory scientist to be awarded the [Materials Research Society Mid-Career Researcher Award](#). The honor, announced in 2019, recognized his exceptional achievements in nanoscale self-assembly and synthesis of functional nanomaterials as well as his technical leadership in materials science.

He also received the MRS Fred Kavli Distinguished Lectureship in Nanoscience in 2015 recognizing his pioneered development of pressure-induced synthesis and characterization technologies. He won Sandia's [Laboratory Directed Research & Development Award for Excellence](#) in 2007; five independent R&D Magazine, now R&D World, R&D 100 Awards in recognition of development of significant and innovative technologies in [2007, 2010, 2016, 2020](#) and [2022](#); and the Asian American Engineer of the Year Award in 2012.

He also received the University of New Mexico's Outstanding Faculty Mentor Award in 2005 as an excellent student mentor and role model as well as the Sandia Materials Science Center Outstanding Wise Leadership Award in 2013 for being an excellent role model and an inspiring technical leader and mentor.

He is a fellow of the [Materials Research Society](#) and the [American Physical Society](#), has helped arrange many technical meetings and serves as editor on several technical journals.



MATERIALS MAVEN — Material scientist and manager Hongyou Fan has received a 2022 Career Achievement Award from the Society of Asian Scientists and Engineers. Hongyou credits his success to his talented collaborators. "I will humbly accept the award on their behalf as well as my own," he said. **Photo by Lonnie Anderson**

On the entrepreneurial side, Hongyou co-founded a startup company based on his inventions, Lunano LLC, to develop disinfectants that kill viruses, bacteria and fungi, including the virus that causes COVID-19.

Recently, the [New Mexico Legislature](#) recognized him in Santa Fe for his distinguished achievements in science and innovation.

Currently, Hongyou leads the geochemistry department at Sandia as well as a group of scientists addressing complex challenges related to climate change security.

All awardees will be honored at the [2022 SASE National Convention](#) in Atlanta Oct. 6-8 and virtually Oct. 28, Nov. 4 and Nov. 11.

SASE's purpose, in its own words, is "to prepare Asian heritage scientists and engineers for success in the global business world, to celebrate diversity on campuses and in the workplace, and to provide opportunities for members to make contributions to their local communities." The society claims more than 1,800 student and professional members.



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Q&A with Roberta Rivera on Sandia Gives

Staff encouraged to follow 65-year tradition of giving

By **Katrina Wagner**



For 65 years, Sandia has been the largest supporter of the United Way of Central New Mexico's annual campaign, contributing more than \$125 million to impact thousands of people through education, family stability and food security. Staff can enroll in the Sandia Gives campaign Oct. 3-21 and contribute to the work of the United Way or another U.S. nonprofit organization by setting up a payroll deduction. Lab News interviewed community relations specialist Roberta Rivera, who administers the Sandia Gives program.

Lab News: How does the United Way of Central New Mexico use Sandia's donations to positively impact communities?

Roberta Rivera: The United Way of Central New Mexico addresses systemic problems affecting families in the community by rallying support, providing comprehensive resources and raising funds to increase family stability and educational attainment. This year, the Sandia Gives program in New Mexico has added an option for donors to designate their pledges directly to the counties where they live: Bernalillo, Sandoval, Torrance, Santa Fe or Valencia.

The United Way of Central New

Mexico provides services to connect people with resources they need, such as the 211 Information and Referral Helpline, Family Advocacy Center and Tax Help New Mexico. United Way Bay Area uses the 211 24-hour communication line to connect callers to local health and human services agencies and to the nearest SparkPoint center. SparkPoint centers provide one-stop access to move families toward financial stability and prosperity with services such as financial coaching, credit repair, job readiness, free tax help and more. These vital resources require overhead funding to remain operational and provide services to people.

During fiscal years 2022 and 2023, United Way of Central New Mexico will distribute more than \$2 million in grant money to nonprofits through its Community Investment Fund. The fund is overseen by the Community Investment Council, which comprises community members who ensure responsible financial oversight.

Nonprofits apply for grants from the fund. Their grant applications undergo a rigorous evaluation-and-reporting process to determine if they will receive funding. Sandia staff members can help make these funding decisions by volunteering to serve on grant panels.

The Labwide Sandia Gives campaign is processed by the United Way of Central New Mexico in Albuquerque. More than 5,300 Sandians participate in the campaign, making more than

8,000 designated payments each month. In total, the United Way of Central New Mexico processes an average of 12,376 designated payments per month from more than 15,500 donors per year, totaling more than \$8.6 million in



SOLVE FOR X — Community relations specialist Roberta Rivera administers the Sandia Gives program at Sandia in New Mexico. “There are so many struggles in our surrounding communities, and our nonprofit donations can help support whatever causes we want to champion,” said Roberta. “Our campaign theme this year is ‘Solve for X’ because we know that Sandians work to solve complex problems every day. X can be any cause in the community that matters to you.”


