LOS ALAMOS NATIONAL LABORATORY ◆ SPRING 2026

NATIONAL ★ SECURITY SCIENCE

THE KNOWLEDGE ISSUE

Fast track to the future: Students gain experience in accelerator operations.

Thinking inside the box: A writer tries her hand at working in a glovebox.

Knowledge warriors: Six employees advance the Lab's mission.

Transforming learning: Preserving and passing along knowledge informs national security.

The mentor in the cockpit: A B-52 pilot trains air crews for the nuclear mission.

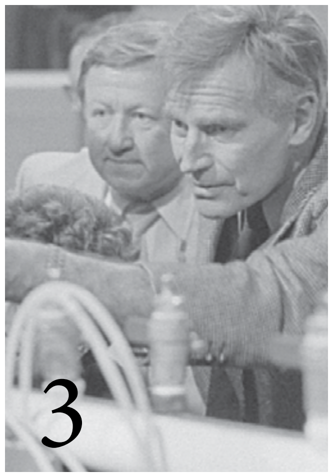
+PLUS:

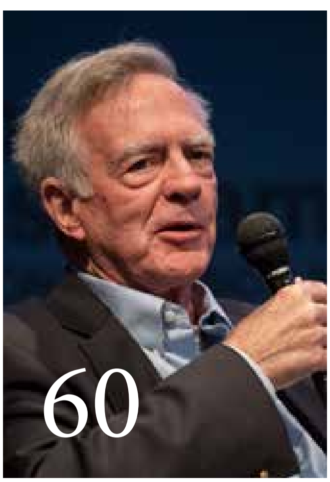
Remembering Los Alamos Director Don Kerr	Finding purpose—and laughter—as a substitute teacher	Sniffing for success: meet the Lab's canine detectors

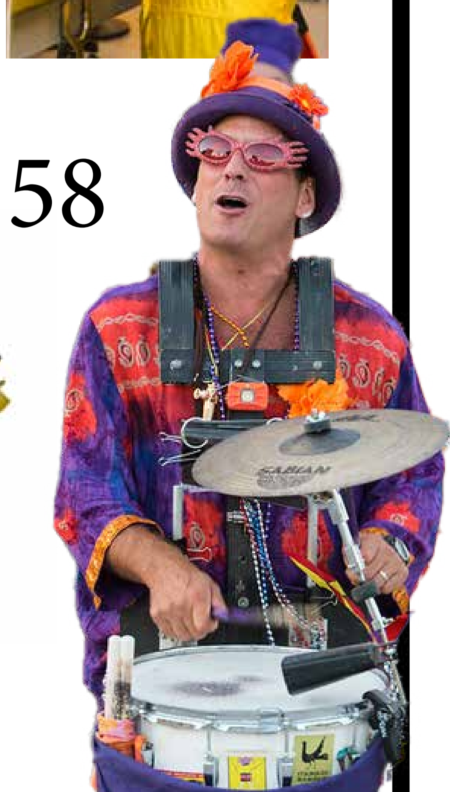
PHOTOBOMB

▼

A crane lowers a 26-foot-tall, 50-ton dual-action press through the roof of Los Alamos National Laboratory's Sigma Complex in September 2025. The press, which can apply a force of up to 800 tons, is used to fabricate metals, including steel, titanium, and uranium. Machinists work closely with materials scientists and engineers in support of Sigma's manufacturing science mission, which involves studying how raw materials are turned into finished products. ★







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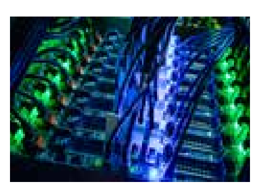
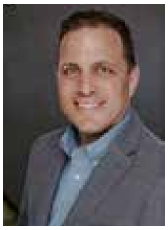


About the cover: A data center rack holds servers used by the Lab's Weapons Research Services (WRS) division. Learn more about WRS on p. 2. ★

THE KNOWLEDGE ISSUE

Capturing, preserving, and sharing information is essential for national security.

BY JASON KRITTER
DIVISION LEADER,
WEAPONS RESEARCH SERVICES



At Los Alamos National Laboratory, knowledge is the foundation of our national security mission. The Lab's success depends on how effectively we collect, share, and apply what we know. For more than eight decades, every experiment and innovation has drawn from and built upon knowledge created by previous generations. We continue to stand on the shoulders of those who came before us, and we are working to preserve today's knowledge for the next generation of national security science leaders.

Weapons Research Services—the Lab's data division, which I direct—links decades of weapons research, design, and testing to the national security work underway today. In this division, our core duties include:

- the management and accessibility of the Lab's classified library and its collections,
- the oversight and development of secure weapons program network systems software and operational technology tools, and
- the capture and dissemination of multidisciplinary knowledge and experimental data.

As the information backbone of the Lab's Weapons programs, the division's job is to empower scientists, engineers, and researchers to think faster, act strategically, and stay ahead in an evolving threat landscape.

Throughout this magazine, you will read about ways we preserve knowledge (such as the work of the National Security Research Center on p. 18), how we protect knowledge (such as the role of classification, countersubversion, and cyber assurance teams on p. 21), and the methods we use to share knowledge (such as the way the Lab is transforming weapons learning on p. 40). You'll explore a new way to train the next generation of accelerator physicists (p. 22) and meet a Los Alamos Air Force Fellow whose work involves training the next generation of pilots who field the nation's strategic deterrent (p. 46).

Preserving and accessing knowledge is important now more than ever for our nuclear deterrent. When asked how legacy data drives modern innovation, I often point to the nuclear weapons production records from the now-shuttered Rocky Flats Plant. Decades ago, teams there built thousands of plutonium pits (the cores of nuclear weapons) and documented every process in detail. Today, that documentation enables us to make more informed decisions and deliver more effective results. And speaking of pit production, go behind the scenes on p. 28 as writer Jill Gibson learns how to work in a glovebox.

Many of the stories in this issue interrelate, demonstrating how much of "knowledge" depends on connecting the dots. For example, former Lab Director Don Kerr, who is remembered on p. 60, started the Laboratory Fellows program, which you can read about on p. 11. Kerr also greenlit what is today the National Security Research Center (p. 18), which was instrumental in preserving photos of actor Charlton Heston's 1983 visit to the Lab (p. 3). That year was also the Laboratory's 40th anniversary, during which a young Steve Cambone (p. 56) was present. Today, Cambone, a seasoned defense strategist and former under secretary of defense, leads the Lab's Strategic Assessment and System Analysis Office, established to assist Los Alamos leadership in critically evaluating the Laboratory's national security initiatives and their alignment with broader national objectives.

You will see that the stories in this issue look beyond systems and structures to the human element: the importance of mentorship, collaboration, and the deliberate transfer of tacit knowledge for those lessons that can't be found in manuals or databases. We will introduce you to some of the people we call knowledge warriors (p. 34) and see how their efforts contribute to the same goal: ensuring that the Laboratory's collective knowledge remains vibrant, connected, and ready to serve our mission for generations to come.

Knowledge is not static, it's living, evolving, and shared. This issue celebrates the people and programs that keep it alive at Los Alamos National Laboratory. ★

MASTHEAD

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NSS STAFF SPOTLIGHT

This past November, art director Brenda Fleming and writer Jill Gibson woke up at 3:30 a.m. to attend a rocket launch at Spaceport America. Learn more about the launch on p. 16. ★

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LOS ALAMOS
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FOR IMMEDIATE RELEASE

CHARLTON HESTON VISITS LAB

LOS ALAMOS, N.M., May 16, 1983 -- Charlton Heston, academy award winner and renowned actor, visited Los Alamos National Laboratory today. Heston was briefed on Lab activities by Director Don Kerr and other Laboratory officials. Heston is a consultant to the National Lab and has assisted in the production and narration of a number of classified films.

Heston made his screen debut in 1950 in "Dark City". He received his academy award for best actor in "Ben Hur" (1959) and is remembered by most for his role as Moses in Cecil B. DeMille's production of the "Ten Commandments".

Los Alamos National Laboratory is operated by the University of California for the Department of Energy.

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■ In 1983, Academy Award–winning actor and World War II veteran Charlton Heston visited Los Alamos National Laboratory to narrate two 30-minute classified films. *The Flavius Factor* is a programmatic overview of the Lab, and *Trust, but Verify* is about the collaboration between American and Soviet scientists. Both documentaries were digitized by the Lab's National Security Research Center and can be watched on historian Alan Carr's YouTube channel. "Interestingly, Heston received his security clearance for this work," Carr notes. "He wouldn't accept payment and was happy to support the project."

Here, Heston (left) and Lab Director Don Kerr attend an event in the J. Robert Oppenheimer Study Center.

Watch Heston's now-unclassified films by scanning the QR code. Learn more about Kerr's life and career on p. 60. ★

THE INTERSECTION

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

SCIENCE

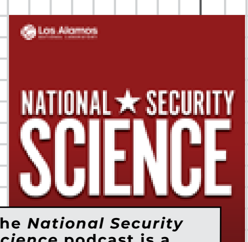
Los Alamos is the first national lab to use immersion pods to cool servers. Pods are filled with dielectric fluid, in which servers are submerged. In addition to being a highly efficient means of cooling, the pods don't take up much space and actually extend the life of the servers.

Nick Smith, a scientist in the Lab's Safeguards Science and Technology group, appeared on National Public Radio's weekly news quiz, *Wait Wait... Don't Tell Me!* on December 6. Smith won the "Bluff the Listener" game, correctly identifying which of three stories read by the show's panelists was true.

In fiscal year 2025, 1,037 graduate students, 1,279 undergraduate students, and 94 high school students worked at Lab.

About a year ago, OpenAI models began running on the Los Alamos Venado supercomputer. On August 28, representatives from OpenAI participated in a panel discussion at the Laboratory before touring some Lab facilities. Here, head of Platform/API Engineering Sherwin Wu visits the Slotin Building, part of Manhattan Project National Historical Park (p. 34).

CULTURE



The *National Security Science* podcast is a spin-off of *National Security Science* magazine. Listen to stories from Los Alamos National Laboratory's Weapons Programs—stories that show how innovative science and engineering are key to keeping America safe.

These turkey vultures near Los Alamos' Omega Bridge enjoy the sun on their wings and the promise of warmer weather. This image was captured by *NSS* art director Brenda Fleming.

Lab program manager Chris Arnold enjoyed an abundant tomato harvest this past fall. He donated his crop to local pizza joint Pi-239, which served up a BLT pizza using the fresh produce. "Fellow nerds," Arnold texted his friends, "Go ask for the Unexpected Yield." Photo: Chris Arnold

Chief Scientist for Weapons Effects Tim Goorley, pictured here with his daughter, was a medieval guard for Halloween. He wore his costume (purchased on sale from the Santa Fe Opera) to work but left his sword at home. Learn more about Goorley's work on p. 34. Photo: Tim Goorley

■ Fensin and Llobet explain that "when time came to coin a name for the experimental series, we wanted something distinctive and memorable. Yet, in true scientific fashion, we couldn't reach consensus on a name. During a particularly spirited brainstorming session, our program manager Kathy Prestridge jokingly suggested Hydrangea. It was so unexpectedly perfect that it bloomed into the official name." Research technologist Pam Scott created this artwork for the experiment.

DYNAMIC PLUTONIUM EXPERIMENTS BLOOM

The Hydrangea series was the first of its kind since 2007.

BY WHITNEY SPIVEY

In September 2025, the Proton Radiography (pRad) facility, part of the Los Alamos Neutron Science Center (LANSCE) at Los Alamos National Laboratory, executed the first experiment in the Hydrangea series. This experiment marked the return of dynamic imaging—capturing a series of images over time to visualize movement—of plutonium for the first time at pRad since 2007. The experiment provided essential data to study the physical properties of plutonium relevant to stockpile stewardship.

