LOS ALAMOS NATIONAL LABORATORY ◇ WINTER 2022

NATIONAL ★ SECURITY SCIENCE

THE DIVERSITY ISSUE

Diversity makes us stronger: Los Alamos employees contribute to America's national security.

Classroom in a canyon: A septuagenarian scientist leads a new generation to success.

Accelerating innovation: A powerful linear accelerator has advanced national security research for 50 years and counting.

+ PLUS:

Los Alamos marks three decades since its last nuclear test

Diversity played a crucial role in building the first atomic bombs

Inclusive student hiring ensures the Laboratory's future

PHOTOBOMB

On July 23, 2022, a payload designed and built by Los Alamos National Laboratory was successfully launched on a suborbital ballistic trajectory during a flight test at White Sands Missile Range in southern New Mexico. The payload was carried on a new type of modular boost rocket funded by Los Alamos' Stockpile Responsiveness Program and built by Albuquerque-based X-Bow Systems.

"This partnership between X-Bow and Los Alamos will enable the Laboratory to leverage the revolution in commercial space flight and provide our scientists and engineers with rapid and cost-effective access to experimental flight test data," explains Charlie Nakhleh, associate Laboratory director for Weapons Physics at Los Alamos. "Experiments conducted at a high cadence are the surest path to learning and innovation and provide one of the best ways we have to train a new generation of scientific and engineering staff." ★

Photo: X-Bow Systems

IN THIS ISSUE

FEATURES

About the cover:

Rainbow ribbon cables are used for data or power transmission in weapons components, including those made or used by Los Alamos National Laboratory. Los Alamos is responsible for four of the seven stockpiled nuclear weapons systems that make up the nation's nuclear triad—a three-pronged capability that consists of land-launched nuclear missiles, sea-launched nuclear missiles, and aircraft-deployed nuclear bombs and missiles. This important diversity of nuclear forces provides the United States with methods to attack by land, sea, or air, and significantly reduces the possibility that all of the United States' nuclear weapons could be destroyed in a single attack.

THE DIVERSITY ISSUE

From the makeup of the workforce to the breadth of the research, Los Alamos National Laboratory embraces diversity to ensure national security.

BY C.J. BACINO
Diversity officer, Office of Diversity and Strategic Staffing

Welcome to this edition of *National Security Science* magazine, which focuses on the importance of diversity and inclusion at Los Alamos National Laboratory. From its inception, our iconic Laboratory has provided solutions to national security challenges and has been a leader in cutting-edge science because of its ability to attract and leverage diverse talent from across the planet.

To say that terms like diversity, inclusion, equity, and belonging are important to Los Alamos National Laboratory is an understatement. These words are not only important, but also essential: essential to how we develop teams, how we conduct our work, and how we ultimately come together—each unique individual bringing their authentic best—to solve problems of the utmost significance.

Of course, we also recognize that work in this arena is never-ending. No matter how much progress we have made in the areas of diversity, inclusion, equity, and belonging, we know there is always more that can be done. It is this ability to recognize that we can do better, listen to one another, share lessons learned, and forge new paths forward that keeps the Laboratory relevant in a constantly changing world.

On the following pages you will learn more about the importance of diversity in the Laboratory's founding (p. 6) and the perspectives of our senior leaders (p. 74). You will read about the amazing contributions of our diverse employees, 36 of whom are profiled, starting on p. 26. As Hazuki Teshima, a Lab technologist, says, "This is a unique place, open to all types of people and backgrounds."

In addition to our diverse workforce, our work is also diverse. Yes, we are primarily a national security science laboratory, but, as you'll see on p. 62, our work also includes developing isotopes that the medical community uses in everything from heart imaging to cancer treatment and diagnostics, unlocking the mysteries of new particles in the universe, and researching what happens when cosmic rays strike electrical circuits, like those found in airplanes and satellites.

Making sure our newest employees understand and appreciate the scope of our work is increasingly important. That's why we're extra grateful for colleagues such as Jim Goforth, who at 74 years old, is passionate about educating the youngest generation here at Los Alamos. Turn to p. 52 to read more about Jim's work at a remote explosives site in the bottom of a canyon.

I hope you will enjoy this celebration of diversity at Los Alamos National Laboratory. Our Laboratory is truly a great place to work, and without a doubt, our people make it so special. ★

MASTHEAD

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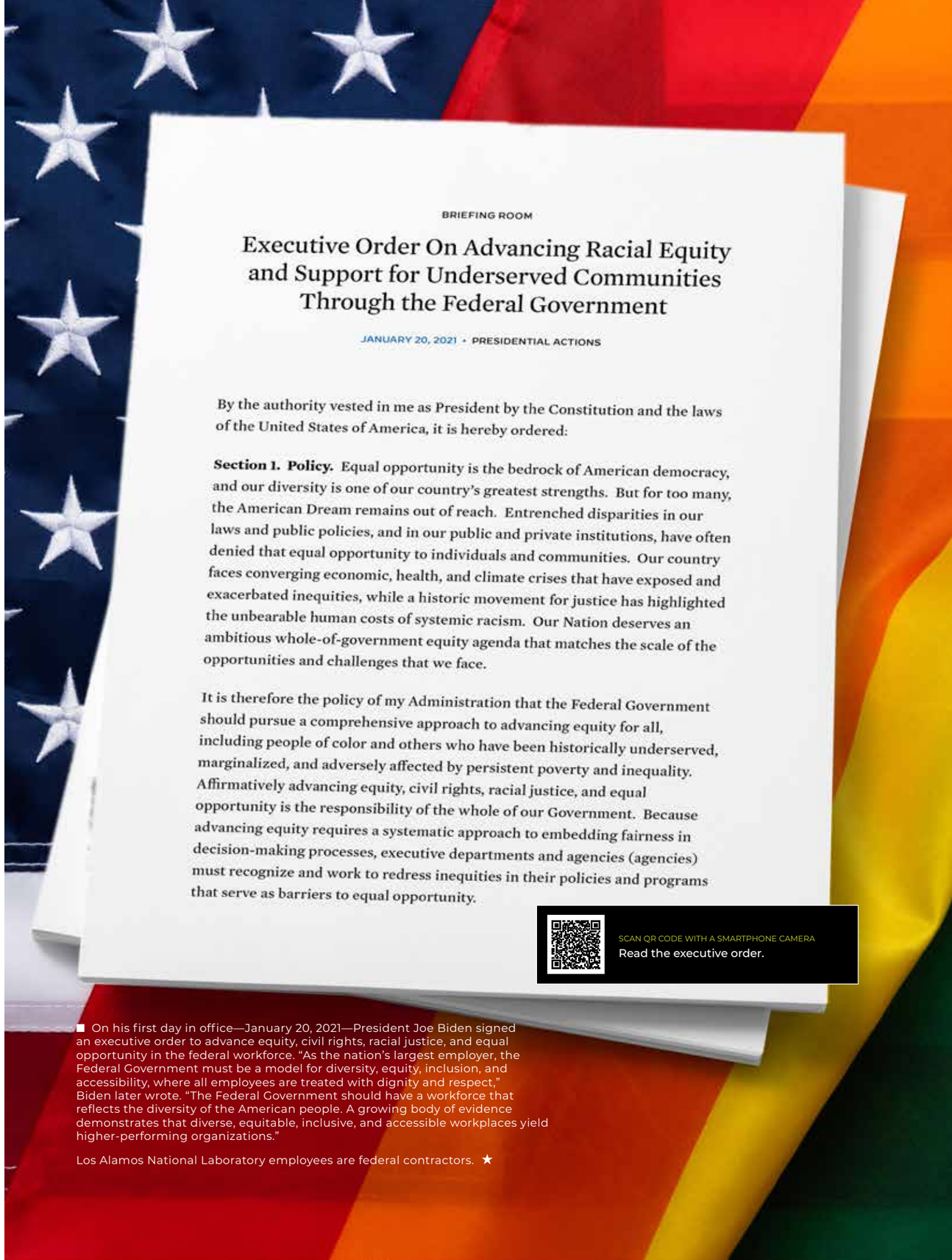
NSS STAFF SPOTLIGHT

Guest writer Cristina Olds is the co-chair of Prism, the Lab's LGBTQ+ employee resource group. Here, she helps raise the progress pride flag at the Lab's Plutonium Facility during Pride Week in June 2022. "The flag—which also flew at four other locations around the Laboratory—is just one of many ways Los Alamos is working to become a more inclusive place to work," Olds explains. "Other initiatives include increasing the number of gender-neutral bathrooms and encouraging employees to add their pronouns to their email signatures." Olds wrote six of the profiles starting on p. 26. ★



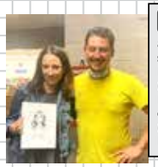
■ On his first day in office—January 20, 2021—President Joe Biden signed an executive order to advance equity, civil rights, racial justice, and equal opportunity in the federal workforce. "As the nation's largest employer, the Federal Government must be a model for diversity, equity, inclusion, and accessibility, where all employees are treated with dignity and respect," Biden later wrote. "The Federal Government should have a workforce that reflects the diversity of the American people. A growing body of evidence demonstrates that diverse, equitable, inclusive, and accessible workplaces yield higher-performing organizations."

Los Alamos National Laboratory employees are federal contractors. ★

INFOGRAPHIC

THE INTERSECTION

Science and culture converge in northern New Mexico—and beyond.

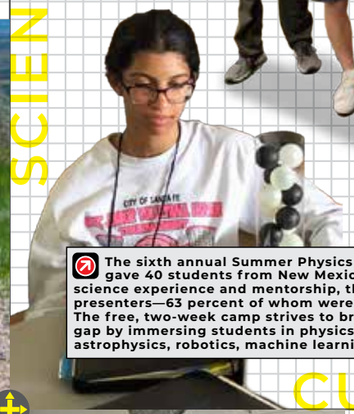


Los Alamos is a small town with a mighty love for comic books, superheroes, gaming, anime, movies, and fandoms—all of which were showcased in July during Atomicon at Mesa Public Library. During the event, Paul Ziomek (right), a graphic designer at Los Alamos National Laboratory, illustrated caricatures for children and adults, including Brye Steeves (left), the communications specialist for the Lab's National Security Research Center.

For the third year in a row, Los Alamos County, New Mexico, was named the healthiest community in the United States by *U.S. News & World Report*. The 2022 report incorporates new data on environmental health and natural disaster threats. Photo: Los Alamos County

SCIENCE

The Los Alamos Project Y robotics team placed fourth at the 2022 FIRST Robotics World Championship in April. The team of high school students traveled to Houston, Texas, to compete against 453 other teams that qualified from almost 6,000 active teams in 51 countries. Photo: Los Alamo Reporter/Christy Patterson



The sixth annual Summer Physics Camp for Young Women gave 40 students from New Mexico and beyond hands-on science experience and mentorship, thanks to 104 volunteer presenters—63 percent of whom were Los Alamos scientists. The free, two-week camp strives to bridge the STEM gender gap by immersing students in physics, computer science, astrophysics, robotics, machine learning, and other fields.

CULTURE

In June, Los Alamos community members used their handprints to create a progressive pride flag in a tunnel along the Canyon Rim Trail. Many members of the Laboratory's LGBTQ+ employee resource group participated.

If you've ever traveled through the Albuquerque airport, perhaps you've seen whimsical murals by Pop Chalee of Taos Pueblo. During the Manhattan Project, Chalee worked as a dormitory matron. In 1945, Howard Hughes, owner of Trans World Airlines, commissioned her to paint murals at the Albuquerque airport. "One day two MPs drove up [to Los Alamos] to escort me [to Albuquerque] to meet him," Chalee is quoted in *Southwest Art* magazine. "Howard had seen my watercolors of Indian dancers. I was supposed to do three murals, and I talked them into doing the whole airport. It was 12 or 13 paintings." Photo: IAIA archives/Albuquerque Sunport

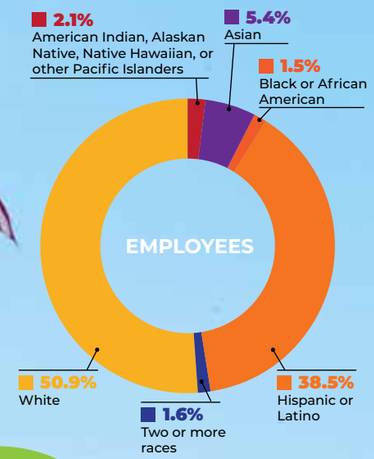
Los Alamos High School graduate Chase Ealey won the women's shot put event at the 2022 World Athletics Championships in July. Ealey, 27, is the first American woman to win a shot put world title. Ealey's mother, Michelle Naranjo-Martinez, grew up in Los Alamos and has worked in Lab's Fire Protection Office for 25 years. "Best decision I ever made," she said of becoming a Lab employee and raising her two daughters in Los Alamos. "The Laboratory makes Los Alamos—there are different people from all over, and the mix makes the town interesting and entertaining." Not to mention, "the school district is amazing academically, and the sports programs offered are incredible. My girls both went to college on full athletic scholarships." Photo: Los Alamos Reporter

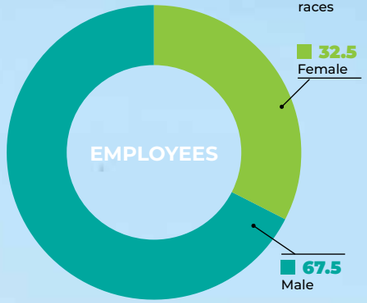
BY THE NUMBERS

DIVERSITY AT LOS ALAMOS

The Lab recognizes diversity, inclusion, equity, and belonging as essential components of national security.

Los Alamos National Laboratory is committed to attracting and retaining a capable and diverse workforce. From 2011 to 2022, the progress of women and minorities into management positions and research and development (R&D) positions has improved greatly. For instance, when looking at executive managers, the percentage of women increased threefold, as did the percentage of underrepresented minorities (Hispanic, Native American, Black). Across all levels of management and in R&D positions, a similar trend of marked improvement holds. ★





5.7% Employees with disabilities

6.2% Employees who are veterans

30% Senior leaders who are women

44.2% Operations managers who are underrepresented minorities (African American/Black, Hispanic/Latino, and American Indian/Alaskan Native)

34.7% Postdoctoral employees who are other people of color (Asian/Asian American)

17.1% Research/technical managers who are underrepresented minorities

QUOTED

"If we're to meet the scientific and technological challenges of tomorrow head on, we need to hire and cultivate future leaders who understand intrinsically that when everyone is valued, we all win. The Laboratory is ready to be part of that change."

—**Kelly Beierschmitt**, deputy director for Operations at Los Alamos National Laboratory and the champion for Prism, an advocacy group for the Lab's LGBTQ+ community ★

■ Despite the similarities suggested by these Project Y badge photos, the staff was quite diverse for the era.

LOOKS CAN BE DECEIVING

Diversity played a crucial role in building the first atomic bombs.

BY JILL GIBSON

Historical photos of scientists at Project Y, the Los Alamos branch of the Manhattan Project, tend to leave the impression that the people behind the creation of the first atomic bomb were a highly homogeneous group. Historians say, however, that looks can be deceiving. One of the keys to the success of the Manhattan Project was the diversity of the people involved.

The concept of diversity has evolved since the 1940s. "The diversity of Project Y was relative to the United States at that point in history," notes Alan Carr, senior historian at Los Alamos National Laboratory. "Project Y might not be considered diverse by our standards today, but at that point in time, a pretty strong case can be made that the staff's diversity really made a difference in the success of the effort to build the world's first atomic devices. If we didn't have the diversity that we did back then, I think that it would have been a tangible detriment to the work here and beyond."

Carr says the staff who ushered in the Atomic Age at Los Alamos included women, foreign refugees, British scientists, Hispanic and Native American people, Jewish scientists, and people from a variety of age groups and backgrounds. "I think that I can prove beyond reasonable doubt that diversity was a key to the Project's success," he says. "Had you removed all of these people from the Laboratory, the work would not have gotten done."

Carr points to the importance of European refugees. Immigrants from Germany, Hungary, Austria, Czechoslovakia, Poland, Russia, Italy, Canada, Switzerland, Denmark, and Great Britain constituted many of the top scientists at the Lab. "The Manhattan Project was one of history's great scientific achievements, thanks in large part to foreign-born scientists," Carr says. "Regarding the British contribution alone, General Leslie Groves, the United States Army Corps of Engineers officer who directed the Project, stated, 'I cannot escape the feeling that without active and continuing British interest there probably would have been no atomic bomb to drop on Hiroshima.'"

During World War II, the Laboratory employed 17 Nobel laureates as staff members or consultants; more than half of them were foreign-born. "It really was a diverse group of people who came here. That group made a disproportionately valuable contribution because so many of them were very experienced in their fields," Carr says.

Among those immigrants were a large number of Jewish scientists. Los Alamos guest scientist Jack Shlachter has spent the past decade studying the contributions of Jewish people to the Project. "According to a May 1945 roster, Jews made up about two-thirds of the leadership in the Manhattan Project's Theoretical Division—the group tasked with calculating critical mass and modeling implosions," Shlachter says. "There's no question that the Manhattan Project was a team effort. In some ways, it was the first example of a large-scale scientific enterprise that involved lots and lots of people and so singling out one group can be problematic. Having said that, because of my own Jewish identity, I take some pride in being part of a group of people who contributed in such an important way."

Shlachter says many of these scientists immigrated to America because of their Jewish heritage. "At least half of Project Y's Jewish physicists came to America due to religious oppression in their home countries. After arriving, some experienced further discrimination in the United States at universities and commercial institutions; they were turned away by organizations citing limits on how many Jews they could accept at one time."

These scientists did not face discrimination at Los Alamos, where recruiters were looking for the best scientists regardless of background. "The top-secret mission's inclusive approach to recruiting top talent regardless of religion (and other factors) proved a major boon to its success," Shlachter says.

Women also played a key role in the success of Los Alamos. Laboratory Historian Ellen McGehee has conducted extensive research on the role of women during the Manhattan Project. Although few women worked as scientists, "there was a diverse group of women, technical and nontechnical, who played many roles and were essential to the smooth running of the Laboratory and the town," McGehee says.

"Women worked as physicists, chemists, and scientific technicians," she continues. "They were on the front line in the technical areas doing hands-on assembly work. They worked on computing and mathematics; they worked as doctors, nurses, biochemists; they were members of the Women's Army Corps; they were secretaries, clerks, and administrative staff. Women worked in supply and procurement. They worked in intelligence and security. They also worked in the housing office and were teachers and childcare workers. There were all these different categories of roles that women played that came together to support the war."

Many of the people working at the Lab and in the town came from nearby villages and pueblos. "This part of the country has a very high percentage of Hispanic, Hispano, Latino, and Native American people," Carr says. "Some of those families go back hundreds of years." Carr notes that some of the local residents joined the lab as scientists and technicians, while others served key roles that formed an invaluable part of the team. "Many of them worked as construction workers. They built roads; they built laboratories; they built buildings. They worked as secretaries and housekeepers. Without them, the Lab would not have run."

Carr says that although African Americans were not represented in Los Alamos during World War II, they contributed to the Manhattan Project by working at Oak Ridge and Hanford facilities and at the University of Chicago's Metallurgical Laboratory. "I think that that is mostly a reflection of the demographics of the area," he says.

Carr, McGehee, and Shlachter all point out that the leaders of the Manhattan Project did not set out to assemble a diverse staff. Instead, their goal was to get the best people for the job.

"Their aim was to have the best workforce that could be brought together at this one time while doing extremely complex technical and scientific work within the constraints of war in the middle of nowhere," McGehee says. "The best workforce just happened to be diverse."