Photo by Amy Tapia

designations to 3,422 nonprofit agencies and programs across the United States.

LN: How can staff members who live in the greater San Francisco Bay Area or other Sandia sites participate in Sandia Gives?

RR: All staff — no matter where they live — can participate in Sandia Gives and designate their giving to any U.S. nonprofit organization. Staff can support the work of United Way Bay Area, United Way of San Joaquin County, United Way of Carlsbad and South Eddy County, United Way of Amarillo and Canyon, United Way of Southern Nevada and more.

LN: How much do Sandians need to give to make a difference?

RR: It doesn't take a lot to help others. Everyone's contribution matters and can make a difference in someone else's life. A contribution of \$10 per paycheck can help buy shoes for eight students a year and help food banks distribute up to 100 meals a month. 

Solve for X Day

You can volunteer with your friends and family and support the Sandia Gives campaign at **Solve for X Day** on Saturday, Oct. 15. In New Mexico, multiple volunteer projects will occur throughout the day, including sorting food at Roadrunner Food Bank, building a ramp with the New Mexico Ramp Project and painting a mural on a playground for children. In California, various teams will coordinate volunteer projects around the Bay Area so everyone can participate in solving for X.

Most Promising Asian American Engineer of the Year goes to Sandia scientist

Bishnu Khanal: Unlikely chemist

By **Luke Frank**

Sandia research and development manager Bishnu Khanal was recently honored with the Most Promising Asian American Engineer of Year award for his work in next-generation optical lithography process development for numerous technologies, along with his deep-reaching community service.

According to Asian American Engineer of Year, Bishnu was selected for his technical leadership and contributions in nanotechnology, semiconductor device fabrication and materials science.

“This recognition means a lot to me, and I’m so proud to be part of it,” Bishnu said. “Coming from a remote village in Nepal, ending up at Sandia Labs and then receiving this award is truly my honor.”

The annual award recognizes distinguished professionals who exhibit leadership, technical achievement and public service in their fields.

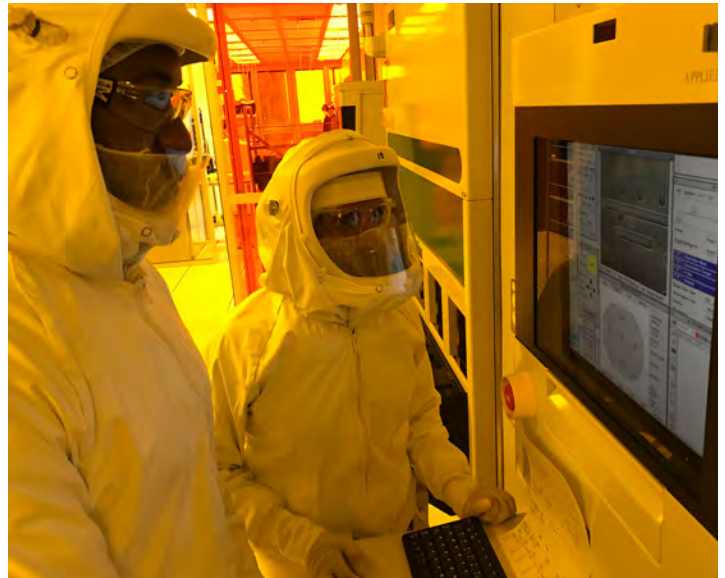
From humble beginnings

The Himalayans thrust skyward where Nepal, China and India meet. At the base of this rugged range lies the small village of Gulariya in western Nepal where Bishnu grew up. He describes his life there as primitive. “It was and still is a very simple agrarian way of life, where crops and livestock goods are sold in a central market,” he said. “That’s the community focus. My parents never attended school and my mom still uses currency based on color, size and weight.”

Despite his limited educational opportunities, Bishnu’s parents enthusiastically encouraged his schooling at every level. “Our shared classroom growing up was under a big tree, and if the weather was bad, we didn’t have lessons,” he said. “They made sure I attended every day that classes were held and that I completed all of my lessons.”

Through his basic studies, Bishnu became interested in science and math and the problem-solving methodologies that came with them. His high school math and science teachers, Shambhu Gautam and Bijay Mishra, recognized Bishnu’s potential and began structuring his assignments accordingly, thus encouraging his problem-solving abilities. “They helped build my interest and fundamental understanding of science and math,” he said.

His educational path seems serendipitous. “I had no big dream or grand plans when I enrolled in college in Nepal, but I really started enjoying chemistry and then organic chemistry,” Bishnu said. “I thought about eventually teaching. That’s all I



LIGHT BRIGHT — Bishnu Khanal, right, and Kel Okoro examine the quality of microelectronic devices on an electron microscope that is patterned using advanced optical lithography. **Photo by Philip Shapiro**

knew. I really had no notion of what else was out there.”