During the experiment, a sample of plutonium housed in a specially designed containment vessel was placed in the path of LANSCE's high-energy proton beam. Multiple images—compiled into a time-lapse movie—were taken of the plutonium's response.

"Directly capturing in situ radiography data during the dynamic response of plutonium unlocks a new level of fidelity in validating the equation of state, strength, damage, and mix models—the fundamental constructs of our national certification science," says scientist and principal investigator Saryu Fensin.

Scientist and principal investigator Anna Llobet (p. 34) has been working on Hydrangea since 2016 and says that executing the experiment is a dream come true. "This achievement stands as a testament to the collaboration and dedication of many stakeholders," she says. "The experimental design, build, and operations that support such experiments are also highly complex, requiring the integration of cross-disciplinary expertise and extensive coordination."

Llobet notes that as additional experimental series unfold, the ability to dynamically image plutonium at pRad "provides an agile and flexible capability to explore the dynamic behavior of plutonium under explosive drive and to validate the models we routinely use to address critical national security questions." ★

LOS ALAMOS JEOPARDY!

TEST YOUR LOS ALAMOS KNOWLEDGE

See how you'd fare on *Jeopardy!*

BY JAKE BARTMAN

On May 28, 2014, "Los Alamos National Laboratory" was one of the question categories on the television game show *Jeopardy!* Prompted by short videos filmed at the Laboratory, contestants answered questions about some of Los Alamos' signature science facilities. How would you have performed if you'd been a contestant on the show? Turn to the next page to find answers to the questions below—and remember that your answer must be phrased as a question! ★

$400 At the heart of the Neutron Science Center is a powerful linear accelerator that accelerates protons to 84 percent of this, the c in $E = mc^2$.

$800 When Trident is active, its three beams produce in 500 quadrillionths of a second the equivalent of 200 times the electrical output capacity of the U.S.; it's a type of this beam device first suggested by Einstein.

$1,200 A Los Alamos operation center monitors instruments that help this craft that landed on Mars in 2012 analyze rocks and soil.

$1,600 The National High Magnetic Field Lab owns a world record. Its magnet reached the goal of 100 of these magnetic units named for a European American scientist.

$2,000 The lab's 3D visualization theater uses 33 digital projectors to study complex physical systems—for example, the asteroid impact that created the Chicxulub Crater on this peninsula, leading to the extinction of the dinosaurs.

JEOPARDY! ANSWERS

(See clues on previous page.)

What is the speed of light?

At the kilometer-long Los Alamos Neutron Science Center (LANSCE), protons are accelerated to 800 million electronvolts, where they're used for everything from probing the structure of atoms to science that directly supports national security–related research and development. LANSCE celebrated its 50th birthday in 2022, and in the next few years, the LANSCE Accelerator Modernization Project is slated to replace the entire front end of the accelerator, ensuring that the facility will support vital research for decades to come.

What is a laser?

At the Trident Laser Facility, researchers used Trident, which was built in the 1980s, to conduct important inertial confinement fusion research (which involves heating and compressing small capsules of nuclear fuel to initiate nuclear fusion). The final Trident experiments were conducted in 2017, and the laser has since been decommissioned.

What is Curiosity?

For some 13 years, Curiosity has roamed Mars' surface, traveling more than 22 miles. Los Alamos developed Curiosity's ChemCam instrument—a laser that "zaps" rocks and enables researchers to analyze their elemental composition. Among other findings, ChemCam has helped establish that Mars' surface once featured shallow, salty ponds.

What are teslas?

The National High Magnetic Field Laboratory, or MagLab, is the largest and highest-powered magnet laboratory in the world. MagLab comprises three sites (at Los Alamos, Florida State University, and the University of Florida). These facilities help researchers understand how materials behave under extreme magnetic fields, probe the behavior of biomolecules, analyze the atomic structure of rocks and minerals, and more.

What is the Yucatán Peninsula?

Los Alamos is home to some of the most powerful supercomputers in the world—machines that are used to produce simulations of everything from protein folding to nuclear explosions. At the Laboratory's Cave Automatic Virtual Environment, researchers and visitors don 3D glasses and experience some of these simulations as immersive experiences produced by high-definition projectors.

FETCHING FOR KNOWLEDGE

A new tool uses artificial intelligence to make classified documents searchable.

BY JAKE BARTMAN

In the 1940s, during the Manhattan Project, Project Y (what is today Los Alamos National Laboratory) began cataloguing the documents that its researchers created as they developed the world's first nuclear weapons. In the eight decades since, the Laboratory has accumulated millions more weapon-related documents, which are today housed in the Laboratory's National Security Research Center (p. 18). Although these documents constitute an invaluable resource for weapons researchers and stakeholders, their sheer volume has created a challenge: how to access information efficiently.

Enter Terrier, a new tool that is leveraging artificial intelligence (AI) to sniff out relevant documents, helping weapons researchers and other stakeholders find the information they need. Originally intended to make data from diverse Laboratory data repositories accessible via a search-engine interface, Terrier has since evolved into a chat-based tool that is leveraging the use of AI in novel ways on Los Alamos' classified network, streamlining a once-laborious processes and pointing toward future AI applications at the Laboratory.

Terrier draws together data from multiple sources at Los Alamos, such as the National Security Data Solutions' Online Vault and other shared drives that contain historic documents from the Laboratory, the (now closed) Rocky Flats Plant in Colorado (where the majority of plutonium pits—nuclear weapon cores—were manufactured), and more. To connect these previously siloed data repositories, Terrier relies on a knowledge graph—a schema that maps weapons-related concepts and terms in a way that computers can understand.

Initially, creating Terrier's knowledge graph was a laborious process that involved interviewing weapons experts, identifying key weapons-related concepts, and charting the connections between these concepts in the knowledge graph. Then, individual documents could be catalogued and indexed to the knowledge graph.

Although these tasks could be completed by humans, the volume of documents meant that a more efficient approach involved using optical character recognition (OCR) tools (which translate hand- or typewritten documents into digital text) and transformers (which extract metadata from a document, capturing meaning in a numerical way). Yet the limits of older OCR tools meant that documents were often misread, leading to the extraction of inaccurate metadata, which in turn led to poorly indexed documents.

"Having humans curate the documents would be better," says Tiffany Clendenin, who manages the Terrier program. "But we calculated that it would take a human something like 2,000 years to catalogue and index eight decades of documents—and that's not considering the new material that the Laboratory is creating every day."

AI has significantly accelerated Terrier's work. In the past two years, Terrier began using new and improved OCR tools to re-scan and index documents. Next, Terrier deployed large language models to automatically summarize documents' contents, identify keywords, and extract metadata, which can be incorporated into the knowledge graph and reviewed by weapons experts.

This approach is much faster than interviewing experts and then mapping their knowledge from scratch, says Jennifer Roos, Terrier's technical project lead. "What I think is particularly exciting about what AI-machine learning is doing for us is that as it's reading this data, it's extracting so many keywords for us," Roos says. "That information is so important to have."

Large language models have also enabled a new interface for Terrier. Initially conceived as a natural language–processing search tool, Terrier is now designed to operate as a chatbot. Unlike chatbots such as ChatGPT, however, when a user enters a query about some aspect of weapons design or production, Terrier responds not with a generalized response written by AI, but with results from documents that address the query (an approach called retrieval-augmented generation). Users can then ask follow-up questions to expand or refine their query—a capability that enables knowledge discovery that goes beyond what would have been possible if Terrier had stuck with a traditional search-retrieval design.

Although new tools are helping Terrier achieve its mission, developing the technology has been challenging in part because of the constraints that come with working on the Laboratory's classified network. A related obstacle involves ensuring that Terrier's users have the appropriate clearance and need-to-know to access certain files. However, in the past year, the Terrier team has overcome these challenges and recently launched the Terrier chatbot at the Laboratory, allowing researchers to search more than two million documents. Additional repositories, which contain more documents, will be added to Terrier in the future.

"We have 80 years of information, and most of the people who created that information are no longer here," Roos says. "These tools are allowing us to share all that information in a useful way." ★

The team's sense of humor is reflected in the *Stranger Things* design for the sticker commemorating the experiment. Hidden in the word DARHT are tilted eights, to reflect the number 3681, the test's relation to a previous test named 3618, the fact that it was the 84th DARHT hydrodynamic test, and the experiment being eight years in the making. The tilted eights also look like the infinity symbol, which team members say it sometimes felt like as they worked to execute the test.

CHALLENGES ACCEPTED

After eight years of obstacles, an experiment is successfully executed.

BY JILL GIBSON

Murphy's Law states that anything that can go wrong, will go wrong. Although Murphy is often correct, a team of Los Alamos National Laboratory scientists, engineers, and technicians recently proved him wrong by overcoming eight years of challenges to execute an experiment—Hydrodynamic Test 3681—at the Lab's Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility.

"Eight years!" emphasizes Jennie Disterhaupt, the lead experimenter for the test. "Everybody had their opportunity to navigate difficult challenges."

The experiment, which kicked off in 2017, faced numerous setbacks from the beginning. "People really rallied to work together against the odds," Disterhaupt says. "We kept pushing, facing hard problems, and coming up with creative solutions to achieve great things."

DARHT consists of two linear accelerators that intersect at right angles and create pulses of high-powered x-rays to produce radiographs (high-powered x-ray images) of mock nuclear weapons components detonating inside a steel containment vessel. In a real nuclear weapon, some of these components would be made with plutonium. In DARHT hydrotests, however, the

Hydrotest 3681 took place on July 11 but was supposed to occur closer to July 4, so the team took a patriotic approach to executing the experiment.

components are made with a surrogate, non-plutonium metal. The implosion rapidly heats the surrogate to temperatures high enough to cause it to flow like water—which is why many DARHT tests are called hydrodynamic tests, or "hydrotests" for short. Hydrotests such as 3681 play a crucial role in conducting weapons research and ensuring the nation's nuclear weapons are safe, secure, and reliable. But what happens when multiple things go wrong? Every experiment the Lab conducts at DARHT is challenging, but Hydrotest 3681 had extra issues to tackle, explains Disterhaupt.

The first challenge was one researchers across the country battled: the COVID-19 pandemic, which delayed the test. When researchers returned to a regular work schedule, they faced personnel turnover, design changes, fabrication issues, assembly issues, and other problems.

A second obstacle was the need to produce an extremely high-energy x-ray so scientists could "see" through what Disterhaupt describes as "a thick object."

"We knew we would need to push the accelerator to produce an extremely high x-ray dose," she says. Once again, Murphy's Law came into play. From integrating maintenance and tuning of the machine to the loss of an accelerator cell and a camera that started showing signs of failure, difficulties continued to arise.

One teammate got extra kudos for his commitment, when the much-delayed test landed on the evening of his 30th birthday—on a Friday night to boot. "I definitely had to adjust my plans," jokes Brian Esquibel, but he adds that he was eager to show up. "I've never worked on a project in my life that required this much tenacity."

Hydrotest 3681 was also the first hydrotest to use optical initiation detonators to start the experiment. These detonators are triggered by laser power rather than electricity. Using optical initiation in the test was an unconventional effort, and the team had to jump through a lot of hoops to get results.

The use of laser technology to initiate high explosives is a major safety improvement, says CJ Benge, an engineer in the Detonation Science and Technology group.

"Traditional initiators are electrically driven, and with that comes the risks of static, lightning, or other electrical hazards," Benge explains. "Optical initiation eliminates several of those hazards and acts as its own electrical standoff, drastically decreasing the risk of an electrical spark or discharge."

The scientists also had to adjust their operational procedures for the new initiators. The form, fit, and function all had to align with exquisite timing—and they did.

Ultimately, Hydrotest 3681 returned much-needed data to ensure that the nation's nuclear weapons remain safe, secure, and effective. Disterhaupt said the success was due to "hardworking people who are really good at what they do."