Choosing a diverse workforce represented another way the creators of the first atomic bomb were breaking new ground at Los Alamos. "To get to the best answers, you want to have diverse perspectives," Shlachter says. "Diverse perspectives lead to better solutions." ★

■ The API ERG leadership team gathers in front of the newly hung Enewetak street sign. Front row, from left: Kumkum Ganguly, Bernadette Guillermo, Arnold Eng, and Roseanne Cheng. Back row, from left: Riz Ali, Mark Anthony, Bret Simpkins, Cesil Alex, and Roger Meade.

■ API ERG co-chairs Arnold Eng (left) and Roseanne Cheng hold the new Enewetak street sign.

DIVERSITY & INCLUSION

SIGN OF THE TIMES

A street name captures the Laboratory's evolving relationship with its past and future.

BY JAKE BARTMAN

The change might seem small: a thoroughfare at Los Alamos National Laboratory renamed from *Eniwetok* Drive to *Enewetak* Drive. But in adopting the spelling preferred by inhabitants of Enewetak Atoll, the road's namesake, the change reflects larger shifts in how Los Alamos approaches diversity and inclusion, and how the Laboratory relates to its past.

"We can be proud of our history and what we've done," says Roseanne Cheng, a physicist at the Laboratory and co-chair of the Asian Pacific Islander (API) employee resource group (ERG), which spearheaded the sign change. "But if we can also acknowledge what happened to the people of Enewetak and the Marshall Islands, we're in a better place here at the Laboratory."

The histories of Los Alamos and Enewetak have been intertwined since 1947, when Darol Froman, a physicist at the Laboratory, chose the Marshall Islands to serve as the site of America's largest nuclear tests. Located 2,400 miles southwest of Honolulu, Enewetak Atoll—which comprises 40 small islands—seemed suitably remote. Like the rest of the Marshall Islands, Enewetak had been placed under U.S. control by the United Nations after the end of World War II.

In late 1947, 136 Enewetak natives boarded American ships and left their homes behind. "We hated to go, but we obeyed," the atoll's natives told anthropologist Jack Tobin in 1954. "We want to cooperate with the Americans all the time."

Between 1947 and 1958, the United States conducted 43 nuclear tests on Enewetak Atoll, amounting to some two-thirds of the 67 total tests that the country would conduct in the Marshall Islands.

The world's first thermonuclear device, codenamed Ivy Mike, was detonated on Enewetak in 1952, vaporizing the islet Elugelab.

Because the tests in the Marshall Islands were either atmospheric (aboveground) or underwater, radiation from the explosions wasn't contained the way it might have been if the tests were conducted underground. As a result, much of Enewetak was left highly radioactive.

Despite a large-scale cleanup, half the atoll's islands remained uninhabitable; however, Enewetak's natives were permitted to return home in 1980. Around that time, the U.S. government ceased spelling the atoll's name "Eniwetok" and instead adopted the natives' preferred spelling, "Enewetak." But for four more decades, the old spelling remained on a street sign at Los Alamos.

"Think how many people pass that street sign on a daily basis," says Alan Carr, senior historian at Los Alamos' National Security Research Center (NSRC), which maintains tens of millions of documents dating back to the Manhattan Project era. "It's kind of been a splinter in my side for a long time."

A few years ago, Carr mentioned the street name to Riz Ali, director of the NSRC. Ali, in turn, discussed the issue with the API ERG, which brought the misspelling to the attention of Laboratory management. Lab officials were eager to correct the street's name.

"How often do we have a legitimate opportunity to correct our place in history?" said Bret Simpkins, the Laboratory's associate director for facilities and operations, during a ceremony at which a new street sign was installed. "This event represents the Laboratory taking a significant step in supporting diversity and inclusion."

Cheng notes that although the name change might seem small, to make the correction required coordinating many different parties, including Los Alamos County. In that sense, Cheng says, the change shows how many groups can work together toward the shared goal of making Los Alamos a more inclusive institution. "It really takes everyone," she says. ★

"It's great to promote our pueblo in its proud heritage and way of life by providing information on its tribal government, traditions, and culture as a resource to the community."

—Gerald Martinez (Ogowi)
Po-Who-Geh-Owingeh (Pueblo de San Ildefonso)
Environmental technician | Environmental Stewardship

DIVERSITY & INCLUSION

NATIVE COMMUNITIES ENRICH THE LAB'S CULTURE

People representing numerous tribes, pueblos, and First Nations speak about their experiences at Los Alamos.

BY J. WESTON PHIPPEN

More than 30 pueblos, tribes, and First Nations across the United States and Canada are represented by employees at Los Alamos National Laboratory. Many of these employees are involved in the Lab's American Indian employee resource group, a forum for promoting communication and community among employees who have an interest in American Indian issues. *NSS* magazine spoke to members of the group to hear more about their heritages and experiences at the Lab. ★

"I want to share the experiences I have gained at Los Alamos and throughout my life to encourage and inform indigenous people about the variety of opportunities in the fields of science, technology, engineering, and math." For more on Harvey, see p. 35.

—Darren Harvey ◆ Diné (Navajo Nation)
Production engineer | Space Instrument Realization

"I truly enjoy working at a national laboratory that provides the opportunity to be a professional, a mom, and a tribal community member."

—Amanda Naranjo-Suazo ◆ Jicarilla Apache and Santa Clara Pueblo
Waste certification official | Waste Management Programs

"Our traditional way is about acknowledging our blessings and asking for guidance from our ancestors."

—Tracy Madrid ◆ Anishinaabe (Leech Lake Band of Ojibwe)
Research technician | Power Supply Production

"The Chickasaw Nation is very large and diversified in many business, health, and education endeavors that benefit its tribal members."

—Russell (Rusty) Ervin ◆ Chickasaw Nation
Special Services office manager | Project Execution Office

New Mexico is home to 23 American Indian tribes and pueblos.

SCAN QR CODE WITH A SMARTPHONE CAMERA
Learn more about employees' Tribal communities.

"I am proud to represent the Navajo Nation as one of the first Indigenous American members of the Large Hadron Collider collaboration at the European Organization for Nuclear Research, known as CERN, a European research organization that operates the largest particle physics laboratory in the world."

—Arielle Platero ◆ Diné (Navajo Nation)
Post-bachelor's student researcher | Nuclear and Particle Physics and Applications

"Life is beautiful waking up everyday as a Native American man, and I'm even more blessed to be a part of the Laboratory's mission."

— Gabriel Gallegos ◆ Nambe Pueblo
Environmental professional | Waste Management Programs

"I left New Mexico to pursue an engineering degree at Stanford University, ultimately returning to be closer to my family and community. Now I want to encourage other Natives to pursue their passion in engineering and sciences wherever it may take them."

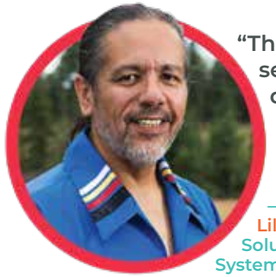
—Teena Redhorse ◆ Diné (Navajo Nation)
Senior project engineer | Engineering Services, Institutional Project Delivery

"My goal is to create a legacy that inspires the Diné youth to see the greatness in themselves, to achieve the impossible, and put back into the world the equivalent of what was taken out of it."

—Marcus Tallman ◆ Diné (Navajo Nation)
Mechanical field research and development engineer | Dynamic Structure Design and Engineering

"Environmental science is important in everyday life because society interacts with the environment every day."

—Kelkenny Bileen ◆ Diné (Navajo Nation)
Environmental professional | Environmental Compliance Programs



"The Lil'wat are committed to tribal self-determination and have developed a comprehensive education system that serves Lil'wat band members throughout their lifetimes."

—Michael Lynn Adams (Séskwi) ◆ Lil'wat Nation
Solutions architect | Production Systems and Technology

■ The Laboratory's Summer Physics Camp for Young Women strives to bridge the STEM gender gap by immersing students in a free, two-week intensive session covering physics, computer science, astrophysics, robotics, machine learning, and other areas.

PROFESSIONAL DEVELOPMENT

PREPARING THE NEXT GENERATION

Diverse student hiring ensures the Laboratory's future.

BY JAKE BARTMAN

When it comes to building a diverse workforce for Los Alamos National Laboratory's future, student hiring is a key strategy for success. In the summer of 2022, more than 1,800 students came to work at the Laboratory. More than 38 percent of these student interns were women, and 32 percent were underrepresented minorities, making students among the most diverse class of Lab employees.

Many of the students who spend summers at Los Alamos will return to work at the Laboratory or go on to careers in national security. Cassandra Casperson, of the Laboratory's Student Programs Office, says that hiring students from underrepresented populations helps the Lab meet important recruiting goals.

"When we think about why we want more diversity, it's the right thing to do, but that's not the only reason," Casperson says. "Many studies show that diverse organizations have far better outcomes."

Laboratory leadership and the Student Programs Office have long emphasized recruiting students from local and regional institutions. Many of these institutions—such as the University of New Mexico or Northern New Mexico College—are Hispanic-serving, meaning that at least 25 percent of their students identify as Hispanic or Latino. Others, such as Navajo Technical University and Southwestern Indian Polytechnic Institute, are tribal institutions.

"We want to make sure that students in our surrounding communities, especially in northern New Mexico, are getting opportunities," Casperson says.

Chantal Morales grew up in Rio Arriba County, next to Los Alamos County. Several summers ago, she participated in the Laboratory's Summer Physics Camp for Young Women, a two-week program for middle and high school-aged students from New Mexico. There, she learned basic circuit programming and soldering, and she became interested in electrical engineering.

Two years later, in 2021, Morales completed a summer internship at Los Alamos. She graduated from Española Valley High School in 2022, and before beginning an electrical engineering degree program at New Mexico State University, she returned to the Laboratory for a second summer.

At the Laboratory, working in the Weapons Engineering associate directorate, Morales became acquainted with the engineers' day-to-day work and gained hands-on experience with electrical diagrams and wiring.

"I'm very thankful for the opportunity," Morales says, noting that she valued the chance to play a role in the Laboratory's national security mission. "Every job is important to meet the big goal," she says.

The Student Programs Office and Laboratory leadership also try to bring students from beyond northern New Mexico to Los Alamos. In pursuing this goal, the Laboratory benefits from participation in the National Nuclear Security Administration's Minority Serving Institution Partnership Program, which supports 24 consortia from across the United States. Among these consortia are Research on the Science and Engineering of Signatures (ROSES), which includes 39 historically Black colleges and universities, and the Advanced Synergistic Program for Indigenous Research and Engineering (ASPIRE), which helps foster careers for Native American students.

Another consortium—the Department of Defense–funded Service Academies & ROTC Research Associates (SARRA) program—also brings students from around the country to Los Alamos. Each summer, some 20 cadets and midshipmen from U.S. military academies and Reserve Officer Training Corps (ROTC) programs come to the Laboratory through SARRA.

Raquel Ruiter, an ROTC student at Brown University who is studying international relations and Russian, first came to the Laboratory as a SARRA student in the summer of 2021. In 2022, she returned as a student employee in the Office of National Security and International Studies, where she studied nuclear deterrence policy and participated in wargaming exercises.

"A huge part of my experience here has been the mentor-mentee relationship," Ruiter says. "It's been really interesting to see how people at the Lab who I aspire to emulate reached their positions." Both of Ruiter's mentors are military veterans.

"The military is part of my career path, and my academic and military careers are able to merge at the Lab," she says. "Los Alamos is really representative of what it is to be in a national security career—of what it means to make sure that America is safe." ★

■ Raquel Ruiter (left) and SARRA student Annelies Bosley hike at the Valles Caldera National Preserve near Los Alamos. Photo: Raquel Ruiter

■ Chantal Morales is a native New Mexican whose interest in electrical engineering was sparked by the Laboratory's Summer Physics Camp for Young Women. Photo: Chantal Morales

■ Capacitor modules, such as the new K-module held by Kalpak Dighe, power Febetrons.

IMPROVED IMAGING

Redesigned capacitor modules mean better radiographs for national security applications.

BY BRIAN KEENAN

Flash x-ray radiography is a technique that captures photographs of materials moving at extremely high speeds (during a detonation, for example). These images help scientists better understand materials' positions, speeds, shapes, and internal density profiles. The images help refine computer models that determine material behavior in high-temperature and high-pressure regimes.

A certain class of x-ray generating devices, called Febetrons, have been the workhorses for flash radiography for nearly half a century. Stacked horizontally inside each Febetron, 80 capacitor modules—ancient by technological standards—power the Febetrons.

"Capacitor modules are like the automobile engines of these Febetron devices," says Kalpak Dighe, a physicist at Los Alamos National Laboratory. "However, that means the Febetron user community is stuck driving with an engine that hasn't changed in four decades."

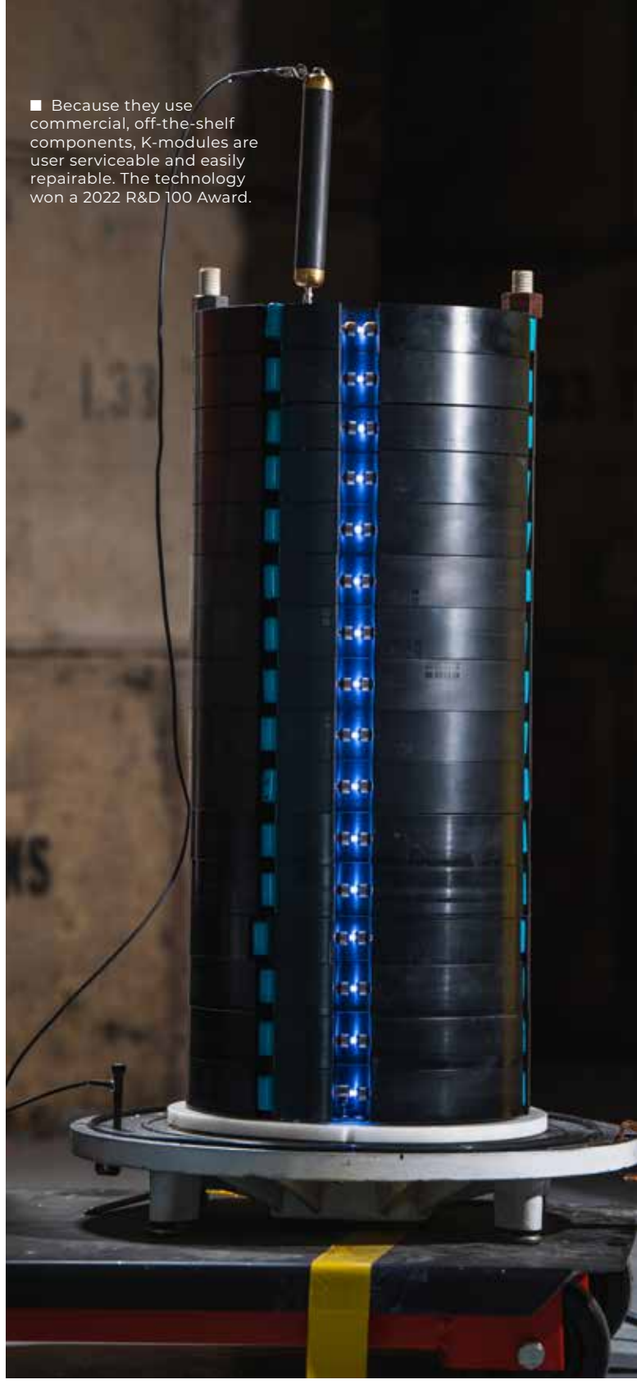
An upgrade was long overdue, so Dighe and his team from Los Alamos developed a new "K-module" device. "What we've done," Dighe explains, "is completely redesign the engine, with all the benefits of up-to-date performance, reliability, and efficiency." The technology is especially applicable to national security missions, as about three-quarters of flash radiography users are Department of Defense and Department of Energy laboratories.

Current capacitor modules generate approximately 2 million volts; K-modules are expected to generate approximately 3.3 million volts. This increase in output voltage will allow x-rays to penetrate farther through material and provide better contrast, clarity, and resolution in the resulting images.

In addition to the performance constraints of current-generation capacitor modules, their reliability is often suspect. In the X-ray Calibration Laboratory at Los Alamos, Dighe can point to a current-technology module that lasted for only 39 pulses instead of the 3,000 that should be its life expectancy. Once a module is damaged, it's unrepairable. Not to mention, ordering a replacement may take months or even a year, which delays experiments.

K-modules, on the other hand, have proved to be reliable during two years and 400 experiments of field testing. However, if repairs are necessary, they are easily done because K-module components are commercially accessible. Additionally, most K-module components are recyclable.

K-modules were developed specifically for Febetrons, and they could have an immediate application in those machines. But pulsed-power capacitor module technology also could be used in x-ray devices in the medical, aerospace, or oil and gas industries. Similarly, K-modules could be applied to electron-beam devices used in the food-packaging industry to kill microorganisms such as *E. coli* and *Salmonella*.



■ Because they use commercial, off-the-shelf components, K-modules are user serviceable and easily repairable. The technology won a 2022 R&D 100 Award.

Electromagnetic pulse applications also could test for radiation hardening of military targets or calibrating sophisticated but remote equipment, such as satellites.

The customizable fabrication of the K-modules leaves the door open for many possible applications. There are, after all, many cars on the road. Now, they finally have a choice of performance engines. ★

■ In August, the LightSlinger technology won a 2022 R&D 100 Award—aka an Oscar of Innovation.

RESEARCH & DEVELOPMENT

TUNING IN TO THE FUTURE

Avant-garde antenna could transform communications.

BY JUSTIN WARNER

With the rise of modern wireless communications systems, telecommunications clutter poses a significant problem. Wireless devices, from internet routers to cellular towers, even toys, appliances, and cameras, are competing for limited space to transmit and receive data. Decreased connectivity—in other words, slow or even nonexistent internet connections—are often the result.

Only a new paradigm in antenna technology can keep pace with the endless proliferation of wireless devices. Researchers at Los Alamos National Laboratory have developed LightSlingers, a leap forward in antenna design that promises to simultaneously declutter and secure the airwaves.

"Our hope is that LightSlingers will, in the near future, replace outdated antenna technology around the globe," says Andrea Schmidt, who developed the technology with John Singleton.

In the past, every antenna since the discovery of radio used, in one form or another, the same basic technology. For years, this approach was sufficient, though not without drawbacks. As connectivity came to define modern life, frequency bands became overloaded, and as devices grew in complexity, manufacture of their fragile parts moved overseas.

LightSlingers are a novel type of directional broadband antenna that offer better efficiency, bandwidth, and security than traditional antennas or phased arrays, all in a sturdier package with far fewer components. Further, they have no geometry requirements—a LightSlinger antenna can be any shape and molded into any device. LightSlingers can be constructed as flat panels, cylinders, or disks that are uniquely optimized to particular situations and applications. For example, they could form part of ceramic armor applied to a tank or unmanned ground vehicle.

These new antennas work by "slinging" tightly focused electromagnetic wave packets with precision toward a target location. Unlike conventional antennas, they use polarization currents, animated to faster-than-light speeds, as their emission mechanism. Sturdy, small, and versatile, they are potentially advantageous for warfighter communications and radar applications.

Several prototype LightSlingers have been tested in lab environments and in the field over distances of up to 76 kilometers. Three of them also were independently validated by a U.S. telecommunications company.

Los Alamos is now looking to transition the antennas to commercial prototypes that can be field tested and mass-produced using additive manufacturing and robotic processing. ★

■ Researcher Andrea Schmidt helped develop a novel type of broadband antenna that "slings" tightly focused wave packets toward a target location, providing better coverage, efficiency, bandwidth, and security than traditional antennas or phased arrays.

■ Forty-three percent of the employees in the Plutonium Infrastructure associate directorate are women. For comparison, 32.5 percent of employees across the entire Laboratory are women.

DIVERSITY & INCLUSION

THE MISSION TO MODERNIZE

Meet some of the women behind the renovation of the Los Alamos Plutonium Facility.