As Bishnu completed his undergraduate chemistry work at Tribhuvan University, he felt the next logical step would be a master’s degree. Once Bishnu completed his master’s degree in 2003, he thought the next step would be a doctorate in chemistry, opening even bigger doors to his future.

Bishnu's world opens up

“I didn’t know what came after earning my master’s, but a Ph.D. seemed like the next step,” Bishnu said. “Honestly, I never thought, ‘I’m going to get my Ph.D. and work in a national laboratory in the U.S.’ I didn’t know such opportunity existed.”

Bishnu spent the next couple of years as an undergraduate and graduate chemistry lecturer at various colleges in Kathmandu, Nepal. In 2005, he applied and was accepted by Rice University in Houston, to pursue his doctorate in chemistry and nanotechnology. There, he excelled in nanomaterials and nanotechnology research, garnering national awards and fellowships. He also was named a visiting graduate student at Massachusetts Institute of Technology. Bishnu was hitting his stride.

He joined Los Alamos National Laboratory in 2009 for his postdoctoral research on synthesis and spectroscopic study of semiconductor quantum dots and quantum rods. While at Los Alamos, Bishnu was selected as a director’s postdoctoral fellow for his outstanding research proposals and achievements.

After a brief period as a research and development engineer

at Micron Technology in Boise, Idaho, Bishnu joined Intel Corp. in 2011 as a research and development process engineer. There, he worked on process development for several technology nodes, installed and qualified process equipment and led advanced technology transfers to Intel facilities in the U.S. and abroad.

The recipient of several academic and professional awards, Bishnu was widely considered a rising star in his field and, again, on the move.

Settling in at Sandia

In 2018, Bishnu joined the Labs to lead advanced optical photolithography research and development activities at Sandia's Microsystems Engineering, Science and Applications, or MESA, division. He has quickly become a primary innovator for patterning process development focusing on radiation-hardened implements for several technologies, including

complementary metal-oxide semiconductors, silicon photonics and quantum computing.

Bishnu also is a key member of numerous programs focusing on microelectronics and micro-electromechanical system development. He leads several fundamental science research projects in nanotechnology in collaboration with other scientists inside and outside of Sandia.

In 2022, Bishnu was selected to lead the Materials Mechanics and Tribology department as a research and development manager. He leads a diverse team of scientists, engineers, postdoctoral researchers, students and technologists working on developing a fundamental understanding of mechanical behavior of materials and operationalizing this understanding to resolve engineering challenges.

Bishnu has found professional energy in managing his team toward its mission goals. "There's something rewarding in stepping outside of problem-solving on my own," he said. "Now our entire team is solving problems together and that's even more exciting and brings a higher impact to our national security mission."

Paying it forward

His many accomplishments aside, Asian American Engineer of the Year also selected Bishnu for the award based on his public service efforts. Bishnu is establishing a trust with his personal funds in his parents' names to support underprivileged students in his Nepal village. "We'll have set criteria for selecting students in a local public school to help provide things like school supplies and clothes — things that I needed growing up," he said. "We are targeting three to five students a year."

Bishnu also serves his local Albuquerque community, volunteering in schools for kids' fundraising fun runs and as a science fair judge. And he mentors New Mexico high school

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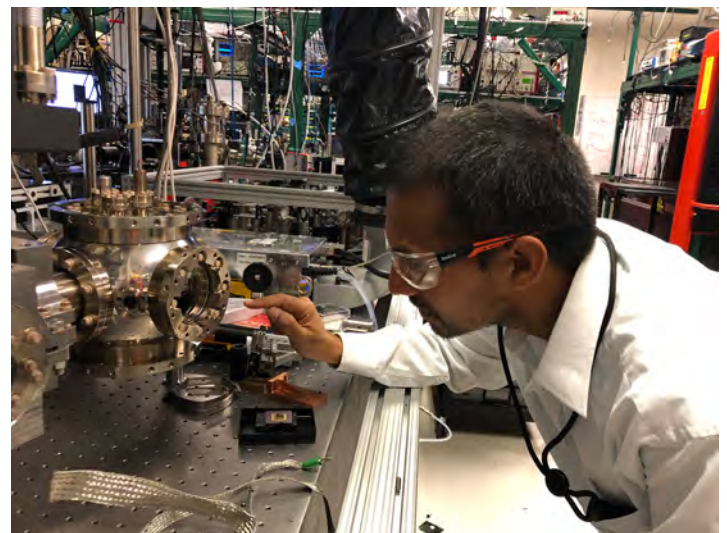
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IONIC IMAGE — Sandia research and development manager Bishnu Khanal works on an ion trapping system to trap ions for a quantum computer device.
Photo by Melissa Revelle

Science park

CONTINUED FROM PAGE 1

builds partnerships between the Labs and the private sector that bring trailblazing technologies to the marketplace.”