Team members have already begun work on the next test for the system, which, according to Disterhaupt, they don't expect to take eight years to complete. ★

■ Los Alamos scientist Matt Carpenter teaches IAEA safeguards inspectors to use a specialized radiation detector to identify the presence of plutonium.

EXPERTS TRAINING EXPERTS

Los Alamos scientists teach international inspectors to identify nuclear material.

BY JILL GIBSON

Los Alamos National Laboratory staff member Pete Karpius hands a small container to the group of people he is teaching. "See if you can figure out what's inside," he says. The container may—or may not—hold plutonium, a highly radioactive material that can sustain a nuclear chain reaction. The people in the class will use a specialized radiation detector to identify whether the sample inside the mystery container poses a risk.

This exercise is part of the International Atomic Energy Agency (IAEA) inspector training that Los Alamos has hosted for decades. Students come from across the globe to learn to use gamma-ray and neutron-based measurement techniques to determine the quantity and characteristics of nuclear materials—such as uranium, plutonium, and various associated isotopes—without altering or destroying the sample being measured. This approach is called nondestructive assay, and it's a key part of how the IAEA verifies that countries are not misusing or concealing nuclear materials.

The IAEA is an autonomous international organization that works in close partnership with the United Nations. Headquartered in Vienna, Austria, the IAEA promotes the safe, secure, and peaceful use of nuclear technology. IAEA staff members travel to different countries to conduct inspections to verify that nuclear material and technology are not being used for nuclear weapons development. To learn how to do that, they turn to the experts at Los Alamos.

"This is a proud part of our Los Alamos legacy," says Marc Ruch, the director of the Lab's Safeguards and Security Technology training program. "Most of the tools and techniques that the inspectors use were developed here. Our trainers understand this stuff inside and out."

Los Alamos offers both introductory and advanced courses so that the inspectors can practice measuring the kinds of nuclear materials they might encounter in the field, including depleted uranium, plutonium, and research reactor fuels. The training groups vary in size from about 10 to 25 people, and the classes are scheduled at the IAEA's request. Each year, the Lab usually offers one introductory class that is required for all inspectors annually and a second, optional advanced class.

"The inspectors have a stressful role, and we aim to teach them to do the best job they possibly can," says Karpius. He points to the image on the monitor displaying the readout from the mystery sample. This image is called a gamma-ray spectrum and is analogous to a fingerprint for the radionuclides inside. "This one is difficult to analyze," he tells the students. "What would you do?"

Many of the IAEA inspectors in this advanced class have been in the field for several years and are eager to attend training. "These inspectors do an incredible job," Ruch says. "It's important for the people implementing nuclear safeguards to have a chance to go through a challenging measurement environment during training like this."

The advanced class lasts two weeks, bringing people from around the world to Los Alamos. "I enjoy meeting inspectors from all over the world; they have a wide variety of backgrounds and perspectives," says Katherine Schreiber, a Los Alamos physicist helping teach the current class.

"These inspectors ask a lot of questions and pick up information fast," she says. "That's important because the way they use this knowledge supports global security." ★

AN HONOR AND A COMMITMENT

Laboratory Fellows steward the Lab's scientific culture.

BY WHITNEY SPIVEY

In 2019, Los Alamos National Laboratory physicist Brian Albright was in Washington, D.C., on official travel when he received an unexpected call from Lab Director Thom Mason. "He was notifying me of my appointment as a Laboratory Fellow," Albright recalls. "At the time, I felt a deep sense of honor, gratitude, and motivation—the appointment represents both a responsibility and an opportunity to give back to the Lab and its people."

Established in 1981 by Director Don Kerr (p. 60), the Laboratory Fellows comprise technical staff recognized for their sustained, outstanding contributions and their promise for continued professional achievement. Since the group's inception, 300 Fellows have been named; about 90 are active, including 60 current employees, who represent roughly 2 percent of the Lab's technical workforce.

The title of Fellow is more than an accolade. "According to our charter, the Fellows are a service organization," Albright explains. "Fellows are expected to play an important role in the Lab community." Collectively, they serve as thought leaders across science, engineering, and mathematics who model the professionalism and commitment to technical excellence that defines Los Alamos. Fellows advise Lab leadership; organize special studies, colloquia, and symposia; and sponsor the Fellows Prizes, awarded annually for excellence in research and leadership.

Fellows are uniquely positioned to help shape the Lab's future research directions. They are charged with maintaining the institution's scientific and technical proficiency by identifying emerging opportunities, addressing potential challenges, and ensuring that bold, creative ideas can thrive. "We take seriously our role in advancing scientific and technical excellence and in helping develop the next generations of leaders," Albright says. "Where appropriate, we also challenge Lab leadership and offer suggestions in areas where we think the Lab can do better."

Looking ahead, Albright identifies two major challenges for the Laboratory. The first is how to navigate an aging nuclear deterrent and stressed weapons production enterprise, even amidst advances in artificial intelligence and experimental capabilities. The second is ensuring the Laboratory has the right workforce and mix of technical capabilities to meet the demands of the first challenge. Albright explains that more than half of Los Alamos staff have worked at the Laboratory fewer than five years, creating hurdles for knowledge transfer, mentoring, and sustaining a culture of technical excellence. "It is telling that despite having our largest technical workforce ever, journal publication rates have declined, which is an issue the Fellows are actively studying," he says. "The question is how we align our people and investments, striking the right balance between deep, targeted expertise in key strategic areas and broad, capability-based research that seeds the breakthroughs of tomorrow. Attracting and developing a workforce that can operate effectively across this spectrum is essential."

Ultimately, Albright says, the nation doesn't look to the national laboratories to conduct university-scale science. "Rather, they look to us to tackle the kinds of challenges that only we can address—work that requires a strong and enduring technical foundation." The Laboratory Fellows help ensure that foundation by upholding the Lab's scientific legacy while guiding its future. "Being a Fellow," Albright reiterates, "is about inspiring curiosity, protecting scientific integrity, and ensuring that Los Alamos remains a place where transformative discoveries can and will happen." ★

■ Los Alamos Director Thom Mason (right) congratulates the 2025 Fellows. From left: James Colgan, Franz Freibert, Bryan Henson, Charles Reichhardt, Tom Vestrand, and David Zerkle. Not pictured: Carl Ekdahl and Toshihiko Kawano.

According to her handler, Zora, a nine-year-old Belgian Malinois, works hard checking for explosives and other prohibited materials, but when the work day ends, she enjoys relaxing on the couch.

Elena is one of five dogs who make up the Lab's canine explosive detection teams of dogs plus their handlers.

THE NOSE KNOWS

The Lab's dog detectors sniff for success.

BY JILL GIBSON

Inspecting vehicles, shipments, and facilities for explosives is all part of a day's work for Zora, a nine-year-old Belgian Malinois on Los Alamos National Laboratory's dog detection team. When not conducting inspections, Zora and her handler, Chris Bailey, stay busy with training. Working together, they sharpen and build on the dog's extensive explosives detection skills.

"Currently we have five canine explosive detection teams—five dogs plus their handlers—at Los Alamos," explains Jason Lujan, from the Lab's Security Operations division. "We must ensure that site protection measures effectively address all potential threats and risks. The dogs are deployed to detect explosives and other prohibited materials."

Lujan says the dogs are extremely accurate and reliable at identifying a variety of explosive materials. In fact, no technological device can match the dogs' 98 percent success rate.

Los Alamos National Laboratory subcontractor Merrill's Detector Dog Services—a company that also serves the Pantex Plant in Amarillo, Texas, and other government sites—supplies the Lab with dogs and handlers. Merrill's begins training the dogs when they are seven- or eight-week-old puppies, marking the beginning of a lifetime of learning for these canine employees. Currently, the dogs working at Los Alamos include Labrador retrievers, German shepherds, Belgian Malinois, and German shorthair pointers. Bailey says personality and drive are more important predictors of training success than choosing a specific breed.

"We start by teaching the puppies to search for food, and then we imprint them on 20 to 30 different odors, training them to recognize the smells." Bailey says. "After they can identify a variety of explosives, we begin hiding the sources and teaching the dogs to hunt for them and perform a response behavior called an alert."

Every dog gets paired with a handler. "We're partners," Bailey says. "The dogs live with us, and, when we go home at the end of the workday, they just get to be dogs." Bailey notes that handlers and dogs develop a connection. "There's such a strong bond between me and Zora. We're a team."

Both the dogs and the handlers must pass annual certification exams administered by independent third-party master trainers proficient in canine certification. "We want to push the dogs to get them to the next level," Bailey says. He explains that handlers vary the lessons, hiding things high and low and in different containers, but, despite the difficulty, "You can't beat that nose."

Katherine Heselton, the owner of Merrill's Detector Dog Services, has worked with canine detection for more than 30 years and says dogs still have the power to amaze her. "We are always training—changing environments, weather, time of day," she says. "We try to come up with ways to trick them, but they can find things anywhere, even beneath ice or concrete or underwater. It's great to see how smart the dogs really are."

Lujan points out that when not working, the dogs are social and friendly. "They are part of the Los Alamos security family and the Lab's security culture. We encourage employees to chat with the handlers and get to know the dogs."

Bailey agrees, adding that when Zora isn't working, she can be found reclining on a comfortable spot on the couch or even sharing his pillow when they travel out of town for detection work at large venues like sporting events. "She's my buddy. I can't imagine life without her," he says.

Heselton says that working with the dogs is all encompassing and rewarding. "They love their handlers, they love people, they love learning, and they love what they do." ★

KNOWLEDGE AFTER HOURS

Trivia night in Los Alamos illustrates the benefits of collective intelligence.

BY SAM BURLEIGH

The answer was "mutton chops," in response to a question asking for the name of the beard style worn by Wolverine, John Quincy Adams, and a few other notable figures.

It's a Tuesday night in downtown Los Alamos, when trivia turns Boese Brew Company into a focused blend of competitive encyclopedic recall and deductive reasoning. In a town known worldwide for scientific achievement, knowledge-flexing—even in the facial-hair domain—is part of the atmosphere.

Cold, crisp air hangs outside, but inside, the bright bulbs cast a warm glow over the packed tables, where teams of up to six squeeze into every available space. Alexandra, the quizmaster, sits at the bar reading questions into a microphone from her laptop. The drink menu above her offers Dr. Strangehop IPA, and to the menu's right hangs a framed drawing of a guy riding a Fat Man–style atomic bomb, cowboy hat raised in the air.

Whenever a team wins the trickiest bonus question in a round, someone threads through the crowd to reach Alexandra and collect the prizes (Boese merchandise) for their team. The classic eight-questions-per-round, seven-round format of Geeks Who Drink—the company providing the quiz—fills about two hours. At the end of the night, the top three teams receive Boese gift cards to reward their well-honed memory powers and encourage future participation.

When asked to describe the typical winning team, Alexandra pauses. "It's usually a mixture of people with different backgrounds," she says. "The questions cover such a broad mix of topics that it really helps when a team's knowledge is spread across different areas."

Players on the frequently winning team The Great Outdoors echo the idea. As Tuesday night regulars, they're part of a core group of trivia devotees who return week after week. "Trivia hits every category you can think of, so we do well because we all bring something different to the table," says Emily, a geophysicist at an environmental services company. Her teammates Ivan, an accountant at a nearby Pueblo, and Michael, a procurement specialist at Los Alamos National Laboratory, nod as she speaks.

The weekly celebration of obscure facts points to a deeper truth: Like the modern science performed at Los Alamos National Laboratory, where specialists coordinate across disciplines, trivia success depends less on individual brilliance and more on collaboration. From facial-hair taxonomy and 19th-century politics to cutting-edge physics, correct answers emerge when different pockets of knowledge converge. ★

Upon completing METM, Gao ordered an Aggie class ring. Soon thereafter, he became a capstone instructor for the program. "This opportunity allows me to give back," he says. "Ultimately, the capstone course equips students with the practical engineering management tools necessary to excel as technical leaders, preparing them for advancement in both technical and managerial career paths." Photo: Jun Gao

PART-TIME AGGIES

More than 100 Los Alamos employees have completed the Master of Engineering Technology Program at Texas A&M University.