BY ALEXA HENRY

Before Los Alamos National Laboratory can meet its goal of producing at least 30 plutonium pits (nuclear weapon cores) per year, the Laboratory first needs to complete an ambitious renovation project.

Modernizing the 45-year-old Plutonium Facility (PF-4) falls under the Lab's Plutonium Infrastructure (PI) associate directorate, which employs more than 130 people—43 percent of them women. These women are among those responsible for decontaminating and decommissioning decades-old equipment, preparing new equipment for installation, upgrading safety systems, and making sure the Laboratory has the personnel in place to complete the work.

"PI has been fortunate to have a significant number of female applicants competing for new and fulfilling roles," says Robin Simpson, a construction projects strategist who attended the Society of Women Engineers hiring fair twice in 2022 to attract as many qualified female employees into technical roles as possible. "Women offer broad experience and new perspectives within our organization, allowing our construction-centric organization an opportunity to grow in exciting new ways while sending the message that historically male-dominated fields are no longer off limits for qualified female candidates."

PI's mission requires execution of complex projects in a fast-paced environment, explains project-program director Carole Engelder, who joined the Laboratory several years ago after 30 years in the renewable energy, petrochemical, and petroleum-refining industries. "Diversity of experience and aptitude fosters better decision making, deeper analysis in problem solving, and higher levels of trust throughout the organization," she says.

Sarah Quintana joined the Laboratory as an intern in 2008 while pursuing her bachelor's degree in mechanical engineering at the University of New Mexico; she later earned a master's of engineering management from the New Mexico Institute of Mining and Technology. Today, she's a project manager who oversees preparation and testing of new gloveboxes and other equipment required for pit production. "Being a part of PI means I am a part of the massive effort to execute numerous projects from infrastructure support to complex equipment installation efforts," she says. "I carry the responsibility of ensuring this work is performed successfully."

Quintana encourages other women interested in joining PI and supporting the pit mission to not be intimidated by any potential challenges. "Pursue the difficult route," she says. "To this day, I am often the only female at the table; I take pride in working hard and earning my place while supporting the pit mission. I hope to continue setting a good example for all women through my work ethic, professionalism, and overall approach to tackling challenges."

Construction manager Savannah Romero agrees. "Take the initiative," she says. "Own your strength—you have an opportunity to make a difference and be a part of something great in service to your country." ★

Q&A

ASK AN ASSOCIATE DIRECTOR

James Owen, associate Laboratory director for Weapons Engineering, answers three questions.

BY ARTHUR BISHOP

Los Alamos National Laboratory is about 50 miles southwest of rural Peñasco, New Mexico. That distance seemed pretty far to Peñasco High School student James Owen. But a field trip to the Laboratory's Bradbury Science Museum changed his outlook.

"A Lab staff member introduced the concept of implosion, and it absolutely caught my attention," Owen remembers. "It's a relatively easy concept to understand now, but as a high school sophomore, I was really perplexed by this idea of implosion versus explosion. I became really enthralled with Los Alamos from that point forward."

As a sophomore, Owen began participating in Lab STEM (science, technology, engineering, and math) programs. Twenty-five years later, he is the associate Laboratory director for Weapons Engineering at Los Alamos. Here, he talks to *NSS* about his career.

As a high schooler, you commuted 100 miles round trip to participate in STEM programs at the Laboratory. What was that experience like?

My guidance counselor, who happened to be my basketball coach, came up with options of how I could get to the Lab every day. But I told myself I wasn't going to do it because the programs conflicted with our practice schedule—and basketball was my primary interest. Then, to my surprise, Coach changed our practice schedule so that I could do both. I was up at 5 a.m. to catch a van to the Lab and then back at basketball practice in the afternoon. As a young adult, this was a large commitment. But it honestly changed my life. I went from being a B-minus student to working at Los Alamos in a STEM program and becoming an A student. And it wasn't because I was academically advanced. I just got interested in science and technology, and I worked very hard at it. It was transformational for me and opened my perspective toward opportunities I never knew existed.

■ James Owen (left) works with students at the 2019 New Mexico Governor's STEM Challenge.

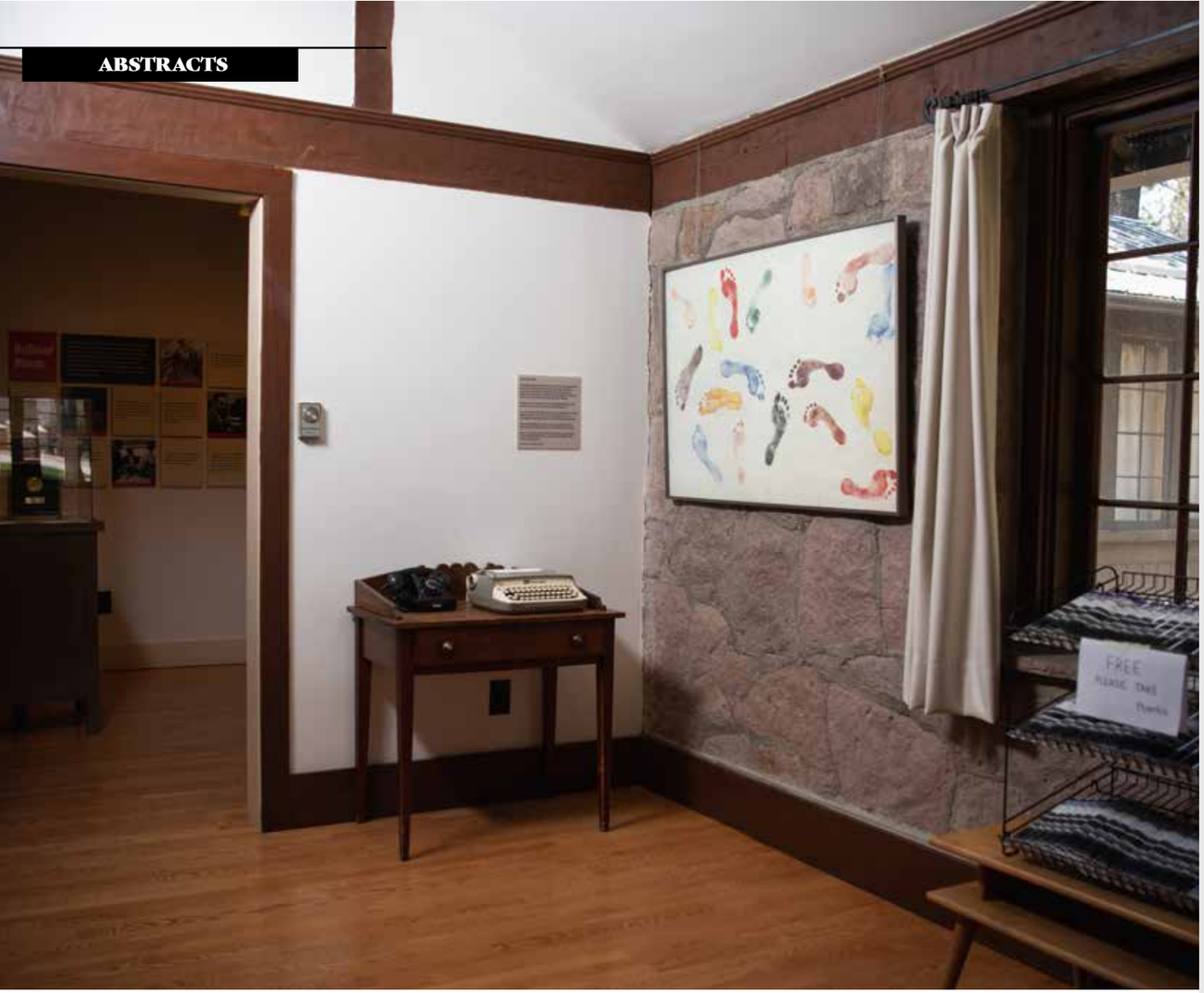
■ As the associate Laboratory director for Weapons Engineering, James Owen manages the operations and infrastructure of high-explosives science and engineering research and development, which are critical to the Laboratory's nuclear weapons mission.

What advice do you have for early career employees at the Lab?

Employ a strong work ethic with a strong focus on mission. We have a Lab populated with some of the world's most intelligent individuals. I've never taken one moment of working here for granted—I'm humbled and proud to work here. This Lab has changed the global landscape, not just through developing the first nuclear weapons, but through wide-ranging national security and scientific achievements that we continue to demonstrate. My advice: Harness opportunities, there are many.

For most of the coronavirus pandemic, the Lab implemented "normal operations with maximized telework." Did this situation have any silver linings?

Our most important strength is our commitment to our vital national security mission—even as we adapted to the changes and challenges COVID-19 presented. If you look at Google, Facebook, and other progressive companies—who, by the way, we compete with for engineers—they have a more liberal definition of what's considered a 40-hour work week. And though much of our work in Weapons Engineering is a contact sport [because of its classified nature], we're finding that we can be more efficient by incorporating flexible schedules. ★



■ Harold Agnew's footprint painting hangs in the living room of the Hans Bethe House, which is part of the Los Alamos History Museum.

HISTORY

PUTTING THEIR BEST FEET FORWARD

Artwork documents a party's notable guests.

BY JAKE BARTMAN

One summer evening in the early 1950s, a group of Los Alamos locals gathered at the home of Harold and Beverly Agnew for cocktails. In addition to Harold Agnew—who later became director of Los Alamos Scientific Laboratory (now Los Alamos National Laboratory)—the guest list included Agnew's mentor, Nobel laureate Enrico Fermi; physicist David Hall; and George Sawyer, principal of Los Alamos High School.

At some point during the party, and at Harold Agnew's behest, the attendees coated their feet in colorful paint, then stepped onto a white-painted Masonite panel.

"My dad had prepared the board beforehand," Harold's daughter Nancy Chapman recalled to Los Alamos Historical Society curator Don Cavness. "The paint was applied to feet with a little hard rubber roller that my dad used for linoleum block prints that he made for Christmas cards."

Although the exact year of the party isn't known, it must have taken place between John Agnew's birth in 1949 and Enrico Fermi's death in 1954. John Agnew later donated the panel to the Los Alamos Historical Society. Today, the framed artwork can be seen inside the Hans Bethe House, which is part of the Los Alamos History Museum. ★

Special thanks to Los Alamos Historical Society (LAHS) curator Don Cavness, LAHS archives and collections technician Tina Moore, and LAHS archives and collections assistant Kaity Burke for their valuable contributions.

01 NANCY CHAPMAN (NEE AGNEW, 1944–) is the daughter of Harold and Beverly Agnew. She graduated from Los Alamos High School in 1962.

02 NELLA FERMI (1931–1995) was born in Italy to parents Enrico and Laura Fermi. She spent part of her childhood in Los Alamos during the Manhattan Project, and she later studied at the University of Iowa and the University of Chicago, where she earned a doctorate in organizational psychology.

03 LEWIS ALLBEE was the principal of Los Alamos High School in 1950. By 1953, he had been promoted to superintendent of Los Alamos Schools, a position he held until 1955.

04 ETHEL FROMAN (1908–1978) was born in Canada but became a naturalized American citizen. She worked as a member of support staff at Los Alamos during the Manhattan Project, and she was the wife of Canadian physicist Darol Froman, who from 1951 to 1962 served as deputy director of Los Alamos Scientific Laboratory.

05 JOHN AGNEW (1949–) is the son of Harold and Beverly Agnew. He graduated from Los Alamos High School in 1967.

06 BEVERLY JACKSON AGNEW (1919–2011) arrived in Los Alamos with her husband, Harold, in 1943. During the Manhattan Project, she worked in J. Robert Oppenheimer's office and was physicist Robert Bacher's secretary. After the war, Agnew served on the New Mexico Board of Education. She was also a painter whose works were displayed in local galleries.

07 GEORGE SAWYER (1922–2011) earned his Ph.D. at the University of Michigan and was a physicist at Los Alamos, where he authored a paper on heavy ion fusion. He also was involved with Los Alamos' Little Theatre group. Sawyer was the son of physicist Ralph Sawyer. In 1946, Ralph Sawyer served as chief civilian scientist for Operation Crossroads, which comprised the United States' second and third nuclear tests.

08 HAROLD AGNEW (1921–2013) was the only child of a Scotch-Irish stonecutter. A student of physicist Enrico Fermi, Agnew joined the Manhattan Project at Los Alamos in 1943 as a physicist. From 1970 to 1979, he served as Los Alamos Scientific Laboratory's third director.

09 RICHARD CROOK (1903–1997) was a civil engineer who worked for the Zia Company, which for several decades managed both the Laboratory and the town of Los Alamos. He was president of the Los Alamos School Board in 1957.

10 VIOLA "VI" ROY (?–1995) was the wife of chemist Max Roy. In 1946, she was the librarian at Los Alamos' Mesa Public Library, and she served on the Los Alamos County Commission's school budget board in 1949. In 1957, she became the first woman to serve on a Los Alamos jury.

11 ENRICO FERMI (1901–1954) won the 1938 Nobel Prize in Physics. Fermi left his native Italy that same year to escape discriminatory laws that affected his wife, Laura, who was Jewish. From 1944 until the end of 1945, Fermi served as associate director of the Manhattan Project.

12 DAVID HALL (1915–1998) was born in New Jersey and worked on the Manhattan Project at the University of Chicago's Metropolitan Laboratory. He later worked at Los Alamos with his wife, Jane Hamilton Hall, on Clementine, the world's first fast reactor, and went on to serve for 20 years as head of Los Alamos' Reactor Division. Jane was best known as the Laboratory's first female assistant director, having served in that role from 1955 to 1970.

DIVIDER, 30 YEARS LATER

Los Alamos marks three decades since its last nuclear test.

BY WHITNEY SPIVEY

On September 23, 1992, the United States conducted Divider, an underground test at the Nevada Test Site. The test, designed and executed by scientists at Los Alamos National Laboratory, was the nation's 1,054th and final nuclear weapons test before the current testing moratorium, marking the end of an era that began with the Trinity test 47 years prior.

"Nuclear tests were confirmation of our ability to predict a variety of nuclear explosion characteristics in a fully integrated way—the one-time measurement of many things that were evolving on a nanosecond time scale," explains physicist David Hollowell, who was on the secondary design team for Divider. "With the Divider nuclear test, this integrated testing approach stopped being the way the United States could improve the validation of our confidence in predicting the U.S. nuclear stockpile or any nuclear design."

Divider was never planned as the final nuclear test; rather, Divider just so happened to be the last test conducted by the United States before a short-term testing moratorium went into effect on October 1, 1992. "Of course, several months into the nine-month moratorium, the Clinton administration extended that moratorium indefinitely," Hollowell says. "And here we are, three decades later."

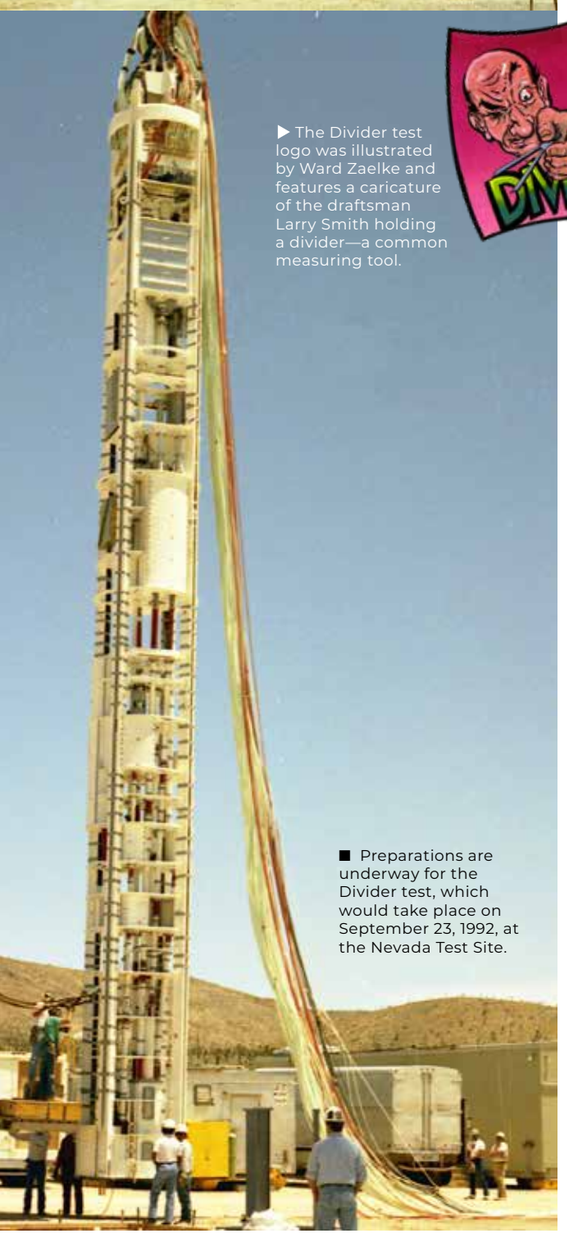
Today, instead of nuclear testing, the United States relies heavily on nonnuclear and subcritical experiments coupled with advanced computer modeling and simulations to evaluate the health and extend the lifetimes of America's nuclear weapons. This approach is called stockpile stewardship.

"At the inception of the stockpile stewardship program, it was unclear whether the stewardship approach would work, and if so, for how long," says Bob Webster, deputy director for Weapons at Los Alamos. "That it has been successful for 30 years is a remarkable achievement."

That success is largely due to the development of tools (such as proton radiography—see p. 62—and improved theoretical models) and infrastructure (such as the Dual-Axis Radiographic Hydrodynamic Test facility and the Plutonium Facility) required to understand what happens to weapons materials and components as they age.

State-of-the-art supercomputers have also been essential to the success of stockpile stewardship. "As weapons age, or material substitutions occur, the underlying physical models of the weapon components become increasingly complex," Webster explains. "As the physical models become more complex, an ever-increasing need for high-performance computing emerges. Stockpile stewardship has been successful to date largely due to major advances in high-performance computing."

However, whether that success will last another 30 years is unknown. "As is typical in science, the question of whether stewardship remains successful indefinitely is not yet decided," Webster cautions. "In part, continued success will depend on balancing the needs of the nation and the capabilities of the stewards." ★



▶ The Divider test logo was illustrated by Ward Zaelke and features a caricature of the draftsman Larry Smith holding a divider—a common measuring tool.

■ Preparations are underway for the Divider test, which would take place on September 23, 1992, at the Nevada Test Site.

■ Beyond the crater formed by the Divider test is the tower for Icecap, a nuclear test that was nearly ready to execute but never happened due to the testing moratorium enacted on October 1, 1992. Thirty years later, the tower is still standing.

■ Between January 1951 and September 1992, the U.S. government conducted 928 nuclear tests (828 of them underground) at the Nevada Test Site (now called the Nevada National Security Site). The test site spans 1,375 square miles and features hundreds of subsidence craters—depressions in the ground that formed following an underground detonation. The size of each crater depended on the test's yield, depth of burial, and geological characteristics of the soil. The Divider crater is pictured here.

■ Los Alamos visitors stand at ground zero in the Divider crater at the Nevada National Security Site in August 2022. The Divider nuclear test marked a turning point in both the nation's and the Laboratory's history: the moment the United States pivoted from underground nuclear testing to stockpile stewardship to evaluate the health of America's nuclear weapons.

DIVERSITY MAKES US STRONGER

Meet 36 Los Alamos employees who contribute to America's national security—and to making the Lab a more inclusive place to work.