As requested by the [City of Albuquerque](#), the [Mid-Region Council of Governments](#) provides an economic assessment of the park every two years. The latest report includes a historical overview of the park and its estimated economic impact in 2020 and 2021. Cumulative impacts since the park was established were also estimated.

The tech park is a master-planned, 340-acre technology community associated with Sandia. It is located adjacent to Kirtland Air Force Base. At the end of 2021, the park was home to 40 companies and organizations.

“In addition to economic impact, the park highlights some of the best tech transfer

and supply chain strengths of Sandia,” said Mary Monson, the Labs’ senior manager of [Technology Partnerships](#) and Business Development. “Some park companies are suppliers of goods and services to the Labs, and this is facilitated by the park being within walking distance or just a short drive away. Also, companies in the park can receive assistance from the Labs for help solving complex problems. We have partnered with some of the companies through programs like the [New Mexico Small Business Assistance Program](#).”

Average park salaries near \$100K

The average annual salary in the research park was \$97,399. The report cites that, according to the Bureau of Labor Statistics Occupational Employment Statistics Program, the average annual salary in the Albuquerque metro area was \$54,028 in 2021.

“Having the technology park in Albuquerque has been instrumental to the success of flagship employers and their employees,” said Albuquerque Mayor Tim Keller. “For nearly 25 years, the Sandia Science & Technology Park has supported our incredibly talented workforce and spurred opportunity, innovation and continued growth in the city’s cutting-edge technology and research industries.”

At the end of 2021, 1,786 employees worked in the park, down from 2,369 when the last park assessment was completed two years ago. The latest report offers some reasons for the drop, including the COVID-19 pandemic, which forced some workers to move out of buildings to telecommute, and the departure of Raytheon in 2021. The report predicts that several hundred workers will return in 2022 and 2023.

According to the report, for every job located in the park in 2020 and 2021, nearly



UPSCALING — Acclaimed artist Amanda Phingbodhipakkiya, with help from students at nearby Technology Leadership High School, painted a large mural in the heart of the Sandia Science & Technology Park. A second art installation is in early development. **Photo by Rebecca Gustaf**

two indirect jobs were created in the region. The park was also responsible for an increase of \$553 million in gross regional product in 2020 and \$514 million in gross regional product in 2021. This is the total value of consumption, investment and government spending in the region.

The science park also helped increase population in both 2020 and 2021 in Bernalillo, Sandoval, Torrance, Valencia and southern Santa Fe counties, according to the report. This was primarily due to new workers and their families being drawn to the area for employment, which brings new spending to the area. Most of the population growth spurred by the park occurred in Albuquerque.

“While the park was impacted by the pandemic, it is still bringing people to the area and creating indirect jobs,” said Dewey Cave, executive director of the Mid-Region Council of Governments. “The park companies helped fortify our communities during difficult times that have impacted everyone.”

In addition to private sector companies, the tech park is home to a credit union, schools, a museum, an early childhood center, parks, exercise stations and walking and biking trails.

The Sandia Science & Technology Park Program Office, managed by Labs staff, also is working with the City of Albuquerque to bring art installations to the area. In 2021, [a large mural](#) painted by renowned artist Amanda Phingbodhipakkiya brightened Research Road. Students from Technology Leadership High School, located in the park, helped with the project. A second art installation is in early development and will be coordinated between the park’s program office and Albuquerque’s Public Art Urban Enhancement Division.

“The park continues to become more vibrant with the addition of new artwork and businesses moving in,” said Sherman McCorkle, chairman of the board of the [Sandia Science & Technology Park Development Corp.](#) “Change is normal and necessary as we continue growing such a wonderful area.”

The report also highlighted that investments in the tech park since 1998 total \$416 million, with \$317 million coming from private sources and \$99 million coming from public investment.

More than \$22.4 million in 2020–21 public and private investments paid for outfitting of existing buildings and ongoing operational needs.

The report also stated that the park produced \$166.1 million in tax revenue for the state of New Mexico and \$36.6 million for the city since 1998.

New projects, developments on the horizon

Additional park expansions are in the works:

- BlueHalo, which provides capabilities in space technologies, counter unmanned aircraft systems, advanced radio frequency technologies and cyber intelligence, moved into the park and is growing operations. The company’s manufacturing facilities are increasing from their original footprint of about 50,000 square feet to over 200,000 square feet, in part by taking over former Raytheon facilities in the park.
- Titan Development, a real estate development and investment firm, is planning to develop a new Titan Innovation Center which will target high tech companies who want to lease space in the park.
- The National Museum of Nuclear Science and History broke ground for a new building in April.
- In addition to students from the Technology Leadership High School participating in painting the mural, they were also invited to learn about careers in manufacturing from several of the park’s company leaders during the annual Manufacturing Day organized by the New Mexico Manufacturing Extension Partnership.