BY WHITNEY SPIVEY

Getting a Master of Business Administration was something Rusty DeBlassie had always considered, but going back to school as a working professional felt daunting. "When you're working 55-plus hour weeks, adding coursework on top is tough," says DeBlassie, a first line manager in the Detonator Production division at Los Alamos National Laboratory. But when he learned about the Master of Engineering Technology Management (METM) Program, he began to reconsider.

Offered through Texas A&M University—a member of the Texas A&M University System, which is one of the three institutions that together operate Los Alamos—the METM program is designed for people already established in their careers who aspire to become technical leaders. The mostly online, two-year program includes two short residency sessions in College Station, Texas. "When I discovered that METM was completely asynchronous with my work schedule and that the Laboratory would cover tuition," DeBlassie says, "it was a no-brainer. The curriculum is similar to an MBA but with a stronger technical emphasis."

Despite not having been in an academic setting for 27 years, DeBlassie settled in more quickly than he anticipated. "When I was in undergrad, I had to physically go to the library to conduct research and type reports," he says. "The learning environment now is so much more efficient because of the online tools available." Those tools proved especially useful during the program's final year, when students complete a capstone project that supports their work at the Laboratory.

Los Alamos group leader and METM graduate Jun Gao currently serves as a capstone professor for the program. "The projects I have supervised span a broad range of areas, including weapons engineering, quality assurance, scientific research, facility improvement, and supply chain management," he explains. "I draw on my technical background to ensure that each project demonstrates sufficient technical rigor for a graduate-level program and that students apply the skills and knowledge gained during their first year to achieve successful outcomes."

Both Gao and DeBlassie agree that a highlight of METM is its emphasis on team building and emotional intelligence during the first residency period. "The focus on emotional intelligence and communication prepares students not only to become effective professional leaders but also to enhance their interpersonal relationships in all aspects of life," Gao says.

Equally important, DeBlassie says, is developing practical project management skills, such as making sound decisions without having all the information. "As engineers, we always want all of the data, but operationally that's not always possible," he explains. "Making an operational decision and understanding its future impact is hard, but the courses teach you how to weigh those risks appropriately and logically."

Gao and DeBlassie earned their degrees in 2022 and 2025, respectively, and are among more than 100 Los Alamos employees who have completed the METM program. DeBlassie says the program was exactly what he needed at this point in his career. "It is very comparable to an MBA, but in my opinion, somewhat better because it focuses more on the practical aspects of management," he says. "After all, management is not only about operations but, more importantly, about the people who make those operations successful. The METM provides a good, solid balance." ★

COLLABORATING FOR A SAFER FUTURE

A partnership between Los Alamos National Laboratory and the Texas A&M University System brings together leading researchers to tackle evolving global security challenges.

BY WHITNEY SPIVEY

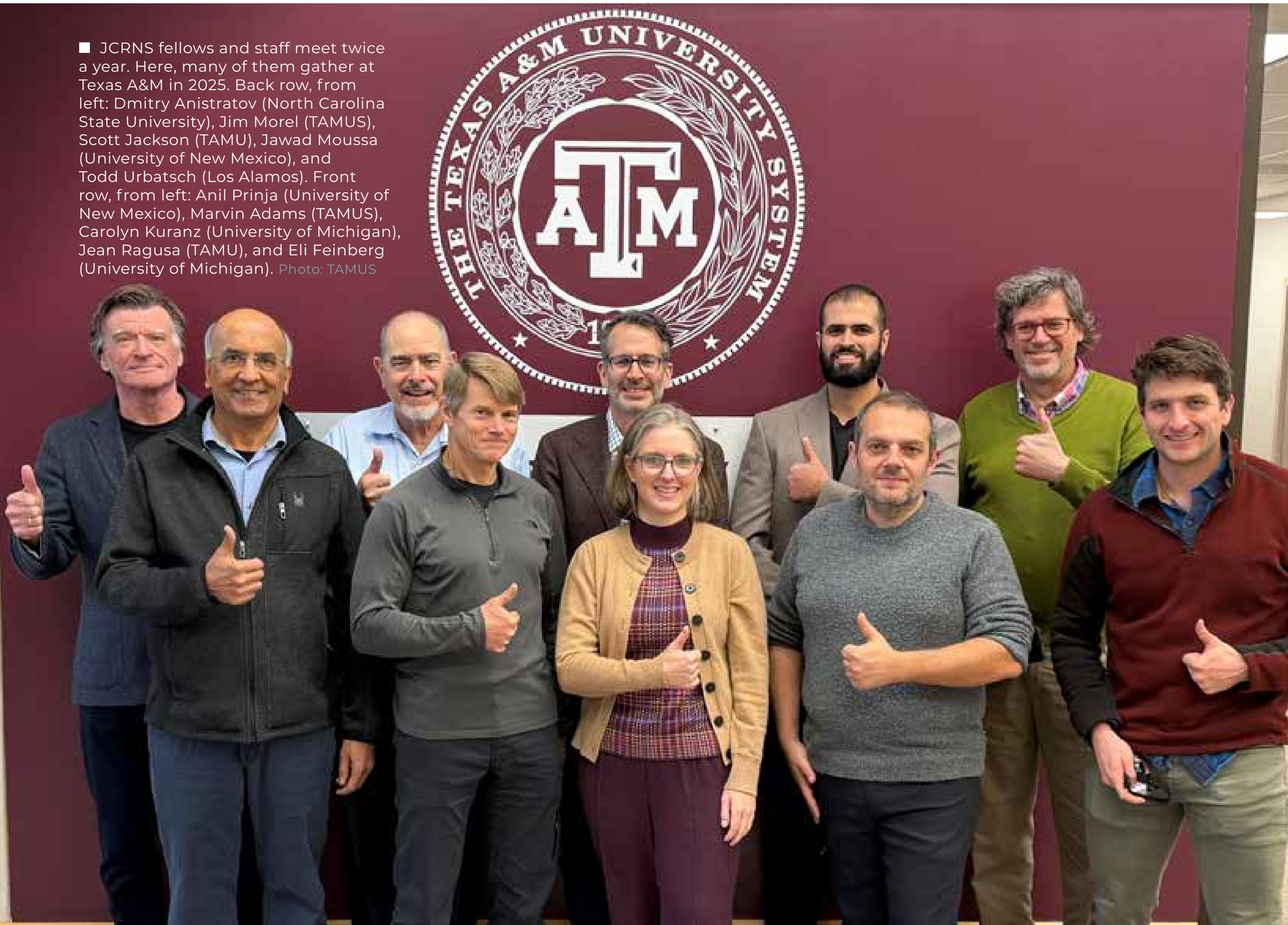
The saying goes that "two heads are better than one." By that logic, many heads working together can address some of the world's most complex challenges. That's the idea behind the Joint Center for Resilient National Security (JCRNS), which was founded in November 2020.

A collaboration between Los Alamos National Laboratory and the Texas A&M University System, JCRNS develops teams of university faculty—known as JCRNS Fellows—and Los Alamos researchers to collaboratively build capabilities for addressing rapidly evolving global threats. The center's mission is to cultivate, among select U.S. university faculty, capabilities that have high impact on national security; to enhance and transfer that knowledge within the nuclear security enterprise; and to apply it in support of Los Alamos' broader national security missions.

To date, JCRNS Fellows represent Texas A&M, the University of Michigan, North Carolina State University, West Virginia University, and the University of New Mexico. "JCRNS Fellows are sought out across the United States for their specific relevant and significant expertise and for their desire to work on nuclear security–related problems," explains JCRNS co-chair Jim Morel. "Being a JCRNS Fellow is a title granted with the expectation that the Fellows will continue to contribute, as appropriate, on problems requiring their specific expertise as long as they are willing and able to do so."

Each Fellow participates in high-quality, publishable research relevant to stockpile stewardship. Research topics have included high-energy-density laboratory physics, radiation hydrodynamics, time-dependent neutronics, and shock physics. Recent topics, such as hypersonics and high explosives, reflect the evolving needs of the mission. "Fellows work closely with key Los Alamos staff, forming teams with the unique expertise required to address these problems," Morel says. "This collective expertise does not exist in either academia or at Los Alamos alone, so collaboration is essential."

So far, the collaboration is yielding results. "Through previous and ongoing research," Morel notes, "JCRNS is already impacting national security decision-making, and thus nuclear security policy." ★



■ JCRNS fellows and staff meet twice a year. Here, many of them gather at Texas A&M in 2025. Back row, from left: Dmitry Anistratov (North Carolina State University), Jim Morel (TAMUS), Scott Jackson (TAMU), Jawad Moussa (University of New Mexico), and Todd Urbatsch (Los Alamos). Front row, from left: Anil Prinja (University of New Mexico), Marvin Adams (TAMUS), Carolyn Kuranz (University of Michigan), Jean Ragusa (TAMU), and Eli Feinberg (University of Michigan). Photo: TAMUS

Up Aerospace, a commercial aerospace company, partnered with Los Alamos to provide the rocket that transported the experimental technology into space.

The U.S. Army provides Blackhawk helicopters to transport the retrieval team into White Sands Missile Range to retrieve the deployed technology and parts of the rocket after their descent.

NEW HEIGHTS

Los Alamos researchers work with commercial partners to launch rockets for high-cadence, low-cost experiments.

BY JILL GIBSON

Los Alamos National Laboratory scientists are examining data from a successful suborbital rocket launch. On November 19, 2025, the Laboratory, in conjunction with commercial partner Up Aerospace, conducted the launch at Spaceport America in southern New Mexico. The goal was to test the performance of a new aeroshell featuring a deployable heat shield developed in collaboration with another commercial partner, Redwire Space, assisted by the NASA Ames Research Center, which develops technologies for NASA missions.

The aeroshell is a heat-shield structure designed to protect the payload—the systems and components within the shell—from excessive reentry heating. During ascent, the aeroshell is released from the rocket and deploys its experimental heat shield. After apogee is reached (the highest point in the flight's trajectory), the systems start their descent back to Earth. The heat shield slows the descent of the deployed payload by using a folded metal structure that opens like an umbrella. This ensures that the payload can survive the drop, which can reach speeds greater than 2,000 miles per hour.

Up Aerospace developed the rocket that transported the experimental heat shield into space. The SpaceLoft-XL 18 rocket is a suborbital research rocket designed to carry scientific instruments or experimental payloads into the upper atmosphere or near space for a short-duration mission—typically just a few minutes—before returning to Earth. During the November launch, the rocket soared to a height of approximately 72 miles above the Earth. Cameras and monitoring systems on the heat shield captured data during the 11-minute flight.

■ The SpaceLoft-XL 18 rocket, carrying an experimental heat-shield structure, launches from Spaceport America on November 19, 2025.

Approximately 200 people witnessed the launch, and then the recovery team departed to retrieve the aeroshell and the pieces of the rocket from White Sands Missile Range. Scientists say the recovered aeroshell did not have significant damage, thanks to its slowed descent from the folded origami-inspired design.

This launch represents the sixth flight test in a series of launches conducted in New Mexico since 2021. "We're able to test sensors and new experiments with these rapid launches that can take place approximately every six months instead of traditional rocket launches, which are much more expensive and can only be conducted once every few years," says project lead Jim Wren.

Los Alamos engineer Justin McGlown praised the many partners that made the launch possible. "All the things that are required to survive the actual flight environment are hard to recreate without a flight environment. Now that we have these commercial rocket companies providing us frequent affordable flights, it's just much faster to build something, instrument it, fly it, and test it, and then iterate and improve."