By Jake Bartman, Jill Gibson, Ian Laird, Cristina Olds, J. Weston Phippen, and Whitney Spivey

CESIL ALEX

TECHNICAL PROJECT MANAGER

DETONATOR PRODUCTION, OPERATIONAL EXCELLENCE AND READINESS

Cesil Alex says his immigrant experience and education have helped him connect with people who may think, act, or look differently from himself. “Coming to the U.S. as a child, I was able to assimilate and make friends with people from all over,” says Alex, who was born in India and raised in Florida, where he earned bachelor’s degrees in biology and finance and a master’s degree in mechanical engineering. “My upbringing, and sometimes being wrongly judged, helps me empathize with others who feel marginalized and excluded.”

Despite not having a community when he moved to Los Alamos, Alex got involved in coaching kids’ soccer and volunteering for local organizations. He’s also made connections through the Los Alamos National Laboratory’s employee resource groups and by joining community volleyball and board-gaming groups that he learned about through social media.

At the Laboratory, Alex manages the production and modernization of detonators—small devices that trigger explosives—which involves collaborating with various Lab groups as well as stakeholders around the country. “I appreciate the push for the critical thinking that comes from a diverse workforce and the opportunities to learn from each other,” he says.

RICHARD ALFARO

RESEARCH SCIENTIST

GEOPHYSICS

“As a minority in the sciences, it can be difficult to find a sense of community,” Richard Alfaro says. “I seriously considered leaving the sciences prior to coming to the Lab.” But after arriving at Los Alamos in 2019 for a postdoctoral position, Alfaro found his place. “I was met with such a welcoming environment and had the opportunity to connect with amazing scientists and mentors who renewed my motivation and interest,” he says.

Alfaro conducts research to advance theories and generate insights from seismic data in support of nuclear explosion monitoring. “My work can be very computationally intensive,” he says. “On a typical work day, I often find myself generating code to solve new problems. I also make an effort to collaborate with others to improve not only our scientific research but our collective community at the Lab.”

Alfaro is a cofounding member of an employee-led volunteer group called Geoscientists United for Inclusion, Diversity, and Equity (GUIDE). “Our goal is to make the Earth and Environmental Science division at Los Alamos a more diverse, equitable, inclusive, and accessible place to work,” he says. Alfaro describes GUIDE as a “collaborative community space where we are always learning from each other,” and he says the group aims to “to support the development of a multicultural workforce that attracts and retains diverse talent.” He praises the Lab for being “an inclusive place where you can make an impact through your research,” and adds, “You will find leaders here who share diverse backgrounds and perspectives.”

I was met with such a welcoming environment.”

STEVE BATHA

PHYSICIST

THERMONUCLEAR PLASMA PHYSICS

Steve Batha came to Los Alamos National Laboratory in 1998 and lost his eyesight in 2008. “Since becoming blind, my colleagues and managers have helped me to remain productive and able to contribute to the Lab’s missions,” he says. “The Lab has been good at supporting me so that I may continue my career.”

Batha’s work involves planning, executing, and analyzing high-energy density physics experiments. Although he enjoys his work, he has had challenges. “As a blind scientist, I face a lot of small irritations that need some planning and ingenuity to solve,” he says. Everyday activities such as getting around the Lab and using video conferencing platforms can be challenging, but assistive technology solves many issues. “Because I am at the manager level, I’m mostly telling people what to do; they are my hands and eyes. So, the physics is not affected,” he says.

Batha applauds the recent formation of the DiversAbility employee resource group, which supports people with disabilities and empowers them to speak up. “Ask for help if you need it,” Batha says. “It’s good to remember that most people are not taught how to deal with blind people. The colleagues I work closely with have adjusted to my disability and figured out how to help me navigate through the day. They help even when not asked. That makes my work and my day much easier. I am very thankful for everyone’s generosity.”

JOCELYN BUCKLEY

ENVIRONMENTAL ENGINEER

WASTE MANAGEMENT PROGRAMS

The next time you're stuck in traffic, look up: You might see Jocelyn Buckley's plane overhead.

In the early 2000s, Buckley, who lives in Albuquerque, New Mexico, earned her pilot's license and began to fly herself to and from work at Los Alamos National Laboratory, about 100 miles north of her home. Today Buckley teleworks, making flying a form of recreation rather than a necessity. But for Buckley, the years of commuting by plane were worth it: "I love my job," she says.

At the Laboratory, Buckley reviews Laboratory projects with potential and realized impacts to specific sites that are slated for environmental investigation and remediation. Her efforts help ensure that the Laboratory conducts work in an environmentally sound manner and that Los Alamos has the space needed to complete projects that are key to accomplishing its national security mission.

"I would advise young people who are interested in working at Los Alamos to go for it," Buckley says. A job at the Laboratory means the chance to experience advances in science and technology firsthand, she says, and affords ample opportunities for personal and professional growth. She encourages Laboratory employees to pursue hobbies and interests that aren't work-related—such as flying a plane, perhaps.

> **"I would advise young people who are interested in working at Los Alamos to go for it."**

DANIEL COX

EXPLOSIVE FIRING LEADER

FOCUSED EXPERIMENTS

After 23 years in the Air Force, Master Sergeant Daniel Cox started looking for jobs in which he could continue supporting national security and help ensure that the nation's warfighters had the best tools available. In 2015, he landed at Los Alamos National Laboratory, where, as a firing leader, he performs and manages operations for high-explosive detonations. "I work side by side with scientists to better understand explosive properties used in America's weapon systems," he explains. "My Air Force experience aided me tremendously in the transition to this new and exciting job."

Cox has found his work to be rewarding. "There are not many other places where you can blow things up for a living," he says. Every day brings a variety of challenges, such as working with heavy machinery, troubleshooting equipment malfunctions, or evaluating whether a test area is a safe and controlled environment. The data he gathers from the detonations is fed into models that help predict how aging affects weapons in the nation's nuclear stockpile.

Cox says the Lab is a place where employees have freedom to explore fields and career paths that don't exist anywhere else in the world. For veterans, in particular, Los Alamos is a place where the goals and values adopted in the military are respected and represented and where one's service to the nation can continue without the uniform.

MAGDALENA DALE

RESEARCH AND DEVELOPMENT ENGINEER

SPACE ELECTRONICS AND SIGNAL PROCESSING

Magdalena Dale worked in research and development for industrial wind turbines before coming to Los Alamos. Since joining the Lab in 2015, Dale has contributed to the design, testing, and launch into space of four different instruments; three are currently in orbit and one is on the Mars Perseverance rover. "It's exciting to know that something I worked on is out there in space right now," she says. "I thought space would be another interesting and trendy area to work in, but I hadn't appreciated the needs of our government in maintaining global security." She now values the important impact she and her teams are having on space security.

Dale is part of several teams that develop technology that monitors for nuclear detonations in space (these types of detonations—and, in fact, all nuclear detonations—are banned by the Comprehensive Nuclear–Test–Ban Treaty). Dale was the engineering project lead for a small satellite project called the NanoSat Atmospheric Chemistry Hyperspectral Observation System. NACHOS, as it's called, is the first CubeSat-based hyperspectral imaging system that can compete with traditional large-satellite instruments in chemical detection applications.

Dale notes that as one of a few women in her group, she feels some pressure to always be correct and not make mistakes. According to a 2019 U.S. Census Bureau report, female engineers represent only about 13 percent of the total engineering workforce in America.

TATIANA ESPINOZA

SCIENTIST

SPACE SCIENCE AND APPLICATIONS

When she was 17, Tatiana Espinoza moved from Ecuador to New Mexico with her mother, a doctor. The first couple of years were an adjustment—living in a new country, attending a new high school, and taking a full course load—while also learning English. After graduating, Espinoza enrolled at the University of New Mexico, where a class on climate change drew her to the sciences, and she learned about a scholarship that could take her to Los Alamos National Laboratory.

"The scholarship I applied for was to help with data entry for environmental compliance," Espinoza says. "I was put on a list of potential interns, and I hoped I would get the position but there were a lot of candidates. Then one day, I got a call."

That call was eight years, a bachelor's degree, and two master's degrees ago. Today, Espinoza builds radiation detectors that will, in the next year, fly to space on satellites to support the Comprehensive Nuclear–Test–Ban Treaty, which prohibits any type of nuclear detonation.

"I'm on a team that helps protect the world," Espinoza says. "It makes me feel more safe, and because I have family in other countries, I feel like I'm keeping them safe, too." ☆

"I'm on a team that helps protect the world. It makes me feel more safe, and because I have family in other countries, I feel like I'm keeping them safe, too."

ELAINE GALLEGOS

MANUFACTURING MANAGER

PIT TECHNOLOGIES

In 1986, Elaine Gallegos' father suggested that she follow in his footsteps. "He had made a career working at Los Alamos National Laboratory, and his dream was to have at least one of his seven children follow suit," she says. Gallegos took her father's advice and started as a glovebox technician. Gloveboxes are sealed compartments accessed through two holes to which gloves are attached. Technicians insert their hands into the gloves and are able to handle radioactive materials inside the sealed compartment.

"The biggest challenge I faced in my early career was that, as a woman, I had to work harder to prove myself: my abilities, my professional opinions, and my potential," Gallegos remembers. But supervisors noticed her skills and abilities. "Once I found my confidence to speak up, I was recognized by my management and colleagues. Since then, I have not doubted myself." Today, Gallegos is a manager in the Weapons Production associate directorate.

Gallegos' entire career has focused on pit production, which includes dismantling old pits (the cores of nuclear weapons that contain plutonium) and recycling them into new pits. "I get to work with some of the world's most dedicated and resilient people who come together every day in support of our nation's security," she says. "There is no other place in the nation that does what we do. I'm really proud of being a part of it." ☆

CATHLEEN FRY

HIGH-ENERGY DENSITY PHYSICIST

THERMONUCLEAR PLASMA PHYSICS

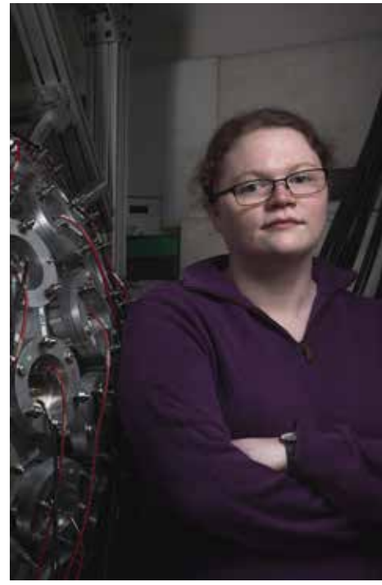
Cathleen Fry always enjoyed math, so in high school she planned to become an engineer. Then during her freshman year of college at Tennessee Technological University, she found a different path: physics.

After earning a Ph.D. in nuclear physics from the University of Michigan, Fry landed a postdoctoral position and later a staff scientist job at Los Alamos National Laboratory. She works at the Lab's Los Alamos Neutron Science Center (LANSCE), where she plans and develops nuclear diagnostic experiments to better understand the physics of nuclear weapons. (See p. 62 for more on LANSCE.)

Today, instead of nuclear testing, the United States relies heavily on nonnuclear and subcritical experiments coupled with advanced computer modeling and simulations to evaluate the health and extend the lifetimes of America's nuclear weapons. This approach is called stockpile stewardship.

"A full nuclear test would escalate global tensions, and I'm excited to be a part of an effort to avoid needing that through science-based stewardship," she says.

Fry is a member of Prism, the Lab's LGBTQ+ employee resource group, and she encourages her colleagues to "get involved in efforts to make Los Alamos a better place." Additionally, she says that "being in an environment with great people with expertise in so many different things is an exciting opportunity to work on multidisciplinary problems." ☆



KUMKUM GANGULY

BIOMEDICAL SCIENTIST

BIOCHEMISTRY AND TECHNOLOGY

When the COVID-19 pandemic hit in early 2020, Kumkum Ganguly and her colleagues were tasked with eliminating infectious virus from contaminated personal protective equipment and studying the effects of the cleaning procedures. Ganguly's team compared sterilization procedures that used ionizing radiation—such as high-energy x-rays and gamma rays—for successful pathogen inactivation and for radiation damage and reusability of N95 filter material.

"This crisis called for technological solutions and scientifically informed policies, and Los Alamos has an essential role to play," Ganguly says. "The Laboratory has long been on the forefront of high-performance computing and complex-system modeling, which now provide the basis for predicting the course of the pandemic. I feel honored to be even a tiny part of it."

Ganguly grew up in India and was headed for a career in pharmaceuticals after her postdoctoral work at the University of Pennsylvania. Instead, she joined the Lab to work on public health issues after she married a Lab scientist and moved to Los Alamos.

Ganguly, who has now been at Los Alamos for 16 years, is integrally involved in projects to design and analyze wet lab (biological or chemical specimen) experiments and develop algorithms for personalized disease prognosis. She's also the chair of the institutional biosafety committee and part of the Lab's Asian Pacific Islander employee resource group. (See p. 8 for more about this group.) "Los Alamos offers diversified research opportunities and unlimited possibilities," she adds. "We are encouraged to think outside the box to consider all ideas for the best outcomes." ★

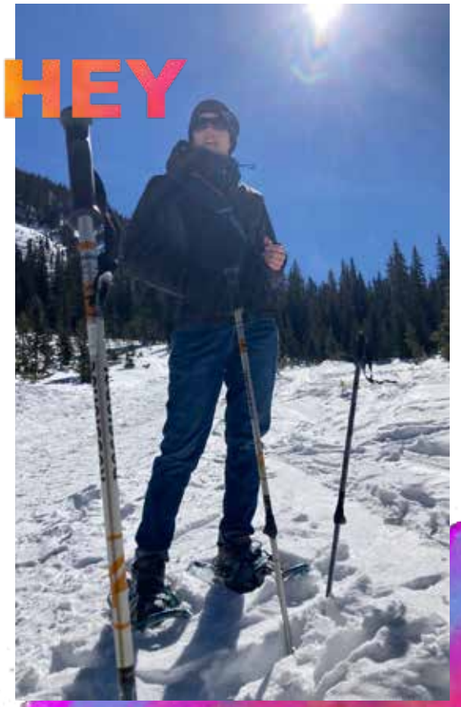
HADLEY HERSHEY

LEAD ARCHIVIST

NATIONAL SECURITY RESEARCH CENTER DIGITAL COLLECTIONS

Nearly three years ago, Hadley Hershey became the lead archivist for the National Security Research Center (NSRC)—the classified library at Los Alamos National Laboratory. "The NSRC covers many of the topics I am passionate about: World War II history, library and archives management, digitization of historical media, and more," Hershey says. "Our collections contain technical information related to many topics, including weapons physics and nuclear testing, and the work we do supports the physicists, chemists, engineers, material scientists, and many others at the Lab."

From the start, Hershey found their work engaging, but, as a nonbinary person, they felt isolated at times and even excluded by colleagues. "It was only after I became more involved in Prism that I started to feel like the Lab was a place for me," says Hershey, referencing the Lab's LGBTQ+ employee resource group. "In that group, I found people who I identified with on a personal level, and I became involved in some of the important initiatives the group has been working on over the years, such as increasing gender-neutral bathroom access." A founding member of the Restroom Access Committee, Hershey says, "you would be surprised by how many people are interested in either building or joining your community." ★



DARREN HARVEY

ENGINEERING TECHNOLOGIST

SPACE INSTRUMENT REALIZATION

As an avionic technician in the U.S. Navy, Darren Harvey spent nearly eight years repairing radar and communications equipment on jets, helicopters, turboprop planes, and other naval aircraft.

Several years after leaving the military, Harvey attended a job fair at which he learned about Los Alamos National Laboratory. His background in aviation and aerospace turned out to be a great fit for a position in the Lab's Intelligence and Space Research division, and he jumped at the chance to continue serving his country.

Harvey is part of the Space Instrument Realization group, which designs, manufactures, assembles, tests, and supports sensing systems—electronic equipment that collects data with national security, environmental, and other applications. "I never thought a little boy from rural New Mexico would have the opportunity to be working on space instruments," he says.

Harvey, who is Diné (Navajo), says he's found an inviting and respectful community at the Lab. He co-chairs the American Indian employee resource group, which he says helps others at the Lab learn about native people and cultures. (See p. 10 for more about this group.)

The group also plays an important role in attracting and retaining native people at the Laboratory. "It is critical for indigenous professionals to engage with each other and assist in any capacity regarding outreach to indigenous people as an underrepresented minority in STEM organizations," Harvey says. "In a sense, I'm simply telling my story of how I got to where I am and providing information to indigenous people about the variety of opportunities available at Los Alamos." ★

> **"In a sense, I'm simply telling my story of how I got to where I am and providing information to indigenous people about the variety of opportunities available at Los Alamos."**

D'ANDRE KLADE

DIMENSIONAL INSPECTOR

PROTOTYPE FABRICATION ENGINEERING

D'Andre Klade began working at Los Alamos National Laboratory in 2020, and she believes she has found a place where she is appreciated as the "tattooed, purple haired, gamer, and all-around weirdo" she describes herself as.

Klade was born in Gallup, New Mexico, and raised about 200 miles east in Mountainair before spending much of the past decade in Oklahoma. Klade says the empowering and endearing nature of the Lab has made her return to New Mexico much smoother, and she now sees plenty of reasons why someone would want to come to Los Alamos. "Not one day has gone by where I feel uncomfortable about who I am or like I don't belong," Klade says. "The Lab is an amazing place to work and to grow in your career. It's also pretty cool to say you work at Los Alamos."

In her work as a dimensional inspector, Klade reviews designs for mechanical components. Some components are requested and made for new research and development projects. Others are parts made routinely by the Lab. Klade uses tools such as micrometers and coordinate measuring machines to conduct her reviews. Once a review is complete, the results are communicated to machinists and customers so they can resolve any issues.

The work Klade's team does is critical to keeping the Lab on track to meet its goals. "Our mission is to deliver precision components that are essential for ensuring a safe, secure, and effective stockpile and enhance enterprise-wide production capabilities," she says. ☆

GRANT MEADORS

ASTROPHYSICIST

SPACE REMOTE SENSING AND DATA SCIENCE

Los Alamos, New Mexico, feels like home to Grant Meadors. "As a gay astrophysicist from the Pacific Northwest who was diagnosed with Asperger's as a child, went to community college at a small liberal arts school, then attended a big public research university, and later lived in Ireland, Germany, and Australia, this town high in the mountains might be the first place in my life where I feel like I could put down roots," he says.

In addition to his work in astrophysics, Meadors participates in many diversity, equity, and inclusion projects and organizations at the Laboratory. He says Los Alamos is a nurturing place that amplifies marginalized voices, and he notes that, since its founding, Los Alamos has shaped the direction of American science. "Others look to the Lab as a model. Los Alamos has spurred new algorithms into being, new methods for scientific understanding. Now more than ever, we need ethical people using science for good."

Meadors offers the following advice to newcomers to the Lab: "Don't discount yourself or what you're capable of; you can reinvent yourself here in so many ways. Everything is possible, from biology to chemistry to environmental science, up toward space and beyond into the mysteries of matter. Persist, because in the middle of the desert, ideas are ever blossoming." ✪

ED LUCERO, JR.

CONSTRUCTION MANAGER

CHEMISTRY AND METALLURGY RESEARCH REPLACEMENT FACILITY PROJECT OFFICE

Ed Lucero's father was an ironworker at Los Alamos National Laboratory. He told his son, "If you're into welding, you should go there—they have the best welders." Ironworkers in Los Alamos' fabrication shops are given a unique opportunity to focus solely on welding, work with a range of metals and processes, and complete challenging projects that receive frequent inspection. And so Lucero followed his father's advice.

Lucero started off in one of the Laboratory's fabrication shops in 2003, where, among other duties, he helped fabricate racks that held instruments for weapons-related experiments. He also supported the repair of testing vessels used at the Dual-Axis Radiographic Hydrodynamic Test facility, which helps validate weapons performance without nuclear testing. From fabrication, he progressed into construction and then into project management.

"All of my assignments seemed to stretch me a bit," Lucero says. "It just seemed like the opportunities were there to grow."