The Sandia Science & Technology Park is a partnership of Albuquerque Public Schools, Bernalillo County, the City of Albuquerque, the Mid-Region Council of Governments, the New Mexico congressional delegation, the New Mexico State Land Office, PNM, Sandia, the Sandia Science & Technology Park Development Corp., the State of New Mexico, the DOE, NNSA and the U.S. Economic Development Administration. [i](#)

Asian American Engineer of the Year

CONTINUED FROM PAGE 8

students for a two-week summer residential science, technology, engineering and mathematics program. “Some kids just need that little extra support, like I did,” he said. “Who knows what they can grow up to accomplish?”

About Asian American Engineer of the Year

The Asian American Engineer of the Year award is an annual national event that honors professionals and their leadership, technical achievements and public services. Asian American Engineer of the Year was first introduced in 2002 as a part of the National Engineers Week (DiscoverE) Program and has since become a forum for corporate America, academia and government entities in promoting STEM activities. Past awardees include Nobel laureates, academia, key corporate executives and astronauts. [i](#)



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Answering the call

Sandians support national security mission

In support of the Nuclear Deterrence Modernization Efforts Rally Cry, Lab News continues to highlight employees and the ways that they contribute to Sandia's national security mission. Read more profiles from [previous editions](#).

Photos by **Craig Fritz**

Kurt Sjoberg

*Biotechnology and bioengineering mechanical engineer
3 years at Sandia*

Kurt was working at a virtual reality hardware firm when he saw an opportunity at Sandia to follow his passion for biotechnology. With a master's degree in biomedical engineering, he now works on detection devices for diseases or chemicals, maturing the hardware packages as well as the system designs and engineering.

With Sandia's encouragement, he has also collaborated with radiation detection groups and a W80-4

product realization team as a product lead. "I had a background in rubbers and elastomers," he said, "which overlaps into the products we work on. We look at how multiple parts will drive the system capability, putting different pieces of the puzzle together to understand the bigger effects."

"The big reason I jumped in to the W80-4 was to see something going all the way to production, knowing that it's important for national security, and I can help with that," he said. "A lot of people at Sandia, maybe nuclear deterrence isn't their primary focus, but they are able to jump in and be a team member, bring their expertise and contribute to the mission space. That's kind of a cool thing."

— J.C. Ross



Photo by Randy Wong

Erica Douglas

*Materials characterization and performance manager
10 years at Sandia*

Erica completed her doctorate at the University of Florida and has been at Sandia for 10 years and in her current role as a manager for two years. Erica leads a team of 28 people including students, post-docs, technologists and staff members.

With a focus in materials characterization, Erica and her team spend most of their days examining different materials and studying how they perform over the lifetime of a weapon system. They also conduct experimental testing.

Erica and her team are creatively expanding their capabilities, accelerating their response to stockpile modernization, improving efficiency, and helping engineers and scientists solve problems and resolve issues by implementing advanced data analytics and developing enhanced techniques.

Most valuable in her work, she said, is "having experts in just about every field and finding ways to approach problems and provide solutions that help our nation."

— Krystal Martinez



John Wharton

*Nuclear deterrence research and development manager
18 years at Sandia*

Devote attention to doing things right to deliver nuclear deterrence programs on time. That's how John describes his team and its work.

"As our senior leaders have clearly communicated, there is an absolute imperative that we implement the W80-4 by the date it's due," he said. "We have doubled down on our planning and our focus to ensure that every bit is dedicated to safety, security and engineering excellence to ensure we achieve that schedule. Every decision is made with engineering rigor and safety in mind. We provide engineering support to

all the system-level modernization programs — it's a great responsibility and honor to support these programs and our DOD warfighters that are so tightly aligned with our national security."

John came to Sandia after a 24-year U.S. Air Force career spanning ground combat, nuclear and ICBM operations and nuclear security. He said his team enjoys challenging, meaningful work.

"Nobody in our group ever has to wonder if their work impacts national security — they know it every day," John said. "My encouragement would be for people that are interested in coming to nuclear deterrence is trust in your abilities and don't hesitate. This is big-league engineering, and we need your help."

— Myles Copeland

Trevor Schultze

Product realization team lead for energetics
5 years at Sandia

When Trevor started at Sandia, his first job out of college, he admits that he didn't know a whole lot about what Sandia did. He just knew that it was a highly regarded national laboratory and part of DOE. Beyond that, he was quite impressed by the people he met and his overall experience during the interview process.

As a product realization team lead, Trevor has developed a deeper understanding of Sandia's mission through his work.