Spaceport America, where the launch took place, is a state-owned, commercial launch and flight-testing facility that enables both private spaceflight (like Virgin Galactic's tourism missions), federally sponsored rocket testing, aerospace research, and other industry and government testing. Up Aerospace maintains a launch complex and payload processing center at the Spaceport.

"New Mexico is a great place to launch rockets," says engineer Jordan Shoemaker. "It's great to be able to just drive a few hours down from Los Alamos to Spaceport America and White Sands Missile Range. These launches provide a fantastic economic opportunity for our state while reducing testing costs and increasing how rapidly we can execute these experiments." ★

Watch the NSRC Digital Collections teams at work in this five-minute video.

NSRC archivist Angie Piccolo, research librarian Laura McGuiness, and Director Brye Steeves review images from the NSRC's collections.

ARCHIVES FOR THE FUTURE

The National Security Research Center collects, curates, and contextualizes past data for present and future national security missions.

BY JENNIFER SNEAD

One of the federal government's largest scientific and technical libraries lives in a building 2,000 miles from Washington, D.C. Here, after passing through multiple security checkpoints, visitors will find J. Robert Oppenheimer's office chair, the patent application for the Fat Man atomic bomb, the technical notebook of Soviet spy Oscar Seborer, and tens of millions (yes, millions) of other media that tell the story of Los Alamos National Laboratory.

Established in 2019, this library—the National Security Research Center (NSRC)—is staffed with research librarians, archivists, historians, data engineers, and knowledge managers who collect, curate, and organize data and information so that it is available to researchers when they need it.

In the era of stockpile stewardship—maintaining nuclear weapons without testing—access to historical weapons data is critical for the Lab's current weapons scientists and engineers. "'Historical data' is not just historical; today's stockpile depends upon it," says NSRC Mission Support Group Leader Julie Maze. "Current weapons developers, engineers, and researchers lean on past knowledge to inform their current work and make informed decisions. They stand on the shoulders of their predecessors."

Although customers can visit in person to access materials, the NSRC is not a stereotypical dusty archive. "It is a 'living library' whose personnel support the Lab's national security mission by digitizing its collections and capturing the knowledge of subject matter experts," Maze says. "The resulting data is then made accessible through artificial intelligence (AI) tools and systems, informing strategic outreach and learning for the Lab's current and future workforce."

The right equipment is crucial to the NSRC's mission. Recently, its Digital Collections group added a high-volume, high-speed scanner to its existing state-of-the-art facilities, significantly reducing processing time for the NSRC's volume of physical records without compromising the image quality necessary for AI-enabled search tools and document processing. A pilot project saved 36 hours of staff labor in scanning the contents of six records boxes; once its settings are fine-tuned, the new scanner is expected to provide the same throughput as 8 to 10 regular paper scanners.

Nanette Mayfield, Digital Collections group leader, underscores the importance of her team's work in curating the NSRC's irreplaceable trove of data and information. "Our group is responsible for ensuring the protection and accessibility of these materials through digitization, making them findable, interoperable, and reusable," she says. "State-of-the-art equipment like our new scanner will allow bulk digitization much faster and with higher quality than currently practical."

With collections growing each year as items are discovered, donated, or cultivated, the NSRC's herculean task to transform its holdings into discoverable data lies at the heart of the Lab's Weapons Research Services division. For Division Leader Jason Kritter, the crux of the NSRC's mission is "to serve as a core competency of Los Alamos by providing researchers with vital knowledge for today's national security mission and tomorrow's discoveries." ★

■ The W88 Alt 370 program addressed aging issues identified during routine surveillance, enhancing the reliability of a critical element of the sea-based leg of America's strategic deterrent. Photo: U.S. Navy

UPDATED WEAPONS HEAD TO SEA

An enterprise-wide effort enhances the U.S. nuclear deterrent.

BY WHITNEY SPIVEY

Los Alamos National Laboratory, together with partners across the nuclear security complex, has completed the last production unit (LPU) of the W88 Alteration (Alt) 370, a multiyear program to modernize the W88 nuclear warhead carried onboard Ohio-class ballistic missile submarines.

The W88 first entered the U.S. nuclear stockpile in 1988. In 2012, the alteration effort began to replace the warhead's arming, fuzing, and firing subsystem and to add safety enhancements, including a lightning-arrestor connector. Sandia National Laboratories and Lockheed Martin led the initial update efforts, while Los Alamos—designer of the original 1980s-era warhead—played a limited role.

That role expanded in 2015, when the Nuclear Weapons Council broadened the scope of the alteration and tasked Los Alamos with refreshing the conventional high explosives and related components within the weapon's nuclear explosive package.

The program reached a major milestone in July 2021, when the first production unit of the W88 Alt 370 was assembled at the Pantex Plant in Amarillo, Texas, and delivered into the stockpile. Four years later, the final unit has now been completed. Achieving this milestone required close collaboration among program managers and technical experts from Los Alamos, Sandia, Pantex, the Y-12 National Security Complex, and the Kansas City National Security Campus, who worked collectively on design, development, qualification, and component production.

"Reaching LPU for the W88 Alt 370 is a landmark accomplishment for this Laboratory and the entire complex," says Anita Carrasco Griego, Weapons Systems division leader. "This program was unlike any other as it was defined by an extraordinary level of reacceptance work, much of it entirely new to us, and carried out under demanding constraints. Our teams met every challenge head-on. Hundreds of people across the complex worked with remarkable tenacity and professionalism to ensure this vital deterrent system was delivered successfully and on schedule. This accomplishment reflects the very best of our Laboratory: innovation under pressure, rigor in the face of the unknown, and unwavering commitment to national security." ★

TRANSLATING KNOWLEDGE

Los Alamos scientists adapt computer codes—and the knowledge embedded in them—to run on a new generation of supercomputers.

BY JILL GIBSON

For a video game enthusiast, it's a relatable problem. You buy a new game console, but now the games you have for your old console aren't compatible with your new system. Fortunately for you, game developers have found ways to adapt their games to run on different systems. The process is called porting—translating the software for a new system. The result: You can buy a new version of the game that will run on your new console. The new version of your old game could even have better graphics and more bells and whistles than the old one.

But what if instead of talking about video games, we're discussing high-performance computer codes used for carrying out specific computational tasks related to national security? Scientists at Los Alamos and Lawrence Livermore national laboratories use the labs' shared supercomputers to run computer codes that simulate the behavior of nuclear weapons. And, just like game developers, scientists have developed codes to run on specific supercomputer systems. So, when these national labs get new supercomputers, scientists must adapt each code.

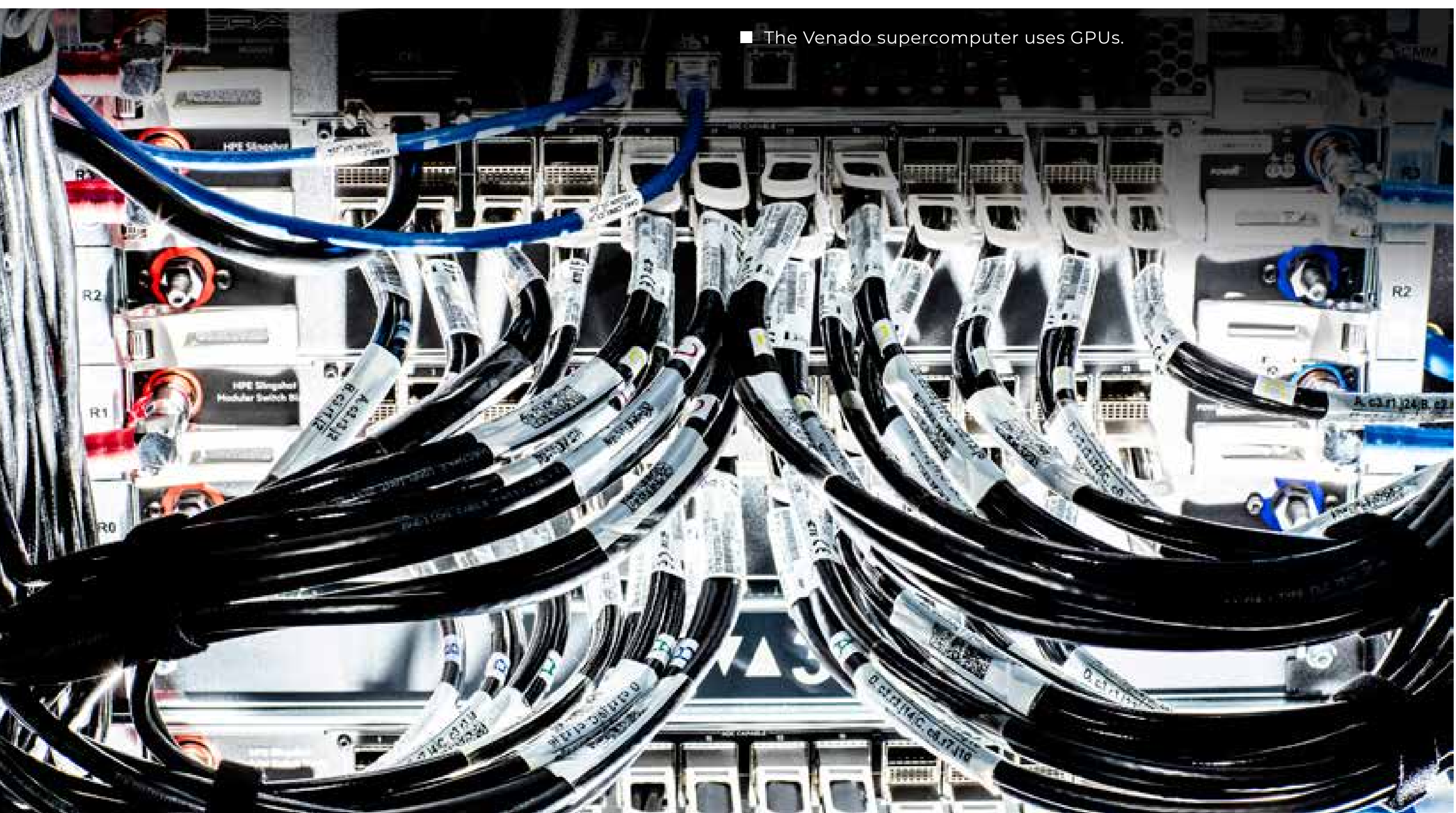
"Los Alamos recently launched a focused effort to modernize our weapons codes by adapting them to run on different computer architectures," says Jimmy Fung, the Lab's Integrated Physics Codes director.

Most of Los Alamos' weapons codes were originally written for computers with central processing unit (CPU) architectures. But many newer computers, including Los Alamos' newest supercomputer, Venado, and Livermore's new exascale computer, El Capitan, use graphics processing units (GPUs). GPUs are specialized processors optimized for parallel data processing. But because CPU and GPU architectures are different, they "speak" different instruction languages—if you try to run a CPU-only program on a GPU, it won't work; the GPU simply won't understand, which prompted the need to port the codes to work on GPUs.

"Over the years, these codes have been ported consistently from one supercomputer to another," says Alan Harrison, Los Alamos Lagrangian Applications Code project leader. "However, the switch to El Capitan is more challenging than most of the previous transitions because El Capitan derives most of its processing power from GPUs." El Capitan is the fastest supercomputer in the world and can perform a billion billion (quintillion) calculations a second. Using a tool developed at Sandia National Laboratories called Kokkos, Los Alamos scientists are rewriting their codes to take advantage of that speed.

"We have significant development work ahead of us, but we are at a stage where we are starting to see the various pieces come together, and this is an exciting time as we prepare to demonstrate 3D stockpile stewardship simulations on the El Capitan," says C. J. Solomon, the Eulerian Applications Code project leader at Los Alamos.