Today Lucero's work involves coordinating the many groups involved in renovating old structures or building new ones at the Laboratory. Among other projects, he has managed fire protection and hazard category upgrades at the Radiological Laboratory Utility Office Building, which houses administrative facilities and laboratories used for research into plutonium and other nuclear materials.

Coordinating the Laboratory's complex infrastructure projects can be challenging, but Lucero says that Los Alamos is replete with experts who help make these projects possible. "You've got to trust people, and you've got to work together for the best of the Lab," he says. ★

"All of my assignments seemed to stretch me a bit. It just seemed like the opportunities were there to grow."

EVELYN MULLEN

EXECUTIVE OFFICER

DEPUTY DIRECTORATE FOR WEAPONS

In 1990, Evelyn Mullen came to Los Alamos to work on nuclear reactor safety accident analyses. But when funding dried up two years in, she stepped out of her comfort zone to look for other opportunities. “Once I started learning more about what we do here and our impact on national security, I became very excited about the Lab’s mission,” she says. “Our multidisciplinary nature and experienced workforce allow us to solve challenging and impactful problems.”

Now, 32 years later, after working in a variety of programmatic and managerial positions across the Laboratory, Mullen encourages others to embrace change. “Maintain a questioning attitude in all aspects of your life—this is how you learn and grow,” she says. “Over the course of your career, many opportunities will emerge. Your challenge is to be prepared.”

In her current role, Mullen is second-in-command of the Lab’s Weapons programs, which help ensure the safety, security, and effectiveness of the U.S. nuclear deterrent—much of which is maintained by Los Alamos. Mullen focuses on the individuals who support this work. “Every one of our employees makes a real difference,” she says. “If I can help someone solve a problem, share lessons learned, remove hurdles, or improve processes working with my colleagues, we can all be more effective in meeting our mission goals.” ☆

“Every one of our employees makes a real difference.”

SUSAN NAVA

TECHNICAL PROJECT MANAGER

SPACE INSTRUMENT REALIZATION

If it’s a Los Alamos project headed for space, Susan Nava likely has overseen some aspect of the project.

As a technical project manager, Nava locates difficult-to-find materials, maintains schedules, and coordinates teams as they build satellite instruments that can detect nuclear explosions from orbit. This job, Nava says, “helps keep our nation and my family safe, and that is important to me. I feel good that I can contribute to such important work.”

Nava came to the Lab in 2000, shortly after serving six years in the Air National Guard. In the 22 years she’s been here, she’s found the Lab a welcoming place to work. “Not only are there outreach programs to help people assimilate and find networks of like-minded people, but most people here are very accepting,” she says. “I have the privilege of working with some of the most intelligent, kind, joyous, fun, and generous people I have ever met.”

To anyone interested in joining the Laboratory, Nava says come on up to Los Alamos, which is perched on the Pajarito Plateau about 7,300 feet above sea level. “The air is fine—thin but fine. You can be part of developing new, leading-edge technology and keeping our nation safe.” ☆

KENNETH NADEAU

QUALITY ENGINEER

INORGANIC, ISOTOPE, AND ACTINIDE CHEMISTRY

Kenneth Nadeau began his career as a boots-on-the-ground member of the United States Marine Corps. “I am a third-generation military veteran,” he says. “My grandfather’s and uncle’s lives were spared due to the atomic weapons [developed by Los Alamos] putting an end to World War II.” Thus, for Nadeau, the missions of the military and the Laboratory have always been intertwined.

Nadeau has worked at Los Alamos for nearly 20 years. His career has included oversight of the Compliance and Metrology program, which provides a range of calibration services for measuring, inspecting, and testing equipment used in support of Los Alamos missions.

Nadeau currently serves as a quality assurance and control official for medical radioisotopes, which play a vital role in cancer treatments and materials research. “Many believe that national security is focused solely on defense programs, but it also applies to the added dimensions of physical, infrastructure, computer, political, and economic security,” he says.

Nadeau has put down deep roots in the greater Los Alamos community. He has coached soccer and wrestling and was a member of the volunteer fire department, among other roles. He has served on national committees of the American Legion, and he hosted two of the three American Legion national commanders who have visited the Laboratory. ☆

TOMMY ROCKWARD

RESEARCH SCIENTIST

MATERIAL PHYSICS AND APPLICATIONS

What's the best part of Tommy Rockward's job?

"I get to perform exciting research as a lead scientist and also as a part of a team," says Rockward, who has worked at the Lab for 22 years. "In addition, I take pleasure in mentoring our next-generation workforce, and I get to witness, first-hand, the excitement on their faces when research goes right."

Rockward works on national security problems, mostly through advancing hydrogen fuel-cell technology that will contribute to the nation's energy security for generations. His work already has led to new international standards on hydrogen fuel quality.

Rockward also is co-chair of Securing Opportunities for the Underrepresented at LANL (SOUL), an employee resource group. As part of SOUL, Rockward has mentored approximately 100 interns and recruited more than 200 students to Los Alamos.

"The continued success of the Lab will partly depend on having a diverse talent pool of attractive candidates," says Rockward, adding that he would encourage young scientists interested in Los Alamos "to have the confidence to bring forth their novel ideas and strategies." Never forget, he says, that you are an integral part of the team. ★

"The continued success of the Lab will partly depend on having a diverse talent pool of attractive candidates."

ROSALYN RAEL

APPLIED MATHEMATICIAN

VERIFICATION AND ANALYSIS

Rosalyn Rael first came to Los Alamos National Laboratory as an undergraduate student intern from Western New Mexico University, which is in her hometown of Silver City. "I was able to work with an excellent mentor and math professor from my university who collaborated with Lab staff during the summer," Rael says.

Rael returned to the Laboratory for several summers as a graduate student at the University of Arizona. After earning her Ph.D. and completing a round of postdoctoral positions, she joined Los Alamos for the long term in 2018.

"I spend most days in front of a computer or meeting with colleagues," Rael says. "My work involves validating and assessing uncertainties in models implemented in multiphysics simulation codes, which includes programming, data analysis, and writing."

Rael notes that Los Alamos' scenic location, the chance to work in her home state, and the opportunity to make use of unique computational resources and scientific capabilities are among the reasons she chooses to remain at the Laboratory.

"Doing work that helps support national security and global security is highly motivating," Rael says. "Working at Los Alamos can open the door to career opportunities, and if you come to work here, aim to develop a network of mentors and colleagues who will support your scientific, career, and personal goals." ★

CAYMAN ROGERS

RESEARCH AND DEVELOPMENT ENGINEER

WEAPONS PRODUCT DEFINITION

A New Mexico native, Cayman Rogers had recently graduated college and was teaching high school algebra when she got a call from a manager at Los Alamos who'd seen her resume. "Honestly, I thought it was a prank call," she remembers. "Los Alamos felt to me like the Super Bowl probably feels to football players: beautiful but most likely unreachable."

The dream of working at the Laboratory became a reality when Rogers was offered a job one month later. At Los Alamos, she brings her skills to bear in modeling weapons parts and assemblies using computer-aided design software. She is also working toward a master's degree in structural engineering offered through the Laboratory by the University of California, San Diego.

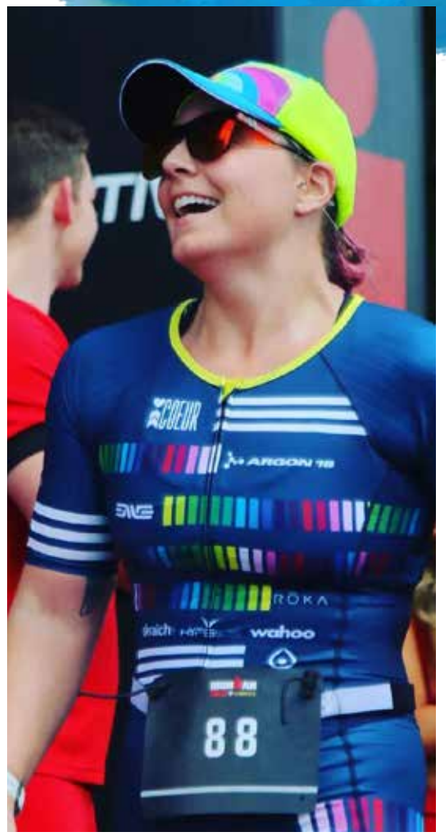
So far, the Laboratory has lived up to expectations. "My boss is kind, my coworkers are fun to be around, my job is stimulating but not stressful, and the location is beautiful," Rogers says.

Asked what advice she would offer other young people who are interested in working at Los Alamos, Rogers advises loading up on summer internships, maintaining a high GPA, keeping records of extracurricular achievements, and attending as many academic conferences as possible. "School is stressful, but it's totally worth the effort when you can get a job that rewards you for your hard work," she says. ★

LANI SEAMAN

CHEMIST

WEAPON SYSTEMS SURVEILLANCE



When she's not competing in triathlons, Lani Seaman works in Los Alamos National Laboratory's weapons systems surveillance program, which is responsible for technical and programmatic oversight of certain nuclear weapons systems. With her background in actinide chemistry, the Lab was a natural fit for her skill set. "I can't do what I do at the Laboratory anywhere else."

After nearly 10 years at the Lab, Seaman remains enthusiastic about her work. "I take a great deal of pride in the work I do," she says. "Even though I am just one piece of the puzzle, I know the work I do makes a difference." She also says her time at the Lab has taught her to be flexible. "Be willing to do something different and out of your comfort zone," she advises new employees.

Seaman, who has bipolar II disorder, serves on the board of the DiversAbility employee resource group. "While at times I've struggled to deal with my disability at work, I have found many of my colleagues are more than welcoming of me—disability and all," she says. "I've been glad to see the progress the Lab has made toward the inclusion of employees with disabilities."

Seaman also notes that Los Alamos offers many opportunities. "Because our Laboratory is big, if you are unhappy or feeling out of place, consider looking into doing something different. There are plenty of opportunities to make a career change." ☆

RACHEL SMULLEN

ASTROPHYSICIST

INTEGRATED DESIGN AND ASSESSMENT

After completing a Ph.D. in astronomy and astrophysics at the University of Arizona, Rachel Smullen became a postdoctoral fellow at Los Alamos National Laboratory during the height of the COVID-19 pandemic. "It was isolating to not get to know anyone except through a camera on Webex," she says. But thanks to "an amazing—and growing—group of mentors, peers, and managers," she started to feel more at home.

"Find your people," she continues. "These people provide me support when I'm feeling demoralized, encouragement when I have a crazy idea, advice when I accidentally demonstrate how new I am to this whole thing, and just a general sense of belonging."

When it comes to recognizing and supporting diversity, Smullen says Los Alamos still has some work to do, but "there are amazing pockets of inclusivity and advocates all over. The trajectory is positive. Visibility is such an important part of showing people that they can belong here."

In December 2021, Smullen was hired as a staff scientist in the Lab's Integrated Design and Assessment group, which focuses on understanding the physics behind nuclear weapon design, performance, and reliability. "My work is important to the nation and the world," she says. "It matters, and I am proud to be a small part of our mission." ☆

ATHENA SAGADEVAN

RESEARCH AND DEVELOPMENT ENGINEER

SAFEGUARDS, SCIENCE, AND TECHNOLOGY

Athena Sagadevan grew up in Kuala Lumpur, Malaysia's capital, where few women leave home to study abroad. However, "I had a strong interest in science and math, coupled with my parents' push to study something that could give back to society," she remembers. "Nuclear energy had lots of potential, and I believed that I could contribute to the growing energy crisis." With that motivation, she traveled to the United States, where she earned a bachelor's degree from the University of Michigan and then a doctorate from Texas A&M University. In doing so, she became the world's first Malaysian woman of South Indian descent to complete a Ph.D. in nuclear engineering.

Sagadevan's doctoral advisor encouraged her to pursue an internship at Los Alamos National Laboratory, which turned her passion into a career. Today, Sagadevan researches safeguards for nuclear microreactors that will be deployed to remote locations and military bases for reliable heat and power. Safeguards are measures to verify that nuclear materials (such as those in reactors) are not diverted from peaceful purposes.

"It can be challenging to find your place within this massive organization," Sagadevan says of Los Alamos. "But there is something for everyone." In her role as a co-leader of the Atomic Women employee resource group, she encourages her colleagues to "explore, collaborate, and realize your full potential by utilizing the world-class facilities and resources provided at the Lab to conduct cutting-edge research." ✪

KASIDIT (BOON) SUBSOMBOON

ENGINEER

SPACE INSTRUMENT REALIZATION

Los Angeles native Kasidit Subsomboon had always lived in big cities before moving to Los Alamos, New Mexico (population 13,000). As a field artillery officer in the U.S. Army, he was stationed in Seattle, Columbus, and Seoul. Later, he opened a Thai restaurant in Bangkok. He learned about Los Alamos National Laboratory at a military job fair in 2016 and didn't mince words when describing his new hometown. "The initial thought you might have is that this is a boring town," Subsomboon says. "I can assure you, it's very boring." However, Los Alamos suits Subsomboon, who says the little mountain town has a calmness to it that, along with his job, makes it "worthwhile to the point that I feel like I can retire from the Lab."

For more than six years, Subsomboon has worked as an engineer, building satellites and instruments for the space nuclear detonation detection program. "The Lab is awesome," he says. "I feel like I can contribute to national security."

Subsomboon says he is mission-driven, and he views the Lab's objectives of nuclear deterrence as being important on a personal level. He likens it to having police patrolling a community. "If anything happens, we can see and react in a timely manner," Subsomboon says. "We have multiple capabilities to detect nuclear activities both in space and around the world and we can then react quickly, both defensively and offensively, if necessary."

Subsomboon worked with diverse colleagues in the military, but at Los Alamos, he has met more people with an even wider range of backgrounds, ethnicities, abilities, and sexual orientations than when he served. For those just arriving at the Lab or thinking of joining, Subsomboon says, "There are several communities and activities you can seek, and most of all, there are people here who are willing to accept you." ★

"The Lab is awesome. I feel like I can contribute to national security."

ANAND SOMASEKHARAN

RESEARCH AND DEVELOPMENT ENGINEER

PRODUCT ENGINEERING AND PRODUCT SUPPORT

Anand Somasekharan (pictured second from left) came to New Mexico from Boston, Massachusetts. Drawn by the Lab's mission, he and his wife decided to make Los Alamos their home. "I believe the work we do here is critical to the deterrence strategies that are integral to our national security," he says.

At the Laboratory, Somasekharan is the lead product engineer in the pit manufacturing program—the Lab's effort to produce plutonium pits (nuclear weapon cores). Somasekharan supports the development, and ultimately the production, of these important weapons parts by translating product requirements to the manufacturing floor.

"The Lab will not disappoint you if you are looking for a meaningful technical challenge, and the opportunity to work with smart and skilled individuals," he says. "There are very few workplaces on this planet, let alone this country, where you get to do the cutting-edge and important work that is conducted daily at the Lab."

Somasekharan notes that although the Lab is making a conscious effort to improve diversity, "we still have challenges to overcome to truly be an inclusive workforce." He encourages coworkers to respect one another's knowledge and viewpoints and says Los Alamos must strive to alleviate disparities in technical education. ★

AGOYO TALACHY-DURAN

ALTERNATE INFORMATION SYSTEM SECURITY OFFICER

ENGINEERING AND SECURITY SERVICES

Growing up in northern New Mexico—specifically in Nambe Owingeh (Tewa meaning "rounded Earth village") and Ohkay Owingeh (Tewa meaning "place of the strong people")—Agoyo Talachy-Duran knew Los Alamos National Laboratory offered interesting, important careers. After interning at the Lab in high school and college, she was hired full time.

Today, Talachy-Duran is an alternate information systems security officer, performing cyber analysis and ensuring wireless technology systems across the Laboratory's campus comply with security laws and regulations. "The Lab's mission is important to me because the nature of the work, research, and development is instrumental in the safety and security of our nation and our future generations," she says.

Outside of work, Talachy-Duran has future generations in mind as she weaves and embroiders kilts. Weaving is a craft she learned from her mother, who learned the skills from a long line of Pueblo embroiderers before her. "These pieces will be used and kept in our family and handed down to my grandsons," she explains. "The most satisfying part of embroidery is to stand back and look at my work in amazement. That I was able to complete a piece like this—I didn't know I had it in me." ★

HAZUKI TESHIMA

TECHNOLOGIST

NATIONAL HIGH MAGNETIC FIELD LAB

> This is a unique place, open to all types of people and backgrounds."

When Hazuki Teshima arrived in Los Alamos from Japan, she could not read, write, or speak English very well. But she was determined to get a job at Los Alamos National Laboratory, where her husband was newly employed. She enrolled at the University of New Mexico, Los Alamos, and began to learn English. She was determined to get an education that could lay the foundation for a career at the Lab.

In 2009, Teshima got her start as a post-baccalaureate student in the Bioscience division, where she researched genomes. Today, she is a generator operator at the Lab's National High Magnetic Field Laboratory-Pulsed Field Facility, which draws international users who need the highest possible magnetic field intensity for fundamental and national security science. At the MagLab, as it's called, Teshima is in charge of monitoring infrastructure and environmental conditions. She ensures that the facility's massive 1.4-megawatt motorgenerator system performs seamlessly when commanded. "Our magnet pulse test methods are unique, and the generator is operated in a very particular way," she says. "Knowing the right operation method and maintenance for this unusual system is challenging."

Through her work, Teshima has discovered a new version of herself. "My strength is that I don't hesitate to ask questions," she says. "I want to be learning all the time." She says her like-minded and creative colleagues make Los Alamos an engaging place to work. "In this Lab, there are workers with novel ideas, unique viewpoints, special knowledge, and good skills," she explains. "This is a unique place, open to all types of people and backgrounds." ✯

GUILLERMO TERRONES

SCIENTIST

SAFETY AND SURETY

As a graduate student, Guillermo Terrones was invited to Los Alamos Days, a workshop at the University of Arizona that a number of researchers from Los Alamos National Laboratory attended. Interacting with these scientists and engineers piqued Terrones' interest in working at the Laboratory.

Since taking a job at Los Alamos in 2002, Terrones has been part of the Theoretical Design division's Safety and Surety group, where he helps ensure the safety of the United States' nuclear weapons. "In general, this activity requires the combined analysis of experimental data and the results of numerical simulations using several Los Alamos–developed computational tools run in our high-performance computing systems," he explains.

Terrones' work contributes to the safety, reliability, and effectiveness of the nation's nuclear deterrent without full-scale nuclear testing. Results from studies conducted by the Safety and Surety group have informed weapons assessments given by Los Alamos directors to the president of the United States.

Terrones recently served as the physics lead on a preliminary assessment of a potential new warhead—the W93. This assessment, called a Phase 1 study, was the first such assessment completed at Los Alamos in more than three decades. For Terrones, such responsibility—plus the chance to work with colleagues across the Laboratory—has made for a rewarding career. "Los Alamos has been a great place for me," he says. "It takes some time to find a place that is right for you, but it is an effort worth making to have a long and satisfying career." ✯

SHAWN TORNGA

PROGRAM MANAGER

SPACE SCIENCE AND APPLICATIONS

In 2006, Shawn Tornga arrived at Los Alamos fresh out of college with a passion for physics. By 2013, while working full-time in the Lab's space-based nuclear detonation detection program, she earned a doctorate in nuclear engineering. But her biggest professional challenge—or so she thought—was still to come: transitioning from male to female.

However, "nothing I was afraid of happened—it was a smooth process," she says of transitioning while working at Los Alamos. "I think that people at the Lab focus more on capability than identity."

When it comes to being capable, Tornga encourages early career scientists to put in the work, focus on their passions, and trust their colleagues. "You have more support than you know," she says. "Make connections, and don't be afraid to advertise your abilities."