"It's a tangible, direct contribution (to national



Photo provided by Trevor Schultze

security), seeing your designs and specifications turn into finished product and delivered hardware that is going into components," he said.

Trevor appreciates that his work is interesting and challenging, and that it has meaning, he said. "It's one thing to find your work interesting, it's another to have a mission that is meaningful and to contribute in that way."

— Diane Mendiola

Chris Quinn-Vawter

Industrial hygienist
6 years at Sandia

Chris is the lead industrial hygienist for the Weapon Modernization Lab, where Sandia executes the hardware, assembly and test support for its nuclear weapon modernization programs.

Chris describes industrial hygiene as the art and science of anticipating, recognizing, evaluating and controlling chemical, radiological, explosive, mechanical and other hazards in the workplace that

could result in worker injury or illness. In his role, he works closely with management and helps safely plan and execute work. His expertise has contributed to an excellent safety record at the Weapon Modernization Lab during his tenure.

"Safe work operations and engineering excellence are dependent — one cannot exist without the other," Chris said. "Organizations like Sandia that ensure we evaluate safety and emphasize employee engagement in safe work practices also take time to scrutinize product designs and production quality. And, when an employee feels that their workplace takes their health and safety seriously, they are more likely to feel like their input on potential problems or solutions is valued in all aspects of their work."

— Karli Massey



How to answer the call

Employees can go to the **Nuclear Deterrence Modernization Efforts Rally Cry** internal website to let Sandia know how they can answer the call or submit questions.

Mileposts



Ed Cole 35



Donna Bauer 30



Bryan Guernsey 30



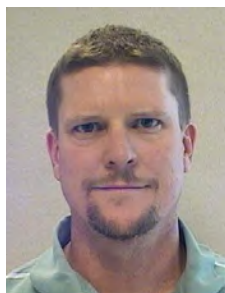
Michael Strosinski 30



Manoj Bhardwaj 25



Riyaz Natha 25



Kevin Rolfe 25



Robert Burr 20



Randy Castillo 20



Pavel Chaplya 20



Todd Coffey 20



Margaret Gordon 20



Frank Hung 20



Kerry Kampschmidt 20



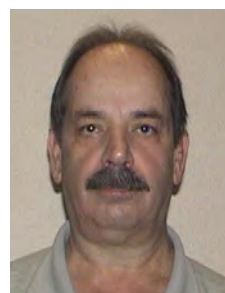
Pat Lake 20



John Moleres 20



Brian Morales 20



Gene Ormond 20



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James Rini 20



Joe Aragon 15



Damon Burnett 15



Timothy Koehler 15



Katelynn Montoya 15

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Sandia Labs has official social media accounts on several online communities to engage in conversations about our work, update followers about the latest Labs news, share opportunities, and support the open government principles of transparency, participation and collaboration.

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Conference offers perspectives on real-world nuclear issues

By **Myles Copeland**

Years before joining Sandia, Weston Nelson became familiar with some of the Nuclear Security Enterprise's most significant products.

"I was in the Air Force," said Weston, who now works as an analyst for Sandia's threat assessments group. "I was a missileer. I was on alert with intercontinental ballistic missiles, so I have, maybe, a different perspective."

Weston was among more than 30 Sandia participants in the **Project on Nuclear Issues** Summer Conference, hosted by the Labs at Albuquerque's Cooperative Education Services Sept. 7-8. He lauded the conference as an opportunity to see complex, real-world nuclear issues from a variety of angles.

"We can get stove-piped," said Weston, describing daily activities inherent in most jobs, including at Sandia. "Sometimes we're not as aware of the military aspects, the nonproliferation aspects. It's great to hear those other perspectives. We have to implement answers within the larger geopolitical realities of our world."

The Project on Nuclear Issues conference brings together professionals from the National Security Enterprise, DOD and academia to discuss a range of nuclear issues

from deterrence, to power, to monitoring and more. Beyond its conference series, Project on Nuclear Issues offers a Nuclear Scholars Initiative that provides top graduate students and young professionals with a venue to discuss nuclear weapons issues with senior experts and a group of nuclear professionals who have been in the field for five or more years and demonstrate promise for developing expertise and moving into leadership positions.

"Sometimes we get so focused on a singular aspect we miss the larger strategic framework," said NNSA Principal Deputy Administrator Frank Rose, who delivered the closing keynote on Sept. 8 and has been involved with the Project on Nuclear Issues for nearly two decades. "PONI does a great job of emphasizing that larger framework, which is crucial in building a pipeline of nuclear policy experts."

The conference drew more than 60 participants for panel discussions and tours of Sandia facilities. The event featured two keynote speakers and was kicked off by Sandia's Deputy Labs Director for Nuclear Deterrence Laura McGill.