The scientists say this work is paving the way for greater flexibility in the future. "Going forward, we must ask ourselves what runs best where and develop codes with modern techniques that are computer architecture agnostic," Fung says. In the meantime, Fung notes that the modernization efforts will also make it possible to explore artificial intelligence applications with codes and code development. "The bottom line is the Lab's national security mission. Ensuring that our codes run well on new machines is an important part of that." ★



■ The Venado supercomputer uses GPUs.

The sun rises above the Lab's main technical area.

PROTECTING KNOWLEDGE

The Lab's offices of Classification, Countersubversion, and Cyber Assurance keep knowledge safe.

BY JILL GIBSON AND MAUREEN LUNN

Knowledge is one of Los Alamos National Laboratory's most valuable assets. Protecting that knowledge in all its forms—documents, software, databases, equipment, and more—requires numerous people and processes. Here are just a few of the ways the Laboratory ensures knowledge stays safe.

Classification

Classified material is information that requires a specific degree of protection for reasons of national security. Much of the information at Los Alamos, particularly that related to nuclear weapons, is classified. Derivative classifiers and classification analysts are Lab employees who have been trained to identify and categorize classified information, although protecting classified information is the responsibility of all employees with security clearances. "The Office of Classification and Controlled Information works to ensure that all Lab employees protect information that our adversaries could use to compromise our national security," says Classification Officer Maria Peña. "We work to review Los Alamos generated documents to prevent disclosure of protected information to unauthorized persons."

Countersubversion

Subversion refers to deliberate acts of disruption to manufacturing processes, the supply chain, or logistical systems. Countersubversion is the process of monitoring for and detecting possible threats.

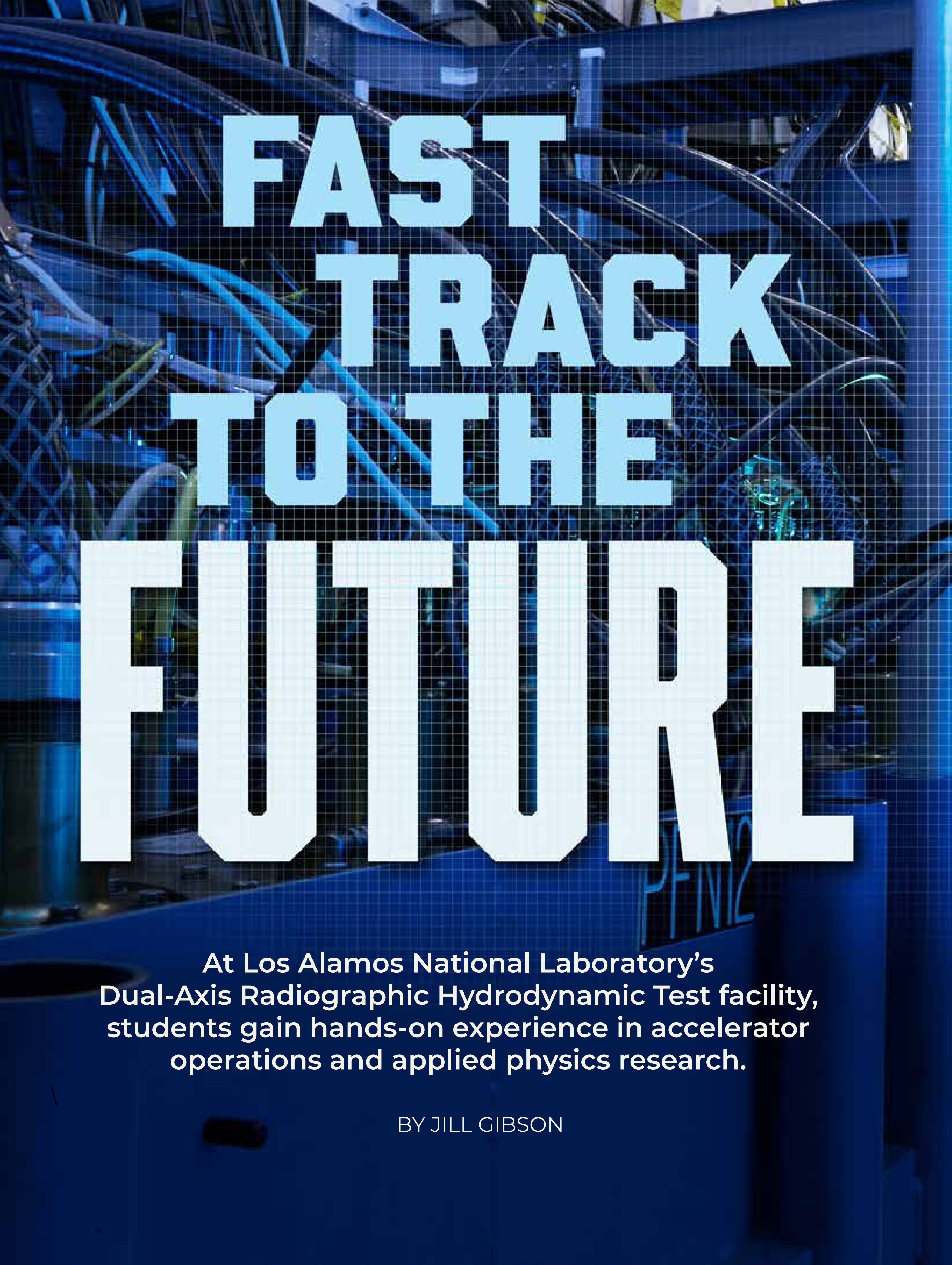
"Here at Los Alamos, our countersubversion experts continually have their eyes on our designs, components, and systems, from the earliest design stages all the way through to production, deployment, and retirement," explains David Dooley, associate Laboratory director for Weapons Production.

At the Lab, the Nuclear Enterprise Assurance (NEA) team uses detection systems to monitor for tampering. As design and manufacturing moves forward, machine operators, inspectors, quality professionals, and managers are trained to detect anomalies and evaluate conditions for potential subversions. The NEA also works with vendors, warehousing, and transportation companies and continually evaluates cyber and technology systems for signs of subversion.

Cyber Assurance

The term cyber assurance refers to monitoring the software tools related to countersubversion. Working in collaboration with the NEA, the Los Alamos Nuclear Weapons Cyber Assurance Laboratory (NWCAL) assesses technology and software used in manufacturing equipment and engineering software tools for potential vulnerabilities.

NWCAL addresses technological and programmatic risks and strengthens the design, engineering, and manufacturing capabilities of the nuclear weapons design, testing, and production infrastructure by identifying and mitigating risks."This work is critical to the U.S. weapons program because it ensures the integrity, reliability, and security of the digital and physical systems that underpin nuclear deterrence," says Rich Taylor, leader of the Weapons Research Services division Secure Networks and Assurance group. "As adversaries develop increasingly sophisticated cyber capabilities, even subtle manipulations of operational technology or engineering software could compromise weapon design fidelity, degrade production quality, or disrupt critical test outcomes. By proactively identifying and mitigating these cyber-physical vulnerabilities, NWCAL plays a vital role in safeguarding the end-to-end lifecycle of nuclear weapons—from concept to deployment, thereby reinforcing strategic stability and national security." ★

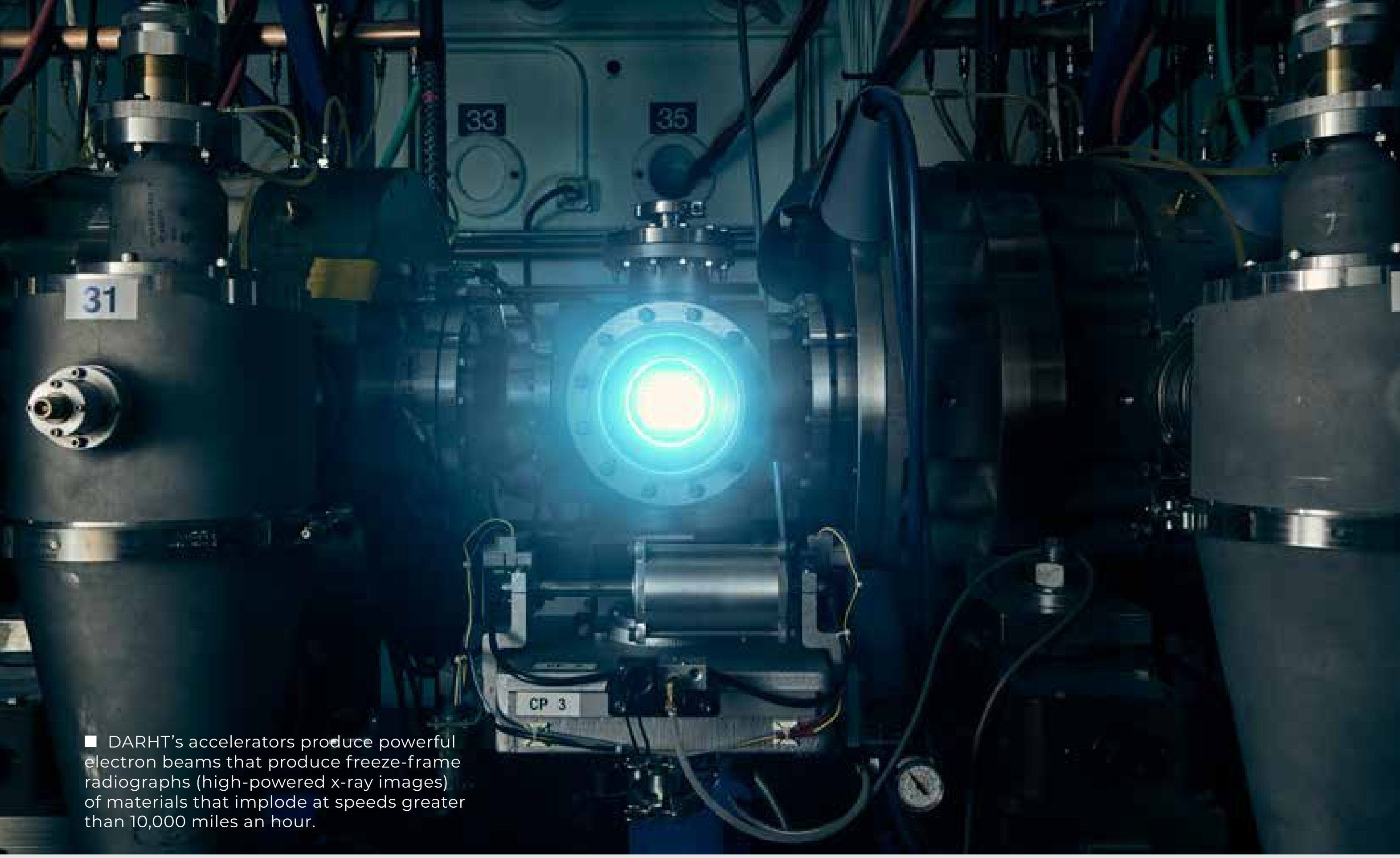


FAST TRACK TO THE FUTURE

At Los Alamos National Laboratory's Dual-Axis Radiographic Hydrodynamic Test facility, students gain hands-on experience in accelerator operations and applied physics research.

BY JILL GIBSON

■ DARHT consists of two linear induction accelerators.



■ DARHT's accelerators produce powerful electron beams that produce freeze-frame radiographs (high-powered x-ray images) of materials that implode at speeds greater than 10,000 miles an hour.

Twenty-three-year-old Jenna Sardelis was at a crossroads. She had completed a bachelor's degree in astrophysics and was trying to decide what to do next.

"I wasn't sure, so I was applying to graduate school and job hunting at the same time," she remembers. "Then, I came across a job posting for a post-bachelor physics researcher at Los Alamos National Laboratory."