Now a program manager in the Lab's Global Security associate directorate, Tornga's work directly supports the Lab's mission to advance nuclear detonation detection and intelligence capabilities, and she credits the Lab's unique nuclear focus for making it one of the only places in the world where she can do this type of work—and be surrounded by a diverse workforce. "Diversity is amazing at the Lab, and that's part of what makes working here great," Tornga says. "We have staff from all over the world with different specialties, experiences, cultures, and identities." ★

TRI TRAN

DIRECTOR

STOCKPILE AND ENTERPRISE ANALYTICS OFFICE

In 1980, following the collapse of the South Vietnamese government, 17-year-old Tri Tran fled his native Vietnam by boat. “I arrived alone in the United States from a refugee camp in Malaysia,” he remembers. He settled in San Diego with his extended family, learned English, and began working his way through school, eventually earning a doctorate in chemical engineering and starting a postdoctoral position at Lawrence Livermore National Laboratory.

“My Ph.D. work was in fuel-cell reactors, and I thought I would teach at a university after a couple years at Livermore,” Tran says. “I could not have imagined a career path in the nuclear weapons business.”

But that’s exactly what happened. Tran (pictured here on the far right) stayed at Livermore for 22 years, including a three-year assignment at the National Nuclear Security Administration. In 2016, he came to Los Alamos, where he currently directs the Stockpile and Enterprise Analytics Office. “My office leads modeling activities and studies to evaluate nuclear weapons stockpile modernization plans and their integration with capabilities at the Laboratory and within the nuclear security enterprise,” he explains. “Analytics enable leadership to understand current affairs, anticipate future changes, and explore solutions.”

“I am humbled by the trust and the responsibility to contribute and to transfer my knowledge to the next generation of weapons workers,” he continues. “It’s truly a privilege to be a part of this Laboratory.” ✯

“It’s truly a privilege to be a part of this Laboratory.”

ASHLEY TRUJILLO

MANUFACTURING MANAGER

PIT TECHNOLOGIES ASSEMBLY

Ashley Trujillo came to Los Alamos National Laboratory more than 21 years ago, following in the footsteps of her aunt, who was the first college graduate and Lab employee in the family. “My aunt is my role model and primary reason for joining Los Alamos,” she says. Once she was here, Trujillo quickly realized that because Los Alamos “has so much to offer in so many different fields, there are people here of all different ethnicities and backgrounds.”

Trujillo works in the Lab’s Plutonium Facility, where she helps build plutonium pits—the cores of nuclear weapons. As the floor lead of assembly operations, she also oversees her team’s training and qualifications, manages schedules and resources, and mentors other technicians. “I am privileged to pass on the knowledge to our new and up-and-coming assembly technicians,” she says. “The Lab’s mission is important to me because I am confident that what I am doing may one day play a vital role in keeping our nation safe.”

In August 2022, Trujillo was recognized for her commitment to this mission by Lieutenant General Thomas Bussiere, deputy commander of United States Strategic Command. Bussiere, who was visiting Los Alamos, presented her with a STRATCOM deputy commander challenge coin for exceptional service. “Don’t drop it, or it’s very expensive,” Bussiere joked. “You have to buy a drink for everyone in the room.” Elaine Gallegos (p. 33) and Anand Somasekharan (p. 45) also received challenge coins. ✯

WENDY WARDE

ENGINEERING TECHNOLOGIST

PROCESS MAINTENANCE AND DECONTAMINATION SERVICES

In 1994, Wendy Warde moved from California to New Mexico for her husband’s work. At the time, Warde was one year into a five-year apprenticeship with the International Brotherhood of Electrical Workers. Because of the move, Warde had to repeat the first year of the apprenticeship, during which she was assigned to work at Los Alamos National Laboratory.

Twenty-eight years later, Warde is still at Los Alamos, where she specializes in resistive heating, which is the production of heat by an electrical current. The applications of this work are broad, varied, and sometimes even out of this world—Warde was recently involved in designing and building the furnace controllers that help produce fuel for the Mars Perseverance rover. “I love and enjoy the people I work with, and I enjoy the actual work,” Warde says. “For me, the Lab’s mission is vital, and I am honored to be part of continuing to meet that mission.”

Throughout her time at the Lab, Warde has been immersed in what she describes as an always improving “inclusive and diverse workplace where people’s perspectives are shaped by your ability to push the envelope to solve problems.” Those problems are diverse and not just for Ph.D. scientists, Warde explains, noting the importance of the Lab’s skilled and craft workers. “The variety of endeavors the Lab is involved in is staggering,” she continues. “If you don’t know exactly what you want to focus on, this is a fabulous place to dip your toe in the work waters and find out what it is you have a passion for.” ✯

JAMES WOERNER

ENGINEERING TECHNOLOGIST

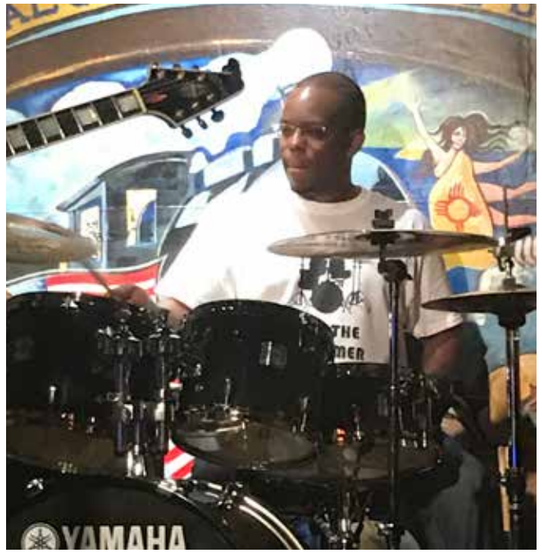
MILITARY AND STOCKPILE OPERATIONS OFFICE

James Woerner first visited Los Alamos National Laboratory as a master sergeant nuclear weapons specialist in the Air Force. "While here I fell in love with the mission and the location," he remembers. When it was time to retire from the military, he returned to Los Alamos, where he could continue his service to the country alongside many other veterans. "There is plenty of support for veterans here at the Lab, and there are plenty of veterans from all branches, so it's easy to find help if needed," he says. "Being a veteran at the Lab is a good fit for me."

At Los Alamos, Woerner develops and coordinates the Lab's response to updates on technical manuals used for maintaining nuclear weapons while in military custody. This work provides the military with guidance and information to maintain safe, secure, and effective nuclear weapons. Woerner often draws on his Air Force experience to explain or expand on how the military operates. He also works closely with the National Nuclear Security Administration and the Department of Defense. "The different people I get to interact with really keep the job interesting," he says.

"I truly enjoy the work I do at the Lab," he continues. "Every day there is the opportunity to learn new things, talk to interesting people, and make decisions that bolster our national security." ★

H. OMAR WOOTEN



PHYSICIST

THEORETICAL DESIGN, PRIMARY PHYSICS

After working at Los Alamos as a student and an early career scientist, Omar Wooten pivoted to a career in academic medicine. "But after spending years in windowless basements of radiation oncology clinics, I knew it was time for a change," he remembers. "At one point, my wife told me, 'The happiest you've ever been was when you were at Los Alamos.' The very next day, I started looking for opportunities to return to the Lab."

Today, Wooten designs and analyzes the results of small-scale and integrated experiments to help predict how nuclear weapons perform. The data from these experiments are fed into sophisticated computer models that can simulate weapons performance. "The experiments I help design and the simulations I run help us understand where improvements are needed and what data will help us improve our predictions," he explains.

This type of work can span years or even decades, which frustrated Wooten as a young scientist but not anymore. "I now appreciate that the Lab has so many opportunities to work on long-term problems that make big impacts to our nation's security," he says. "But even better, at the end of each day as I walk out of my building, I'm greeted with the most beautiful views of the Sangre de Cristo Mountains—sometimes snow-capped, other times topped with storm clouds. The views and clean air here are like nothing else I've ever experienced." ★

JOLANTE VAN WIJK

GROUP LEADER

COMPUTATIONAL EARTH SCIENCE

In December 2002, Jolante van Wijk traveled from her native Netherlands to the southwestern United States—more than 5,000 miles—for a scientific career path that included a postdoctoral position at Los Alamos National Laboratory. Twelve years later, after teaching stints at the University of Houston and the New Mexico Institute of Mining and Technology, van Wijk returned to Los Alamos to lead Computational Earth Sciences, which she describes as "a dynamic group with expertise in topics related to energy, global security, wildfire, and climate change." The group members, mostly Earth scientists, work side by side with physicists, engineers, mathematicians, and others, to tackle challenging problems.

For van Wijk, the work is personal. "Growing up in Europe, the impact of World War II was often addressed in my family, at school, and in public," she explains. "These discussions included the roles played by the United States and Los Alamos. Today, global security and energy security are, unfortunately, very urgent again. Los Alamos is part of the efforts toward resolving or de-escalating these problems, and this has my full support."

Career development opportunities, great colleagues, a pleasant work environment, and a short commute also have van Wijk's full support. "I have only been at Los Alamos for a short time," she says, "and I am looking forward to a long future here." ★

> **"Los Alamos is part of the efforts toward resolving or de-escalating these problems, and this has my full support."**

TAKEAWAY

BETTER SCIENCE = BETTER SECURITY

Los Alamos National Laboratory's greatest resource is its workforce—people whose diverse backgrounds and experiences help solve the problems that keep our nation safe.

CLASSROOM IN A CANYON

BY JILL GIBSON

At the bottom of a rift in the Pajarito Plateau, a septuagenarian scientist leads a new generation to success.

ANCHO CANYON

Ancho Canyon slices through northern New Mexico's Pajarito Plateau. The canyon, which is in some places 800 feet deep, forms at the base of the Jemez Mountains and ends at the Rio Grande. Nearly the entire canyon—approximately seven miles—is part of Los Alamos National Laboratory.

Jim Goforth, a physicist, has been coming to work in a remote part of the canyon for more than 40 years. Although he is actively involved in technical explosives work, much of his current focus is on transmitting his knowledge and enthusiasm to the younger generation of scientists and engineers who also work in the canyon.

On a cool June morning, Goforth and a handful of his colleagues in the Explosive Applications and Special Projects (M-6) group gather in a cluttered conference room. They rattle off numbers, brainstorm ideas, and laugh frequently. Pieces and parts of previous experiments lie scattered around the room, along with models, diagrams, old photos, and mementos from the past. Plastering the corkboards on the walls are photos from Russian scientists' visits to Ancho Canyon in the 1990s, images of fireballs that resulted from various experiments, and even a picture Goforth took of a mountain lion one morning outside his office door. A model of the group's most recent project occupies the conference table, along with coffee and doughnuts.

Goforth stands at the head of the table. A quiet man of small stature, he has a commanding presence—even without his signature cowboy hat. At age 74, Goforth isn't ready for retirement.

"We call him Grandpa Jim," says Jake Gunderson, an engineer. "He's kind of like the group grandpa."

"Jim is the single most important person in the group," echoes Conrad Farnsworth, also an engineer. "Although everyone is critical, and we would be crippled for some time if any one of us left, Jim's experience and expertise is essential for the group to function."

■ Ancho—Spanish for "wide"—Canyon is southeast of the town of Los Alamos.

■ Wearing his signature cowboy hat, Jim Goforth helps prepare an experiment in Ancho Canyon. "A lot of our work advances nuclear weapons research without doing underground nuclear testing," he explains.

■ Dennis Herrera (left) and Jim Goforth (center) set up an experiment. The men have both worked in Ancho Canyon for more than 40 years. "We're standing on the shoulders of giants," Jake Gunderson says of the opportunity to work with Herrera and Goforth.

Jim Goforth (left) shares his knowledge with one of the team's newest members, Ryan Buchanan.

Seeking answers

Since 1953, Ancho Canyon's steep walls and remote location have allowed Los Alamos scientists to safely isolate explosives tests from the public. The group based here conducts experiments to study the behavior of nonnuclear weapons and explosives. The experiments take place outdoors, with scientists monitoring results from a nearby bunker.

Physicist Tom Gianakon works closely with the M-6 group and explains that many of the experiments focus on pulsed power, the science and technology of accumulating electrical energy over a relatively long period and releasing it extremely rapidly to create a highly concentrated burst of power. This power can take different forms, such as magnetic fields or electrical currents. "Every step down the line we are trying to get a shorter and more powerful pulse," he says.

Pulsed-power experiments allow researchers to better understand how materials behave in extreme conditions, such as those that weapons components must withstand. The experiments help identify and decrease uncertainties in nuclear weapons performance without actually detonating any nuclear weapons. The Ancho Canyon work is crucial to the Lab's national security mission.

"Here's how I explain my work to people," Goforth says. "On a good day, I do high-energy density physics experiments using explosive pulsed-power systems, and on a bad day, I just blow things up."

Researchers work on several experiments simultaneously; currently, 14 different types of experiments are underway. Gunderson says that from initial design concept to execution, an experiment can take up to two years. "These are some of the most complicated experiments that the Laboratory does," he says.

The team uses carefully assembled and installed diagnostic techniques to measure the output, the material properties, and the success of the experiment. The researchers capture information using high-speed cameras and advanced diagnostic probes. "It can take quite a while to analyze the data," Goforth says.

Although the scientists predict the outcomes of the experiments, they often get surprising results. "My job is to design experiments," Gianakon explains. "I use all the advanced computer modeling codes that we have at the Lab to design experiments and then see if we get the answers we expected or if we have surprises. You can learn a lot from the surprises."

For Goforth and the team, every experiment is an opportunity to learn. "You push the button and the ground shakes. You look at the data, pick up the pieces, and go on," he says.

Building a legacy

Born in the small, rural town of Tularosa, New Mexico, Goforth grew up in the shadow of White Sands Missile Range and Holloman Air Force Base. He earned his bachelor's and master's degrees in physics from New Mexico State University before joining the Air Force. At the Air Force Research Laboratory, Goforth began working on explosive pulsed-power, which involved frequent collaboration with Los Alamos

> "On a good day, I do high-energy density physics experiments using explosive pulsed-power systems, and on a bad day, I just blow things up."
>
> —JIM GOFORTH

Jim Goforth (left) and Dennis Herrera prepare an experiment in the 1980s.

Jim Goforth (right) leads a collaboration with Russian scientists in the 1990s.

SCAN QR CODE WITH A SMARTPHONE CAMERA
Watch video of this blast.

■ An explosion in Ancho Canyon drives the process that creates a short pulse of extremely high current used for various tests. From initial design concept to execution, preparing an experiment can take up to two years.

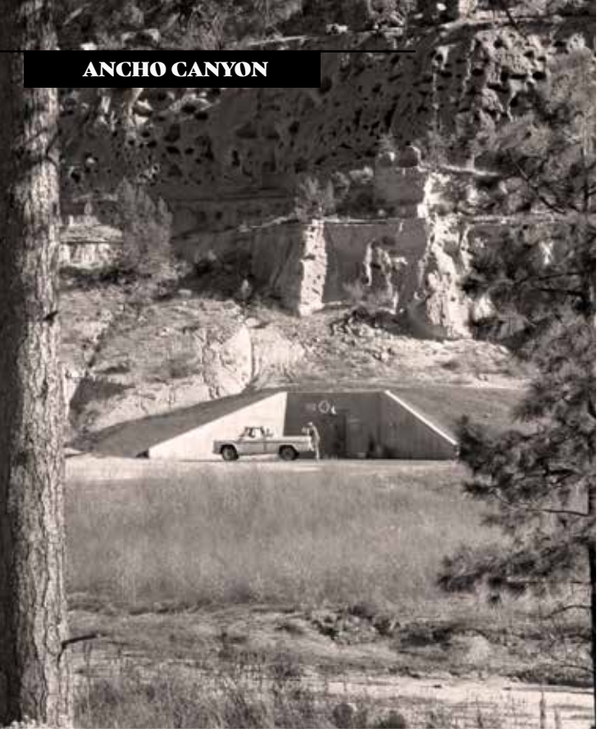
scientists. "I watched my first experiment in Ancho Canyon as a lieutenant in the Air Force in 1973," he remembers.

Dennis "Denny" Erickson, a retired Los Alamos physicist, worked in Ancho Canyon at that time. "We were impressed with Jim and knew he was coming to the end of his Air Force term, so we encouraged him to apply at the Laboratory," Erickson says. Because there wasn't a spot in the Shock-Wave Physics group (what is now M-6), Goforth came to Los Alamos in 1976 as the head of the detonator exploratory development unit. In 1981, he moved to Shock-Wave Physics and has been there ever since.

> "This older generation has knowledge, and they didn't just learn it in a book somewhere. They went and did it, and they're the ones that wrote the damn book."
>
> —JAKE GUNDERSON

At Los Alamos, Goforth joined a team of highly esteemed physicists from all over the country. Clarence "Max" Fowler, who led the Shock-Wave Physics group, had become well-known throughout the scientific community for his pioneering research and application of explosive-driven magnetic-flux compression. In fact, a yellowed copy of a letter from Fowler to Soviet physicist Andrei Sakharov hangs on a wall near Goforth's office. The letter, written in the mid-1950s, inquired about Soviet research and paved the way for Fowler and his Los Alamos colleagues to begin a close technical working relationship with their Soviet counterparts.

After the collapse of the Soviet Union, Goforth played a key role in a collaboration between the Russians and the United States. The lab-to-lab effort included cooperative



■ This photo of the Ancho Canyon firing site was featured in the November 1967 issue of *The Atom* magazine.

work on pulsed power and extreme magnetic fields. "Jim was a very active principal in those exchanges," says Erickson, adding that Goforth made several visits to Russia and hosted Russian scientists visiting New Mexico.

By 1996, the media had caught wind of the Lab's international collaborations. "We had six countries here in 1996 for high magnetic field research and the CNN news crew in the bunker when our team fired the explosives," he remembers. "Pretty good for a Tularosa boy," he adds with a laugh.

Erickson agrees. "Jim was this small-town, southeastern New Mexico kid, looking at all these high-powered people and wondering, 'Where do I fit in?' Well, he found his way. He made his small town and his family proud."

Janina Gielata, an explosives technician, says everyone in the group relies on Goforth's guidance. "We all have respect for Jim," she says. "He takes time, he does the legwork, he crunches the numbers, and he comes up with the solutions. When you second guess yourself, you go to Jim and say, 'Hey, Jim, am I doing this right?'"

Transferring knowledge

What will happen when Goforth retires? Engineer William Shofner jokes about "an elaborate plan to copy Jim's brain and upload it to the cloud," while Gunderson quips, "I was just going to go with shackles and a chain."

Jokes aside, knowledge transfer is a priority for M-6 leadership. Gunderson credits the M-6 group leader, Peter Dickson, and deputy group leader, Amanda Smith, with carefully choosing employees who are committed to teaching and learning. "That's one thing we have been focused on: bringing young people into the group and really getting that knowledge transfer going," he says, adding that "this older generation has knowledge, and they didn't just learn it in a book somewhere. They went and did it, and they're the ones that wrote the damn book."

Of course, with all that experience, comes lots of stories. "Some days we've got to get through 'Storytime with Jim' before we can get some work done," Gunderson says, chuckling. "You're going to spend an hour listening to stories, but the stories are instructive and great to have."

Farnsworth describes Goforth as "having pulsed power as his lifeblood. We'll get emails at all hours of the day just because he was daydreaming or thinking of something and he stumbled on a critical issue that all of us have somehow missed."

Goforth seems to derive energy both from enthusiastic new team members and from the promising future of pulsed power. "He's got all of us youngsters off doing work, and he's doing what he loves," Gunderson says. "His life's work is coming to fruition with pulsed-power research becoming a priority. I honestly don't see him quitting now."

Goforth notes that recent technological developments are helping move the group closer to its goal of achieving more current in less time. "Our tools are so much better than they were when the Lab first started this research—the diagnostics we can build, the computer design codes we have, and we have this wonderful new crew," he says. "This is fun stuff, good people, and a mission that I think is important for our country."