Retired Air Force Gen. Timothy Ray, who delivered a Sept. 7 keynote on the current global threat landscape, thought the Project on Nuclear Issues conference was an



ADDRESSING THE FUTURE — Deputy Labs Director for Nuclear Deterrence Laura McGill makes opening remarks at the Project on Nuclear Issues Conference on Sept. 7.

Photo by Myles Copeland


especially important audience to reach.

"Young, bright, capable, concerned minds," said Ray, describing the attendees. "They are the future."

Sandia electrical engineer Julia Tilles said the conference made issues of nuclear deterrence "more immediate and urgent."

"Lots of people are part of a generation that didn't live through the Cold War and that threat," said Julia, who performs electrical breakdown and high-voltage research. "This made it much more real and renewed this feeling of, there are still nuclear weapons in the world. It's great to step back and see, what are the issues right now? Where is Sandia and my work in all this?"

Tina Hernandez, a senior manager in Sandia's Global Security and Nonproliferation department, said the conference could benefit employee retention by illustrating the real-world urgency of Sandia's work.

"At Sandia, especially when you're early career staff, you might not have a sense of the real importance of your work," Tina said. "PONI helps them to see, 'I'm making a big impact in our national security and global security.'" 



THE BIG PICTURE — NNSA Deputy Administrator Frank Rose delivers the closing keynote address at the Project on Nuclear Issues Summer Conference on Sept. 8.

Photo by Lonnie Anderson



WORTH THE WAIT — Retired Air Force Gen. Timothy Ray addresses the Project on Nuclear Issues Conference on Sept. 7. With pandemic-related delays, the conference was Ray's first speaking engagement since retiring as Commander of Air Force Global Strike Command and Commander of Air Forces Strategic-Air, U.S. Strategic Command in 2021.

Photo by Lonnie Anderson

Road warrior

Cyclist blazes an environmentally friendly trail to Sandia/CA

By **Trina West**

As chair of the Sandia Bicycle Group, chemical engineer Patrick Burton practices the lifestyle of BYOB. That is, bring your own bike. Most days, he bicycles about seven miles round trip to the Albuquerque campus, despite owning a car.

“I would say that I probably get about 70% of my annual transportation done by bike,” he admitted.

For a recent trip to Sandia/California, Patrick decided to challenge himself by bringing his bike. To minimize the cost of travel — and, more importantly, his carbon footprint — he charted a low-emissions path that combined public transit and bicycling. The inspiration to integrate cycling into his travel plans came from watching a commercial about a foldable bike. He chose this particular model for the trip because it is easy to transport and designed for mixed-mode travel. The bike weighs under 50 pounds and can be checked as luggage on an airplane, making it a convenient alternative to renting a vehicle.

“I used the luggage case and just an overnight bag to store my helmet while traveling,” he explained.

Preparation and perspiration

According to Patrick, being prepared for anything is the key. To ensure the success of his endeavor, he scouted out his journey by getting help from colleagues in the California bike commuter group and researching public transportation options and bike routes before hitting the road. He advises seeking out local bike shops and plotting bus routes in advance, noting that commuting by bus and bike in tandem works very well.

Although it may take longer to travel, cycling provides a fun workout that makes up for the time spent driving to the gym. And due to the abundance of safe bicycle lanes and bike racks throughout Livermore, Patrick was able to enjoy the local culture and scenery as he biked instead of wasting time indoors.

Minimizing environmental impact

Over time, using low-carbon transportation pays for itself and offsets the greenhouse gases emitted by traditional travel




BRING YOUR OWN BIKE — Sandia chemical engineer Patrick Burton demonstrates that commuting is as easy as riding a bike.

Photo by **Randy Wong**

vehicles. To prove this point, Patrick estimates that he saved over \$200 while traveling to California — about the same cost as renting a car. He hopes to inspire others to become more carbon-neutral by encouraging them to try less fuel-intensive ways to travel.

“You could come out here and do this, and it’s possible. And it’s not as intimidating as one might think,” he said.

Through his advocacy, Patrick is the ultimate road warrior pioneering a path for those who want to be more environmentally conscious while traveling.

[Learn more](#) about the Sandia Bicycle Group and Patrick’s trip to Livermore. 



COMPACT COMMUTE — When folded, Patrick’s slim-fit bicycle is 30% smaller than the average folding bike.