A few months later, Sardelis moved from Florida to New Mexico for a unique hands-on learning experience in accelerator physics at the Lab's Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility, which uses two linear accelerators to conduct experiments to help ensure the safety, security, and effectiveness of the nation's nuclear weapons.

"I have gained so much knowledge here," Sardelis says. "You are never not learning. It's an incredible opportunity."

Sardelis owes much of her good fortune to Los Alamos physicist David Moir. About two years ago, Moir came up with the idea of starting a postbaccalaureate program for the Lab's Engineering, Operations, and Physics group within the Integrated Weapons Experiments division. This group develops DARHT capabilities, operates the accelerator, and conducts research and development.

Moir, who started working at Los Alamos 54 years ago as a graduate student, wanted to create a pipeline of qualified young physicists. He proposed hiring students who had recently completed their bachelor's degrees. His goal was for the recent college grads to help with research and operations while gaining skills and knowledge and preparing for graduate school. Moir had seen that graduate programs in physics were becoming increasingly competitive due to decreased funding. With fewer graduates to choose from, he was worried the Lab might struggle to find qualified scientists in future years.

"At first I was hesitant," says Howard Bender, who leads the group. Then he considered how fast the workload at DARHT was growing. "With the demands of the experiments for the W93 [the new nuclear warhead that the Lab is designing for the U.S. Navy's submarine-launched ballistic missiles] and other modernization efforts, we have to have the people." So, Bender gave the proposal the green light and says he hasn't regretted the decision. "When I met the first cohort of students, I realized, 'Wow, this could work.'"

Moir hired three students in the first year and four in the second. "These were very strong applicants," says Mike Jaworski, the group's physics team leader. "Through this program, we are already hiring and preparing the sort of folks our Lab needs." After completing a year in the program, one of the students has already left for graduate school but is staying in touch with his Los Alamos mentors. "If these students end up back at the Lab after grad school," Jaworski says, "it's a huge win."

Operating accelerators

DARHT consists of two linear-induction accelerators arranged at right angles to one another. Each accelerator produces a powerful electron beam. Within the accelerator, magnets couple to the electrostatic fields and accelerate electrons to extremely high energies. The high-energy electrons hit a metal target and are deflected, converting the beam's kinetic energy into x-rays to produce freeze-frame radiographs (high-powered x-ray images) of mock nuclear weapons components detonating inside a steel containment vessel. These images, along with information produced by other tools, create data sets that scientists use to improve and verify computer models for nuclear weapons. "DARHT plays a critical role in national security," Bender says. "That's why it's essential that we hire people who understand the facility. These students are filling a gap."

Before starting the postbaccalaureate program, Thomas Magee completed an internship at Los Alamos while earning his bachelor's degree in physics and aerospace engineering at Texas A&M University. Magee says he was excited for the opportunity to return to the Lab after graduation. "We are getting on-the-job training in a one-of-a-kind facility," he says. "You don't get classes like this in school."

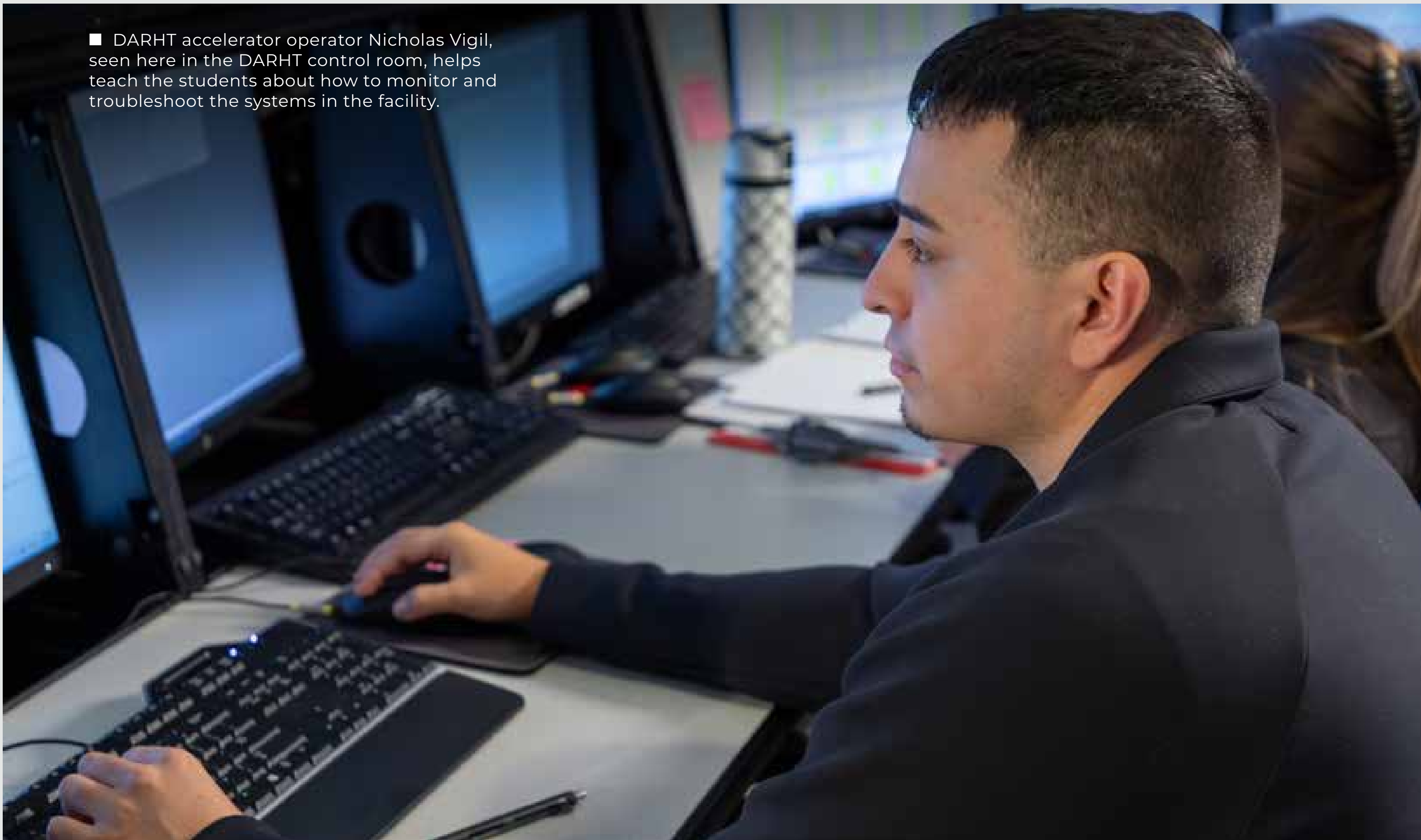
Students begin the program by developing a thorough understanding of the facility. They start by training alongside the accelerator operators."We basically embed them with the operators so they can build familiarity with the tools and how DARHT's functions impact experimental results," Moir says.

The operators teach the students about the facility's many systems. "We monitor everything," explains accelerator operator Nicholas Vigil. "Magnets, vacuum, power supply, target… there's always a problem to solve." Operators also train the students to press the button to initiate, or fire, the experiment. This is an opportunity that few students in physics graduate programs (and even fewer in bachelor's programs) ever get.

> **"DARHT plays a critical role in national security. That's why it's essential that we hire people who understand the facility."**
>
> —HOWARD BENDER

Jasmaine Baca, another accelerator operator, helps the students master the unique vocabulary and skillset needed to operate the accelerators. "Our work is very hands-on, and the students are fast learners," she says.

The students learn to run the accelerators and troubleshoot issues. They analyze photon and bremsstrahlung radiation and become proficient using equipment, including digital oscilloscopes, high-speed cameras, and fiber-optic spectrometers. They discuss experiments with the accelerator operators and the physicists in the group.



■ DARHT accelerator operator Nicholas Vigil, seen here in the DARHT control room, helps teach the students about how to monitor and troubleshoot the systems in the facility.

> "I love this job. I love what I do and the people I work with."
>
> —JENNA SARDELIS

Operations team leader Manolito Sanchez says that, although the students learn from the operators, the operators also learn from the students. "We have a collaborative relationship," Sanchez says. "They teach us a lot." Sanchez, who has worked at the Lab for 27 years, says there's always something new to learn about the facility. "This is the most interesting place I have ever worked," he adds, noting that the students bring in new ideas and questions, challenging the operators and sharing perspectives from their physics training with the technical staff.

"I am actually applying everything I learned in my undergraduate physics classes," says Owen Sneddon, who began the program after completing his bachelor's at California State University, Long Beach. "We're getting once-in-a-lifetime opportunities to gain an understanding of the complexity of an accelerator and its subsystems. There are lots of moving parts."

As their mentors have explained, understanding all those moving parts and how they interact and impact experiments is crucial for the students' growth as physicists. "While we are doing experiments, it's important for us to know how the machine is working," says Michigan State University physics graduate Sienna Frost. "Particle accelerators are not taught in college."

Conducting research

After spending approximately six months learning to work as accelerator operators, the students begin research.

"Our projects are based on questions that the physicists in the group want to explore," Sardelis says. One of Sardelis' projects is designed to help prepare the DARHT facility for the possible addition of a third electron beamline to expand capabilities. Her work involves analyzing the radiation emitted by the second beamline and predicting possible impacts on experiments.

Like every other part of the program, the research is adding to her overall knowledge of accelerator physics. "Whether we are operating the accelerators or doing experiments, we are learning every day," she says.

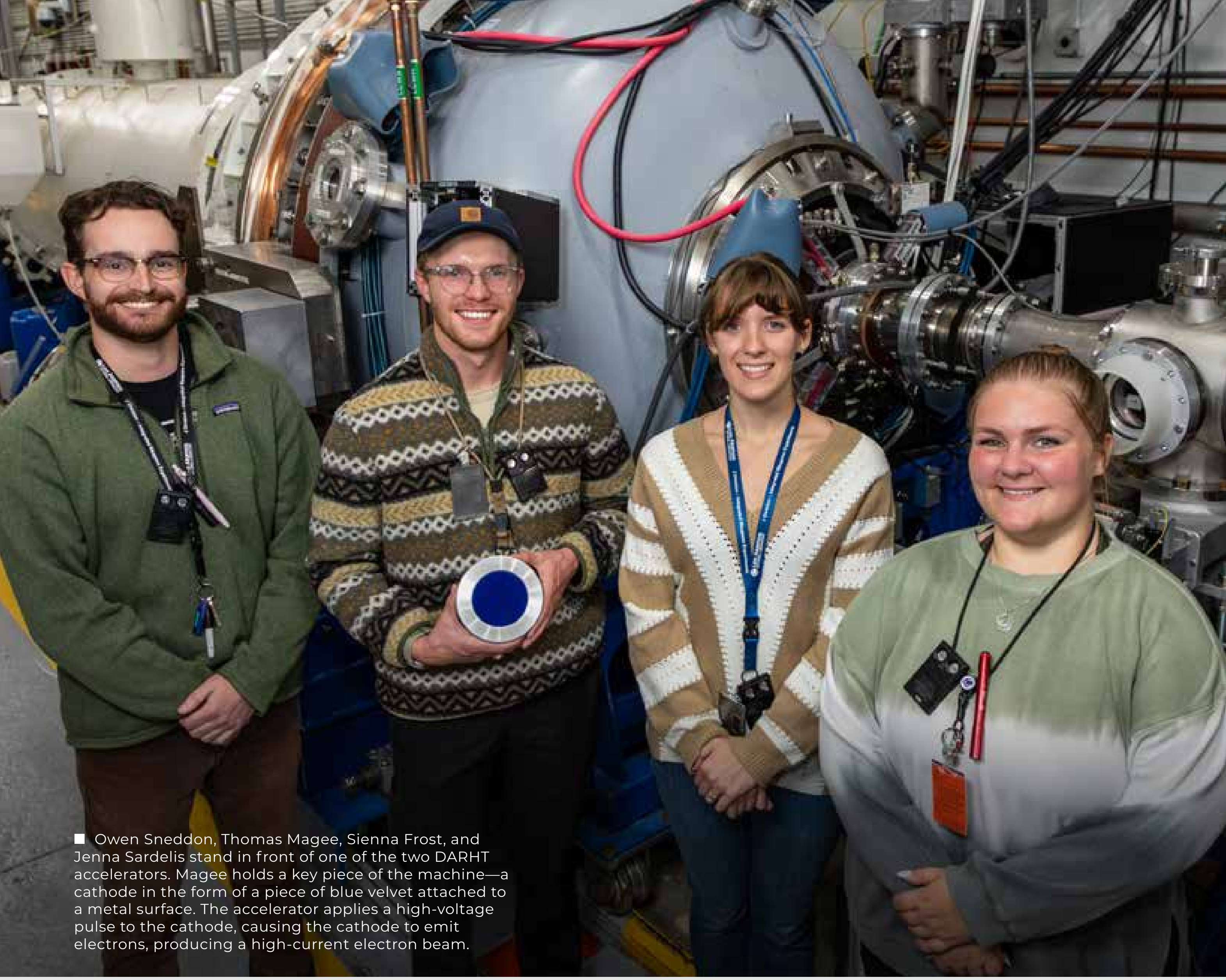
Sneddon is working on a project that involves using gamma spectroscopy to study materials that become briefly radioactive when exposed to high-energy photons. "This helps improve how we measure radiation doses during radiography at DARHT," he explains. "My experiment has left me with questions that only further experiments can answer."