Not to mention the fact that he still has lots of stories. "I can tell stories all day," he tells the group, and then adds, "This is the last story, I promise." As laughter breaks out in the crowded conference room at the bottom of Ancho Canyon, Goforth leans in toward the group's newest grad student. "Just be careful about asking questions 'cause I can do this forever," he says. ★

TAKEAWAY

BETTER SCIENCE = BETTER SECURITY

The Lab's workforce features diversity in ages, backgrounds, and experiences to ensure generational knowledge transfer.

■ Jim Goforth and his coworkers survey the site after conducting an experiment.

■ On June 9, 1972, protons were accelerated to 800 megaelectron volts (almost 20 laps around the Earth per second) at the new Los Alamos Meson Physics Facility.

By Brian Keenan, J. Weston Phippen, and Brye Steeves

ACCELERATING INNOVATION

In 1972, Los Alamos National Laboratory debuted the world's most powerful linear accelerator. Fifty years later, the facility continues to support the Lab's national security work.

Louis Rosen (wearing the bolo tie) and a team of scientists watch a computer monitor as they fire up LAMPF's accelerator.

With its powerful linear accelerator and five state-of-the-art experimental areas, the Los Alamos Neutron Science Center (LANSCE) at Los Alamos National Laboratory contributes to a range of national security goals. The world-renowned facility supports the Lab's stockpile stewardship program, helps advance the science of medical radioisotopes, improves the understanding of hydrodynamics, and more.

LANSCE celebrated its 50th anniversary in June 2022. While many years have passed since the accelerator's creation, it continues to serve the nation. "Since 1972, LANSCE has been the Lab's major experimental science facility," says Alan Carr, senior historian at the National Security Research Center, the Laboratory's classified library and archives. "LANSCE underpins Los Alamos as a world-class scientific institution. This was true 50 years ago and is still true today."

THE FATHER OF LANSCE

In 1962, Lab physicist Louis Rosen proposed the creation of an interdisciplinary facility that would help secure Los Alamos Scientific Laboratory (as the Lab was then called) as a leader in nuclear technology. His proposed facility would be a place where science would meet the challenges of national security, including energy security, medicine, environmental stewardship, and nuclear nonproliferation. "Louis Rosen knew nuclear science played a key role in helping address these challenges," says historian-archivist Madeline Whitacre.

Rosen was particularly interested in using a high-energy accelerator to study subatomic particles. The accelerator would use electrical fields to accelerate protons (positively charged subatomic particles) to then-unheard-of speeds. The beam of protons would be directed to various experimental areas, where it would smash into metal targets—a process called scattering, which results in neutrons that can be used for a variety of experiments.

"No one could guarantee it could be done," Rosen said later. "And, in fact, people who really knew the game were betting we would fail."

But the Lab director at the time, physicist Norris Bradbury, saw the value in Rosen's proposal. At this point in the Laboratory's history, many of the bright minds who'd come to Los Alamos during the Manhattan Project had returned to civilian life following the end of World War II. Rosen and Bradbury both viewed the promising facility as a way for Los Alamos to stay relevant and attract the next generation of great scientists. "I convinced myself that we had to do something really major in nuclear science if we were, on the one hand, to fulfill our obligations to support a strong nuclear weapons program and, on the other hand, to maintain the prestige and credentials that would permit us to attract the very highest caliber of scientific people," Rosen said. And in 1985, he wrote, "Los Alamos, under the able leadership of Norris Bradbury, was seeking ways to diversify its contributions to the nation while enhancing its viability and vitality as one of the nation's foremost national security laboratories."

Of course, the facility Rosen and Bradbury envisioned was so abstract for the time that many people thought it wasn't possible. "It takes people of extraordinary courage to stake their scientific future, their professional careers, on something that is really very risky," Rosen later recalled to *Los Alamos Science* magazine. "But people do it all the time. They take the gamble and they may lose. But unless you take these gambles, you can never win."

A DREAM AND A GAMBLE

By 1963, a proposal for what was originally called the Los Alamos Meson Physics Facility (LAMPF) was presented to the Atomic Energy Commission (AEC), which was the predecessor of today's Department of Energy (DOE).

In March 1964, a scientific advisory panel, headed by Nobel laureate and former Los Alamos physicist Hans Bethe supported the proposal and recommended that such a facility be built "for the vigorous pursuit of the study of nuclear structure." That same month an AEC special advisory committee recommended the facility be constructed at Los Alamos.

By December 1965, Congress authorized $1.2 million (the equivalent of nearly $11 million today) for the facility's architectural and engineering design. The official groundbreaking was in February 1968, and construction began that October. The building's costs would total $57 million, equivalent to more than $470 million today.

"I never doubted we'd get the facility built," says Jerome Peterson, a professor at the University of Colorado who, with his experience working on the cyclotron in Boulder, was asked to help design some of LAMPF's beam lines—the vacuum tubes that used electromagnetic pulses to speed and steer protons. "Louis was a master of manipulation. Not in a bad way, he just had a sense for how to get things done in the political sense. For example, when he received funding to examine the nature of rock, he used some of the money to excavate a trench line for a future accelerator beam. Because once the trench was built, why not finish the job?"

> It takes people of extraordinary courage to stake their scientific future, their professional careers, on something that is really very risky."
>
> –LOUIS ROSEN

Once completed, LAMPF stretched for more than half a mile atop one of Los Alamos County's many long, narrow mesas. In June 1970, the first section of the facility's accelerator produced the first proton beam at 5 million electron volts (an electron volt is the unit of measurement for the kinetic energy of a proton accelerated from a state of rest). A year later, in June 1971, a proton beam with an energy of 100 million electron volts was produced. And a year after that, on June 9, 1972, the much-anticipated energy of 800 million electron volts was achieved, making LAMPF the most powerful linear accelerator in the world at that time.

A USER FACILITY

LAMPF was the first "open user" facility at Los Alamos, meaning scientists from across the country could harness its power for research. During 1974—LAMPF's first full year of operation—the facility beam was part of 73 experiments on behalf of 331 scientists from 72 institutions.

For these experiments to be successful, the accelerator had to deliver full-energy beam, which means that the facility's thousands of vacuum, radiofrequency, electronic, cooling, electrical, and control circuits all had to function properly. "If any one of them fails, the beam goes down, and sometimes diagnosing and repairing the issue can take hours, days, or even weeks in the worst cases," explains LANSCE Director Mike Furlanetto. "That reliability has gotten better as we've improved the systems over decades, but even now we only deliver beam approximately 70 percent of the time that we plan to do so."

John C. Browne, who would later become the director of Los Alamos, worked at Lawrence Livermore National Laboratory in the early 1970s and traveled to Los Alamos specifically to run experiments at LAMPF. "I started to do experiments when the beam reliability was very low," he remembers. "I'd bring my equipment, and we might sit there all night waiting for the beam and it might not show up until 4 a.m., or it might not show up at all, so we'd go back to our hotel and wait."

One of Browne's favorite stories from the early days of LAMPF is when a well-known professor at Yale University asked to run an experiment at the last minute, and Browne's team was bumped. "I went to Louis' office and told him it wasn't fair," Browne remembers. "I said, 'I know I'm a young scientist, but our project was reviewed, and my whole team is here.' Louis looked at me and said, 'I think you're right.' After he told the professor, Louis came to me with a smile and said my beam time was back on. But he cautioned, 'Just don't go near this guy for a while because you're on the top of his you-know-what list.'"

The memory sticks out to Browne because as an open-user facility, LAMPF was egalitarian—a place where the science and not the scientist mattered most.

Today, a user group manages proposals for beam time and ensures that scientists outside the Laboratory continue to have the opportunity to use the facility.

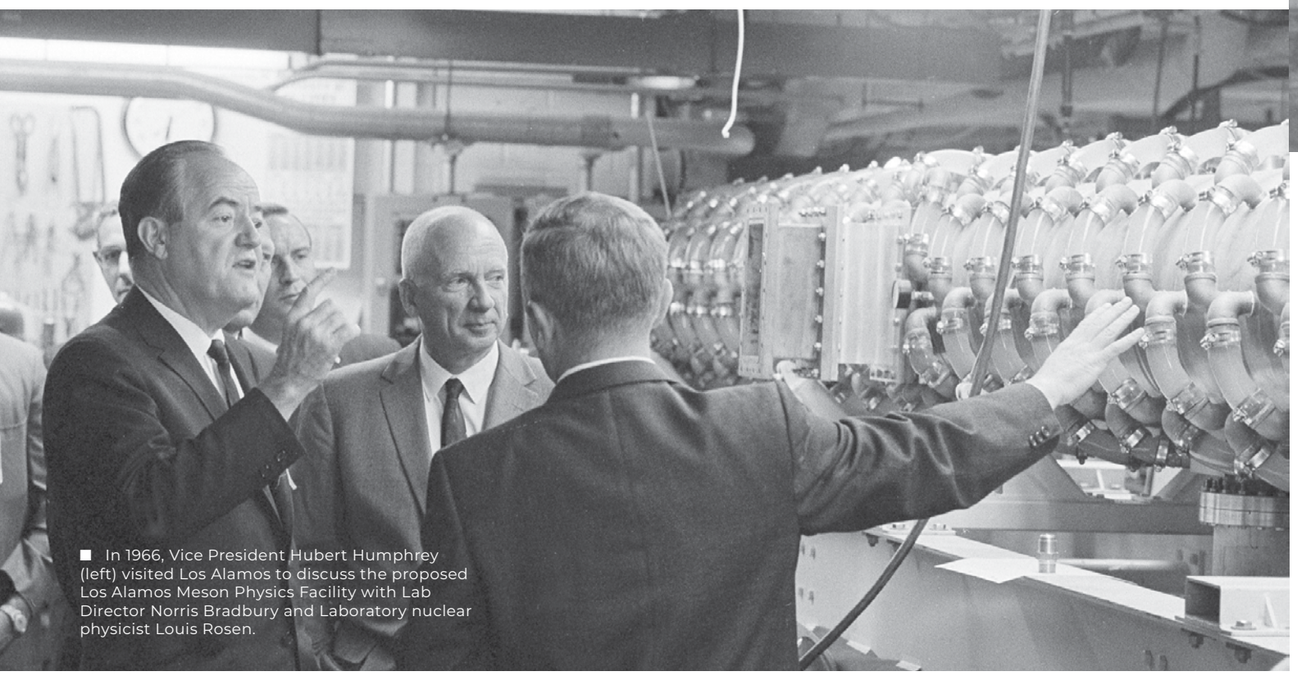
"LANSCE has had a user group since the LAMPF days, which was another brilliant idea of Louis Rosen's," Furlanetto says. "By tying science at LANSCE to the broader community, we ensure that our science stays world-class and that we have a chance to recruit the best students and postdocs to work at Los Alamos."

Carr adds that "For 50 years, LANSCE's main linear accelerator has provided unique capabilities to Laboratory researchers and external partners. The facility continues to support our national security mission as well as basic research and development."

LANSCE'S MANY USES

In 1995, LAMPF was renamed the Los Alamos Neutron Science Center, or LANSCE, with the new name meant to be more reflective of the broad range of neutron science topics that the facility had come to support. Today, LANSCE's proton beam is delivered to five state-of-the-art experimental areas (see p. 72), a capability that makes the accelerator stand out among its peers.

"LANSCE is unique in that many accelerators have just a single mission focus," says Los Alamos Director Thom Mason. "With five areas, we can work on many different types of complicated problems across scientific fields. At LANSCE, our research program in nuclear physics and materials science, as well as our fundamental science and medical isotopes programs, are as essential today as they have ever been."



■ Louis Rosen (left) led the development of the world's most powerful linear accelerator, which culminated in the creation of the Los Alamos Meson Physics Facility, known today as the Los Alamos Neutron Science Center.

■ In 1966, Vice President Hubert Humphrey (left) visited Los Alamos to discuss the proposed Los Alamos Meson Physics Facility with Lab Director Norris Bradbury and Laboratory nuclear physicist Louis Rosen.

ISOTOPE PRODUCTION FACILITY

Starting from the accelerator's injector system and traveling east (see p. 72 for a map), the proton beam's first destination, traveling at just over 100 megaelectron volts, is the Isotope Production Facility, a key facility within the Department of Energy's Isotope Program and part of a tri-lab effort with Brookhaven and Oak Ridge national laboratories. In April 2020, as facilities shut down during the pandemic, LANSCE started the beam up ahead of its normal run schedule to fill a supply chain gap and deliver critical supplies of the isotope strontium-82, which is used in heart imaging, and the isotope germanium-68, which is used in cancer diagnostics.

The Isotope Production Facility excels in the basic science and applied engineering needed to produce and purify useful isotopes that can then be produced at scale in the marketplace. In the fight against cancer, recent and current clinical trials are yielding promising results with the short-lived isotope actinium-225, which delivers high-energy radiation to a cancer tumor without greatly affecting the surrounding tissue. The isotope can be chemically modified to target certain cancers—prostate cancer, colorectal cancer, melanoma and others—that produce a distinctive antigen.

"Unfortunately, almost everyone is affected by cancer, themselves or the people they know and love," says Kirk Rector, the Los Alamos point-of-contact for the DOE Isotope Program. "That's part of what makes the work around actinium-225 for cancer in particular very exciting. The results from clinical trials using

Louis Rosen (front) and others celebrate the success of the facility's first 800-megaelectron-volt beam in 1972.

actinium-225 to treat even late-stage prostate cancer suggest that it could be a pretty significant way to attack that horrible disease."

New Los Alamos research indicates that actinium-225 may also be effective against bacteria, especially important in an age of increased antibiotic resistance.

ULTRACOLD NEUTRON FACILITY

Powered up to 800 megaelectron volts, and now traveling at 84 percent the speed of light (over 250 million meters, or almost 20 laps around the Earth per second) the proton beam can be delivered to four more areas, each more than a half mile from the injector system.

At the Ultracold Neutron Facility, protons are cooled to near absolute zero, about minus 460 degrees Fahrenheit, so that the basic properties of particles can be explored. Last year a research team measured the lifetime of a neutron with the most precision ever, finding that a lone neutron lasts for 877.75 seconds before disintegrating. Those precise measurements can impact the search for physics beyond the standard model—helping unlock the mysteries of new particles, even dark matter. The results could also advance understanding of the abundance of nuclei in the early universe and the formation of elements.

PROTON RADIOGRAPHY FACILITY

LANSCE also helps researchers evaluate the reliability of the nation's nuclear weapons stockpile. The most recent full-scale nuclear test conducted by the United States took place in September 1992. As the nation moved away from nuclear testing, additional facilities were needed to understand and certify stockpiled nuclear weapons.

LAMPF veterans working at LANSCE rose to that challenge. In the mid-1990s, they invented proton radiography (pRad), a new technique for imaging the insides of explosions while they occur.

"Even the data from those early pRad experiments impacted decisions relating to our nuclear stockpile," Furlanetto says. "The ensuing 25 years of data have made major impacts on our understanding of stockpile science and nuclear counterterrorism."

At LANSCE, America's scientists are able to examine individual parts in weapons under high explosive blasts, using the pRad Facility to take videos of the results. LANSCE has also helped scientists understand the point at which fusion occurs and becomes self-sustaining, which became vital to fine-tuning the codes that scientists use with supercomputers to digitally replicate the physics of nuclear weapon performance.

"Accelerators are very versatile facilities, and if they're well taken care of, they'll grow and evolve and develop new capabilities over their lifetimes. LANSCE has evolved to do things that no one anticipated when it was built."

–THOM MASON

"There were certain computer models that worked well to explain how nuclear implosions worked," Browne says. "But with LANSCE, and abilities like those offered by pRad, we could watch in real time what happens. The modeling people were ecstatic because they had something that could verify their codes."

LUJAN NEUTRON SCATTERING CENTER

At the Lujan Neutron Scattering Center, another user center at the end of the main proton line, a neutron beam is produced that can offer the microstructural characterization researchers need to probe the properties of materials and learn how they react under different conditions.

For example, Los Alamos scientists have probed aging plutonium in pits, key components of nuclear weapons, at the atomic level to ensure they function properly and to learn more about their material properties. This capability has become especially relevant as the Laboratory is currently working to produce 30 plutonium pits a year, all of which will be made from existing pits that are decades old.

"Understanding materials as they age, along with their interaction with neutrons, represents a key challenge to our physical understanding of weapons as we continue to ensure the safety and effectiveness of the

LANSCE Director Mike Furlanetto

Audience members applaud remarks at the LANSCE 50th anniversary celebration.

Deputy Laboratory Director John Sarrao, Matt Miller (field representative for U.S. Representative Teresa Leger Fernandez), NNSA Principal Deputy Administrator Frank Rose, Los Alamos Director Thom Mason, DOE Under Secretary Geri Richmond, U.S. Senator Martin Heinrich, Eric Chavez (field representative for U.S. Senator Ben Ray Luján), and LANSCE Director Mike Furlanetto.

aging nuclear stockpile," says Bob Webster, deputy Laboratory director for Weapons. "The essential data we gather at LANSCE through real-world experimentation complements the modeling and simulation integral to stockpile stewardship."

WEAPONS NEUTRON RESEARCH FACILITY

The benefits of that data extend beyond the national security mission. For instance, at the Weapons Neutron Research Facility, obtaining the right safety measurements for criticality—the point at which a fission reaction becomes self-sustaining—are crucial data not only for key Laboratory activities but also for the nuclear industry overall. Understanding the physics properties of materials, including radiation effects on reactor components, helps ensure the safety of civilian reactors and the people who operate them.

The capabilities of the Weapons Neutron Research Facility also mean LANSCE is the premier and only U.S. facility for electronics testing and certification with neutron beams—technology that is applied to avionics, vehicles, medical devices and more.

IMPROVEMENTS ENHANCE CAPABILITIES

Recent upgrades at LANSCE ensure that the facility remains relevant in the coming decades. For example, the spallation target (the source of neutrons) at the Lujan Center was improved. In the process, the system was redesigned to enhance its performance. In doing so, the Lujan Center is now able to study the kiloelectron volt range, a new energy regime for nuclear physics.

Across the accelerator, teams are replacing old electrical components with newer and safer components. Additionally, in keeping with the Lab's broader sustainability initiatives, systems that use greenhouse gases are being replaced.

"The improvements and the investments we're making result in a safer machine able to do better science," Furlanetto says. "The kind of experiments we are able to do now were almost unimaginable when I joined the Laboratory 17 years ago, and I'm sure that in another 20 years we will be delivering even more exciting data."

The accelerator is a complicated piece of machinery, and it takes a cross-organizational effort of more than 500 people—engineers, scientists, technicians, and others—to keep it performing. Those individuals are each committed to the goal of delivering science that tackles difficult challenges, whether enhancing national security, understanding the origins of the universe, or developing medicines that allow people to live longer and healthier. That work represents an abiding mission for the decades to come.

Historic and current images of the linear accelerator at LANSCE

50TH ANNIVERSARY

During a special event in September 2022, Los Alamos employees and distinguished visitors celebrated the 50th anniversary of LANSCE. Laboratory Director Thom Mason highlighted the multifaceted mission areas at LANSCE, from nuclear deterrence, to medical isotope production for medical imaging and therapy, to proton radiography.

"As you look at how this facility has evolved, one of the really striking things is the breadth of the programs supported here," Mason said. "Accelerators are very versatile facilities, and if they're well taken care of, they'll grow and evolve and develop new capabilities over their lifetimes. LANSCE has evolved to do things that no one anticipated when it was built."

For example, isotope production and proton radiography were not initially conceived of as part of LANSCE but have emerged as key capabilities. Isotopes are developed by the Isotope Production Facility for trials and then produced by private companies, and proton radiography technology provides crucial imaging data for the safe maintenance of the deterrent arsenal.