Photo by **Patrick Burton**


Sandia's role in the nuclear triad

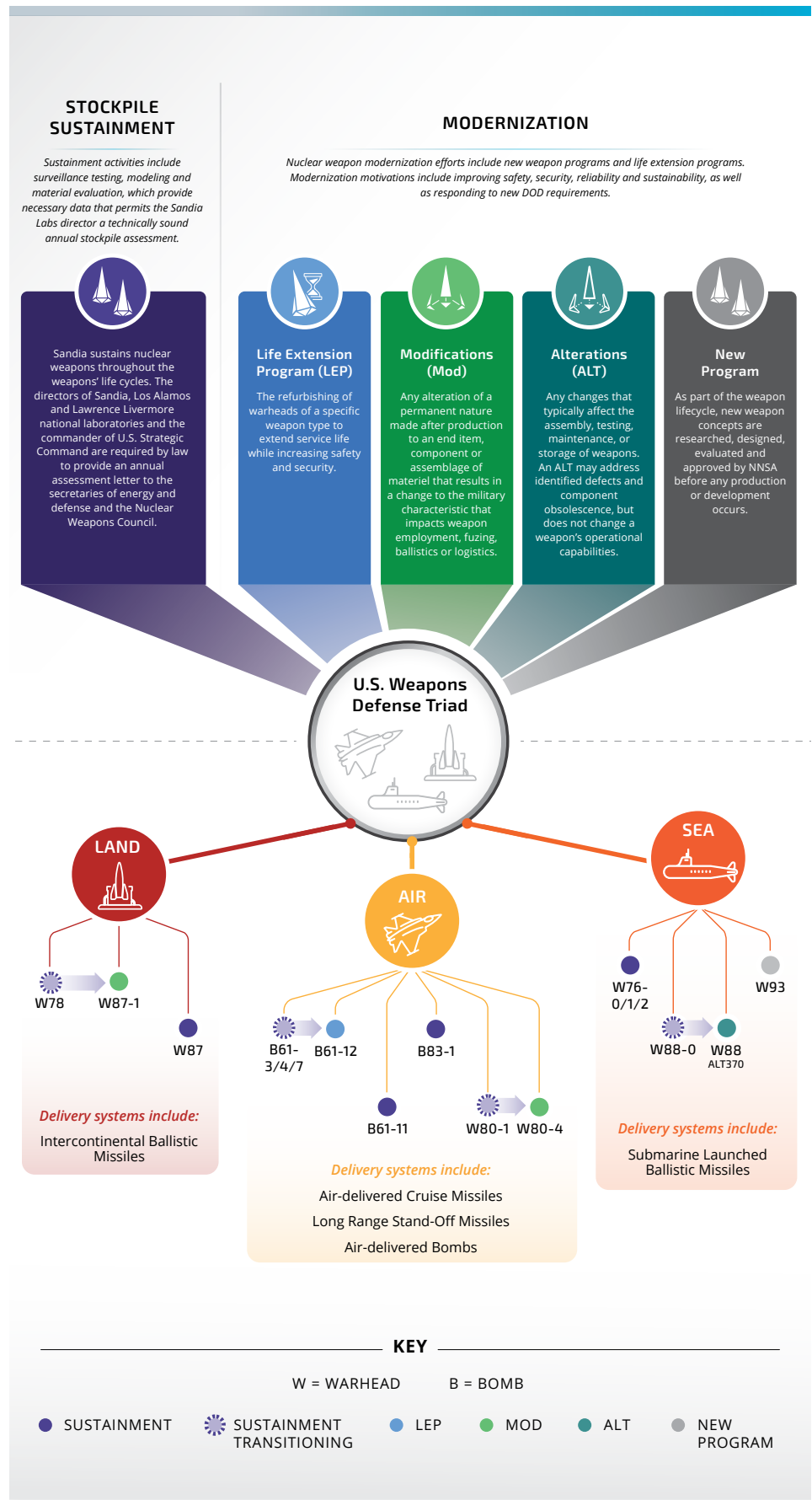
As Labs Director James Peery calls upon staff to fill gaps in the nuclear deterrence program, education about Sandia's role in national security is critical. While many Sandians work outside of the nuclear deterrence program, all the work that happens here has a connection to national security and Sandia's key role in developing, producing and maintaining the nuclear stockpile.

Lab News worked with the nuclear deterrence program to illustrate the U.S. Weapons Defense Triad, from stockpile sustainment to modernization. For more information about how to contribute expertise to the nuclear deterrence programs, visit the Nuclear Deterrence Modernization Efforts [Rally Cry website](#).

In August, Lab News worked with the nuclear deterrence program illustrated the [nuclear weapons life cycle](#). Learn more on the Lab News website.

The nuclear triad at a glance

Sandia is America's nuclear weapons engineering laboratory. Labs staff is responsible for designing non-nuclear weapon components and integrating the weapon's nuclear explosive package with Sandia and DOD hardware. The Labs is also responsible for weaponizing the nuclear explosive package. The primary mission is to ensure that U.S. nuclear weapons in the stockpile are safe, secure and reliable. Sandia's two primary nuclear weapon activities include stockpile sustainment and modernization. 



Graphic by Stephanie Blackwell; Information provided by Whitney Lacy