Furlanetto praised the hard work of the employees who contribute to the facility's operations and achievements, an interdisciplinary endeavor that often means working nights, weekends, and even holidays to maintain the accelerator and meet production targets. "Though we have all this great equipment, what makes this place work is the people," Furlanetto said. "They sacrifice to get data and research out and to make the world a better place." ★

TAKEAWAY

BETTER SCIENCE = BETTER SECURITY

As LANSCE has evolved over five decades, it continues to support Los Alamos National Laboratory's national security mission as well as basic research and development.

LANSCE AT A GLANCE

For more than five decades, the Los Alamos Neutron Science Center has provided the scientific underpinnings in nuclear physics and material science needed to ensure the safety and surety of the nuclear stockpile. The facility also provides the scientific community with intense sources of neutrons and protons to perform experiments that support civilian research and the production of medical and research isotopes.

Here is an overview of LANSCE's five state-of-the-art experimental facilities that enable this diversity of work. ★

NATIONAL ★ SECURITY SCIENCE PODCAST

The Los Alamos Neutron Science Center turns 50!

SCAN QR CODE WITH A SMARTPHONE CAMERA

1

Isotope Production Facility

IPF uses a 100-MeV proton beam extracted from the main LANSCE accelerator to produce isotopes for medical, fundamental nuclear physics, national security, environmental science, and industrial applications. IPF supplies a variety of radioisotopes to medical researchers and other scientists all over the world and is a leader in developing and producing new and unique isotopes for international research and development.

2

Proton Radiography

Invented at Los Alamos National Laboratory, proton radiography (pRad) employs a high-energy proton beam to image the properties and behavior of materials driven by high explosives. The efficacy and versatility of proton radiography stems from the ability to produce multiple proton pulses in an accelerator coupled with multiple optical viewing systems that can result in 20-40 frame movies.

3

Ultracold Neutrons

This facility produces high-energy spallation neutrons and uses solid deuterium to cool neutrons by one million billion-fold. The resulting ultracold neutrons have unique properties that allow them to be studied precisely: they move at speeds of only a few meters per second and are completely confined by magnetic fields and material bottles for many hundreds of seconds at a time.

Weapons Neutron Research

Using the high flux of neutrons provided by the LANSCE proton beam and a unique instrument suite, WNR enables basic, applied, industrial, and defense-related research. Science thrust areas include fission processes, neutron capture cross sections, neutron radiography, and semiconductor irradiations. WNR delivers key nuclear data in support of the National Nuclear Security Administration's Defense Programs.

4

5

Lujan Neutron Scattering Center

Named after U.S. Representative Manuel Lujan Jr., this facility provides exceptional research opportunities to scientists in national security, academia, and industry. Here, neutron scattering probes the microstructure and dynamics of condensed matter. Applications for neutron scattering include materials science, engineering, condensed matter physics, chemistry, biology, and geology. The center leverages moderated pulsed neutrons for the National Nuclear Security Administration's Defense Programs.

DIVERSITY EQUALS NATIONAL SECURITY

People of diverse backgrounds and perspectives are essential to the success of Los Alamos National Laboratory.

BY JILL GIBSON

What do diversity and inclusion have to do with the United States' ability to protect and defend itself? The answer is: a lot.

"Diversity isn't just nice to have," says Bob Webster, deputy director for Weapons at Los Alamos National Laboratory, which is charged with maintaining America's nuclear weapons and other national security work. "Diversity provides a scientific and strategic advantage for the Laboratory. Working on nuclear weapons at Los Alamos has always required the best, brightest minds and the most creative people."

Los Alamos employees represent a variety of ethnicities, backgrounds, and scientific disciplines. Women in nontraditional fields, people with disabilities, veterans, people of different sexual orientations, gender identities, interest groups, ages, countries of origin, and more all contribute to Los Alamos' overall accomplishments and mission.

"Diversity is really important to this institution," says Laboratory Director Thom Mason. "It's embedded in our values." Mason says the key to the Lab's scientific achievements, and thus to national security, is maintaining a diverse workforce.

Katherine Haight leads diversity and inclusion initiatives as part of the Lab's Office of Diversity and Strategic Staffing. "We are a premier research organization—not just nationally, but internationally—because we have so many different perspectives," Haight says. "These diverse perspectives coming together in a collaborative environment is necessary to develop new science and expand our knowledge of national security issues."

Demographics reflect growing diversity

Intentional hiring decisions reinforce the Lab's commitment to building a diverse workforce. "We want people to be hired, promoted, and given opportunities based on their skills, and sometimes our unconscious biases can lead us away from that path," Mason says. "Making generalizations about people based on their appearance or what we think we know about their background does not get us to our goal of having the best people working on the most important problems. There's a lot that we can do to combat that, and it's helpful to bring in different perspectives through things like search committees with diverse representation and scrutinizing the basis for our decisions."

According to Haight, the Laboratory's recent hiring surge has increased diversity and led to a positive change in overall demographics. As of July 2022, 32.5 percent of the staff identify as women, 49.1 percent of the staff come from an underrepresented ethnic group, 5.7 percent identify as disabled, and 6.2 percent of the employees are veterans.

Haight also says the COVID-19 pandemic helped boost diversity by changing managers' opinions about remote work. "This new economy, where we have so many people who are able to work remotely, has increased our ability to bring in a more diverse workforce in some of those areas where the Laboratory has struggled with diversity in the past."

Haight says the demographic breakdown of Los Alamos management represents a conscious decision. "Our Laboratory is really a premier example of how to promote some aspects of diversity. We have one of the most diverse executive management teams, particularly with regard to women, because there has been an effort to really promote women in research and development positions and in management." During the past 10 years, the Lab has seen a significant change in the demographics in top positions, Haight says.

Haight adds that the Lab succeeds in recruiting underrepresented minorities, particularly Hispanic and Native American people, but could increase the number of Black and Asian employees. "Nearly 50 percent of our workforce is underrepresented minorities, which is driven largely by our location," she says. "When you break it down, Los Alamos is really leading the way in recruiting, retaining, and promoting Hispanic people."

Employee resource groups ensure inclusion

Statistically, Los Alamos is a diverse institution, but Laboratory leaders say that isn't enough. "Our numbers are not sufficient," says John Sarrao, deputy Laboratory director for Science, Technology, and Engineering. "To really succeed, we need to create an inclusive culture that allows everyone to articulate their perspective and be part of the conversation."

That's where the Laboratory's 13 employee resource groups (ERGs) come in. "The work of the Laboratory's ERGs is really essential," says Sarrao, who champions the Laboratory's Women's Group. "It creates a venue to have those conversations to create community."

"I've had the opportunity to work with our SOUL Employee Resource Group for our African American colleagues," says Laboratory Staff Director Frances Chadwick. "This has been a huge learning experience for me and really increased my awareness of the unique perspective that that community brings."

Commitment to diversity continues

Scientists and engineers from a variety of disciplines with differing backgrounds, viewpoints, and life experiences form the foundation of Los Alamos National Laboratory's legacy. "Since its inception, the Laboratory has relied on the contributions of people across a huge range of fields and backgrounds to enable our national security work," Mason says.

Webster points out that many of the first scientists to arrive at the Lab in the 1940s during the Manhattan Project were originally foreign born. "We had scientists from all over the world who came to work and provided the success of the Trinity test, Little Boy, and Fat Man," he says. "They were among our most gifted, our most enthusiastic, and our most patriotic laboratory members."

The diversity seen during the Manhattan Project (see p. 6) set the tone for the work that continues today at Los Alamos. "We have better ideas, we make better discoveries more quickly when we bring a variety of perspectives to the table," Sarrao says. "We do that by having different voices in the room."

That commitment to finding and encouraging diverse voices is an ongoing process. "We have to keep working to provide diversity and inclusion throughout our workplace," Webster says. "By doing so, we honor our past and ensure our future." ★

Employee resource groups:

Active Bystander
SOUL: African American
American Indian
Asian Pacific Islander
Atomic Women: Women in STEM
Connect: New Employee and Early Career
Dependent Caregiver
DiverseAbility
HOLA: Hispanic
Prism: LGBTQ+
Veteran and Transitioning Service Members
Women of Computing
Women's Institutional

SCAN QR CODE WITH A SMARTPHONE CAMERA
Learn more about the Lab's employee resource groups.

■ Fisher poses with gear from the various sports he's supported and coached over the years.

■ Carved ivory and baleen bracelets.

■ Fisher's grandfather was featured in *National Geographic*.

FISHING FOR SUCCESS

Kane Fisher, a Yupik Eskimo, has made a name for himself as a commercial fisherman, athletic coach, mechanical engineer, and mentor.

BY OCTAVIO RAMOS

"My experiences in a harsh place like Alaska have served me well," explains Kane Fisher, a Yupik Eskimo who now works at Los Alamos National Laboratory. "It was a place where we played as hard as we worked. I grew up hunting and fishing, taught by my father, who was a school teacher."

That outdoor education came in handy after Fisher graduated from high school. "I had no trust fund or any reserves of money when I went to college, so I sent myself through school by working as a commercial fisherman on fishing boats in Kodiak, Alaska," Fisher remembers.

After earning a graduate degree in mechanical engineering, Fisher took a job at Los Alamos. One day, he received a phone call from a fisherman friend, who asked him to be the captain of a new fishing boat. "So, I went to my boss here at the Lab and told him about the opportunity," Fisher says. "My boss told me, 'Go ahead and do it. You'll still have this job when you get back.' I kinda looked at him, as in, 'Are you kidding?' But he wasn't, and that's what I did for a season."

During that time, Fisher appeared on the Discovery Channel's *Deadliest Catch*, a reality television series that features fishing vessels in the Bering Sea.

CONTRIBUTING TO NATIONAL SECURITY

After his fishing adventure, Fisher returned to Los Alamos and began working in the Lab's weapons programs. "Right out of the gate, we end up delivering a new component to the nuclear stockpile—that was my first project," Fisher remembers. "I lucked out on achieving such a deliverable—I mean, there are folks here who've been working for more than 25 years without ever delivering a new component to the stockpile."

■ Fisher and an Alaskan king crab.

That initial success sent Fisher on a career path that included work at the Lab's tritium and plutonium facilities. "Eventually, as the deputy for all engineering, I was in charge of all plutonium machining and pit-making processes," says Fisher, noting that he was involved in making the first W88 diamond-stamped plutonium pit (nuclear weapon core) at Los Alamos in 2007. When a pit (or other weapons component) is diamond stamped, it is literally stamped with a diamond shape as a visual indicator that it has met all design, manufacturing, and quality requirements and that it is ready to be used in the nuclear stockpile. "It was a big deal," Fisher remembers. "New Mexico Senator Pete Domenici and other dignitaries came to Los Alamos for the celebration."

As focused as Los Alamos is on building pits, sometimes pits must come apart (for example, to either be recycled into new pits or to be broken down into plutonium oxide powder, as part of the Lab's nuclear nonproliferation work). Now, after nearly 29 years at the Lab, Fisher says he is one of only three people in the world who has taken apart every single retired and enduring stockpile pit.

"It's a habit for me, breaking records," Fisher says. "In my recent job fabricating detonators, my team and I consistently broke records on the number of diamond-stamped detonators ever produced within short timeframes."

PAYING IT FORWARD

"I grew up doing all kinds of outdoor things, so when I had the opportunity to give back, I became a scoutmaster for the Boy Scouts," Fisher says. "It's an opportunity to counter the softness found in some of today's youth, giving them a chance to experience outdoor stuff like canoeing, shooting arrows from bows, and hiking trails while also learning how to navigate, understand astronomy, and acquire the basics of engineering."

In addition to his involvement with the Boy Scouts, Fisher is a sports fanatic. "I come from an extreme, so-called 'real-man' world, and that led me to participate in some tough sports, like wrestling and rugby," he says. "I currently serve as a high school assistant varsity baseball coach and the gear manager for the Los Alamos Hockey Association." In this role, Fisher purchases, distributes, and fits every single piece of gear for the more than 100 kids in the association. Fisher has coached rugby, football, and baseball for more than 25 years.

Fisher sees a direct correlation between sports and his work at Los Alamos. "Having coached so many young athletes over the years has improved how effectively I interact with the younger generation here at the Lab," Fisher says. "It's my responsibility to pass on what I've learned to the new engineers, who are hungry for such knowledge. I've had 15 students who I feel I've mentored the right way, so that they succeed as well as I have." ★

■ Fisher, sitting behind a whalebone carving, wears a wolverine parka.

■ Fisher coaches baseball.

THE DISTINGUISHED ACHIEVEMENTS OF LOS ALAMOS EMPLOYEES

Los Alamos National Laboratory is 17th among the "Top 20 Government Employers," as determined by readers of *STEM Workforce Diversity* magazine. Readers of the magazine selected the top companies and government agencies in the country that they would most prefer to work for or believe would provide a positive working environment for science, technology, engineering, and math (STEM) professionals.

Zhaowen Tang, of the Dynamic Imaging and Radiography group, received an Early Career Research Program funding award from the Department of Energy's Office of Science. The award bolsters the nation's scientific workforce by providing support to exceptional researchers during crucial early career years, when many scientists do their most formative work. Tang's project, "Understanding the 10-second neutron lifetime discrepancy," was selected for funding by the Office of Nuclear Physics. His research will look at neutron lifetime at the one-second level, which is necessary to improve predictions of the elements generated from the Big Bang.

Luis Chacon, of the Applied Mathematics and Plasma Physics group, is the winner of the Ernest Orlando Lawrence Award for 2021. He was selected for seminal contributions in multiscale algorithms for fluid, kinetic, and hybrid simulation of plasmas, enabling scientific breakthroughs in fast magnetic reconnection and self-organization in magnetic fusion systems, and in reactivity degradation in inertial fusion systems.

Neil Bourne, of the University of Manchester at Harwell, has been selected as the Laboratory's 2023 LANSCE Rosen Scholar. The fellowship is reserved for scientific leaders in a field of research currently performed at the Los Alamos Neutron Science Center (LANSCE) and those who exemplify the innovative and visionary qualities of Los Alamos physicist Louis Rosen, who is considered the "father of LANSCE." While at LANSCE, Bourne will work to advance extreme science, researching the transition in behavior in extreme states of matter. For more on LANSCE, see p. 62.

The **Los Alamos Personnel Security Office** received the 2021 Jane Hall Award, which recognizes a group or team that improved safety and security processes. The office was selected for its success in streamlining the clearance process to handle a greater influx of arrivals at the Lab during the COVID-19 pandemic.

ChungHyuk Lee and **Katie Lim** received the U.S. Department of Energy's Hydrogen and Fuel Cell Technologies Office Postdoctoral Recognition Award for 2022. Lee was honored for his work during a postdoctoral fellowship on the Fuel Cells and Electrochemical Sensors team within the Materials Synthesis and Integrated Devices group. Lim, a postdoctoral research associate in the Fuel Cells and Electrochemical Sensors team, received honorable mention recognition for her work developing membrane electrode assembly for high temperature polymer electrolyte membrane fuel cells, one of the most promising technologies to realize the electrification of heavy-duty vehicles.

The Athena Engineering Scholars Program, which is open to all Los Alamos women, students, and staff who are interested in pursuing a graduate engineering degree, announced its 2022 winners: **Margot Goler**, **Tabitha Kalin**, and **Selma Wanna**. They were nominated by mentors who will help them with their research and support them professionally as developing engineers.

Sara Dumit, an internal dosimetrist within the Radiation Protection Division, recently attended the Health Physics Society's annual meeting, where she was presented with the 2022 Elda E. Anderson Award. The award recognizes excellence in research or development, discovery or invention, and significant contributions to the profession of health physics.

Associate Director of Plutonium Infrastructure and Senior Director for Project Execution **Carolyn Zerkle** retired from Los Alamos to become the deputy director of Lawrence Livermore National Laboratory. Since 1992, Zerkle served Los Alamos in a variety of program, project, and operations leadership positions.

BETTER SCIENCE = BETTER SECURITY

Hardworking people—the Laboratory's most important asset—enable Los Alamos to perform its national security mission.

Nine Lab technologies won 2022 R&D 100 Awards, which honor the most innovative technology products of the past year. The awards span industry, academia, and government-sponsored research organizations. Read more about two of this year's winners, K-Modules and LightSlingers, on p. 14 and p. 16, respectively.

Los Alamos' Chemistry and Metallurgy Research Replacement (CMRR) PF-4 Equipment Installation-Phase I (PEI1) subproject was awarded the U.S. Department of Energy (DOE) Secretary's 2021 Project Management Achievement Award. DOE presents the annual award to project teams that have demonstrated significant results in completing projects within cost and schedule. In this case, CMRR PEI1 was delivered $110 million under budget and 16 months ahead of schedule.

Dave Funk, senior director of the Advanced Sources and Detectors Project Office, retired from Los Alamos to embark on a new opportunity at Nevada National Security Site (NNSS): vice president of the Enhanced Capabilities for Subcritical Experiments portfolio. In this new role, Funk is responsible for the U1a Complex Enhancements Project, the ZEUS Test Bed, and the NNSS scope for the Advanced Sources and Detectors (ASD, also known as Scorpius) Project—all of which will deliver high-quality plutonium data for use in stewarding the nation's nuclear deterrent.

Materials scientist **Jacob Spendelow** received an Electrochemical Society Toyota Young Investigator Fellowship for projects in green energy technology. Spendelow's research investigates electrochemical energy technologies, including fuel cells and electrolyzers.

National Security Science writer **Jake Bartman** received a 2022 Distinguished Student Performance Award from the Lab's Student Programs Advisory Committee. Bartman, who is earning a master's degree in creative writing from the University of Florida, has successfully communicated complicated technical information about the Laboratory's national security work to nontechnical audiences. ★

55 YEARS AGO

After World War II, Los Alamos Scientific Laboratory (now Los Alamos National Laboratory) hired Frederick Worman to be its first archaeologist. Worman, pictured here in Los Alamos Canyon circa 1967, recorded and excavated archaeological sites in preparation for construction projects as the Laboratory expanded operations across its property. He also supervised the partial excavation of Tsirege Pueblo, which was occupied from 1325 to the late 1500s by ancestors of the modern-day Pueblo de San Ildefonso people. The 800-room pueblo is located on the eastern edge of the Laboratory and is one of the largest ancestral pueblo sites in northern New Mexico.

Today, Los Alamos has a close relationship with the Pueblo de San Ildefonso and other Native American communities throughout the Southwest. The Laboratory strives to protect and preserve ancestral places for future generations. ★

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Photo: Los Alamos Ski Club

THEN & NOW

In the 1940s, the scientists and soldiers working at the Los Alamos branch of the Manhattan Project—the U.S. government's top-secret effort to build the world's first atomic weapons—formed the Los Alamos Ski Club. "The membership list … reads like a 'who's who' of science and includes notable figures in history such as Robert Oppenheimer, Hans Bethe, Edward Teller, Enrico Fermi, and Nicholas Metropolis," writes Deanna Morgan Kirby in her book *Just Crazy to Ski: A Fifty-Year History of Skiing at Los Alamos*. "After working all week developing nuclear weapons, many of the physicists, chemists, mathematicians, engineers, and technicians spent their weekends cutting ski trails (or using explosives to clear slopes), building primitive rope tows, and 'designing' ski lodges from salvaged Army buildings."

Today, the Los Alamos Ski Club actively maintains the 750-acre Pajarito Mountain ski area (pictured here in the 1960s and in 2019), which tops out at 10,440 feet above sea level. Located just miles from town, many physicists, chemists, mathematicians, engineers, and technicians still spend their weekends (and often their lunch breaks) here.

Visit pajarito.ski for information on opening day, lift tickets, and more. ★

Photo: Los Alamos County/Vint Miller