Moir says he tries to encourage such curiosity. "There's nothing better than being asked a question," he says.

"We have lots of back and forth—lots of different perspectives," Magee says. "Everybody knows something you don't know, and you might know something someone else doesn't."

Magee is collaborating with Frost on research that applies computer modeling and simulation to experimental designs.

■ The students and physicists meet regularly at a local coffee shop to discuss their work. Mentorship, hands-on experience, and supportive relationships have made the DARHT post-bachelor's program a success.



■ Owen Sneddon, Thomas Magee, Sienna Frost, and Jenna Sardelis stand in front of one of the two DARHT accelerators. Magee holds a key piece of the machine—a cathode in the form of a piece of blue velvet attached to a metal surface. The accelerator applies a high-voltage pulse to the cathode, causing the cathode to emit electrons, producing a high-current electron beam.

"I went from feeling kind of unsure about applying for grad school to conducting graduate-level research at a national lab," Magee says.

Jaworski points out that, as recent bachelor's graduates, the students didn't come to the Lab with significant research experience. "In college, they were assigned homework. Here, we are telling them, 'we have a problem, and we don't know how to solve it,'" he explains. "Our goal is to make them independent researchers. We are essentially research advisors. We treat them like graduate students, mentoring them, reviewing, and supporting their work."

As part of this research, Jaworski ensures the students receive support to travel to professional conferences and other accelerator facilities to conduct and view experiments. "Part of doing research in modern times is learning that no one lab has everything. It becomes part of the skillset to travel to and work with other labs."

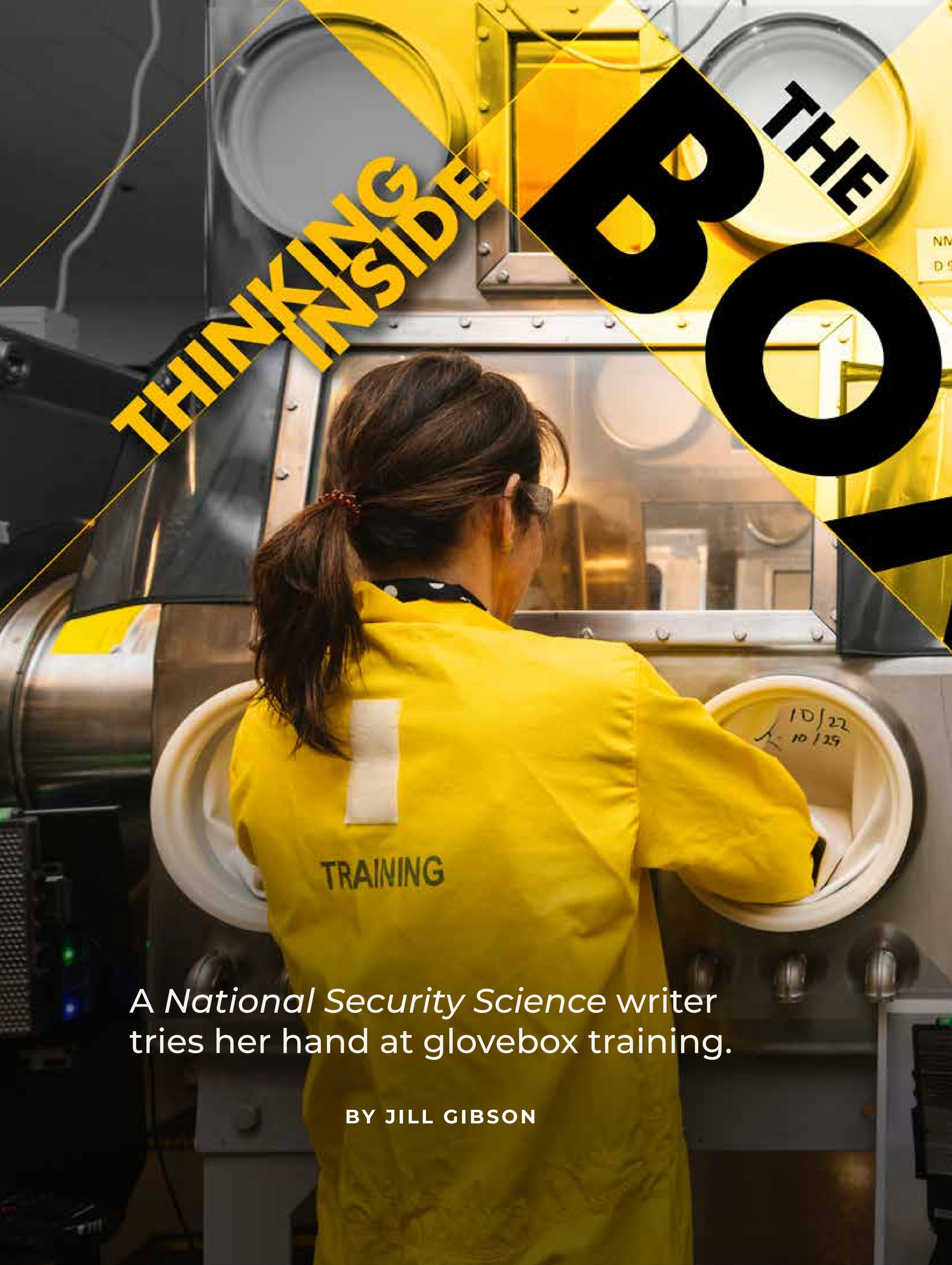
The students also can attend classes through the U.S. Particle Accelerator School, a national program that offers training related to particle accelerators and associated systems. Additionally, the students have access to tours, seminars, and colloquia offered at the Lab. "Los Alamos has lots of resources for students, and we encourage them to take advantage of that," Jaworski says.

But both the students and scientists agree that some of the best resources are the informal ones. Every other Friday at 8 a.m., the physicists and students meet on the patio of a local coffee shop. Armed with laughter and caffeine, they discuss recent success and failures. Both the mentors and the students welcome the opportunity to interact and learn.

"I love this job," Sardelis says. "I love what I do and the people I work with."

Meanwhile, Moir is gearing up to start reviewing applications for the next cohort of postbaccalaureate students. "Sifting through applications and interviewing the students takes some time and effort," he says, "but, we're growing the next generation of accelerator physicists, and that's an investment that will pay off." ★

Thinking Inside the Box



A *National Security Science* writer tries her hand at glovebox training.

BY JILL GIBSON

■ Technical trainer Daniel Garcia (right) instructs writer Jill Gibson on how to properly place her hands inside a glovebox. These glass and steel enclosures allow staff at Los Alamos National Laboratory to handle radioactive materials, such as plutonium, safely.

With her hands inserted in the long lead-lined gloves attached to the glovebox, Gibson wiggles her fingers to test her dexterity. Thicker and heavier gloves are used for certain tasks, while lighter-weight gloves are used for others.

The adage goes that you can't understand someone's life until you've walked a mile in their shoes. Recently, I set out to see whether I could understand someone's job by training an hour in their gloves. That's right—I wanted (literal) hands-on experience as a glovebox worker at Los Alamos National Laboratory.

Gloveboxes are sealed, steel compartments inside which radioactive materials can be safely handled. Long, heavy gloves are attached and secured to openings in the glovebox. Technicians insert their hands into the gloves to carry out a wide variety of processes inside the enclosures. One of the most important processes that requires gloveboxes is the making of plutonium pits—the cores of nuclear weapons.

A pit is a hollow sphere of plutonium that, when uniformly compressed by explosives inside a warhead or bomb, causes a nuclear explosion. Los Alamos produced the first plutonium pits in 1945 during the Manhattan Project and is now making new pits by refining and recasting plutonium from old weapons. Currently, the Lab is the only place in the United States where technicians build pits, which means supervisors can't rely on hiring people with pit-making experience. New hires must learn one-of-a-kind skills for a one-of-a-kind job that takes place in a one-of-a-kind building. It's a steep learning curve.

Inside gloveboxes, employees purify plutonium, cast it, machine it, measure it, test it, and more, often moving parts between different boxes using an electronic trolley system (that works like a small, horizontal elevator). But, before technicians can master specific processes, they must learn numerous safety protocols and pass written and hands-on evaluations. This training takes place through the Lab's New Employee Training (NET) Academy for Nuclear Facility Workers, so that's where I head to begin my exploration of how glovebox operators develop knowledge and skills for their unique jobs.

A paradigm shift in training

Kristan Cisneros, who leads NET Academy, says that since its start in 2020, the Academy has trained nearly 1,000 people in glovebox operations and fissile materials handling, which certifies them to work with nuclear materials capable of sustaining a fission chain reaction. "We bring in cohorts of 20–30 people roughly monthly," she explains, noting that people can begin the training while obtaining the security clearances that enable them to work in the buildings where pit manufacturing takes place. Cisneros says this has increased efficiency and cut down on past training bottlenecks, which is helping the Lab achieve its pit production goals. "This is the only facility like this in the nation.

You cannot bring in anybody that has the skill set that we need. So NET Academy is vital in providing those hires that foundation of knowledge for safety, for security, and for the work that they're going to be able to do."

At NET Academy, the new hires have lectures, assigned reading, and testing before the practical training begins. Along the way, they undergo various evaluations. Although that could sound a bit intimidating, Cisneros says the employees have lots of support. "NET Academy provides the new hires with guidance and mentors. We build relationships and trust, and they know that if they have questions or problems even after their training, they can always reach back out, which boosts retention."

Amanda Quintana supervises the technical trainers who instruct the new hires. "It's a high-stress job for the trainers because they're the ones who say, 'yes, we believe this individual is capable and has the knowledge to move forward,'" she says. Quintana points out that all the trainers have extensive experience working with nuclear materials, usually within the Lab's Plutonium Facility, known as PF-4, at Los Alamos. She says the trainers are committed to each new employee's success. "We're here to help them. We're here to make that connection. We're here to get that piece where the lightbulb turns on over their head and they understand why, or what, or how."

Quintana explains that training begins by going over procedures, safety, compliance regulations, and more. Although I'm eager to get a true "new hire experience," I decide to skip the paperwork, lectures, and tests (which is not something real technicians can choose to do). The next part of the training involves touring PF-4, the facility where the plutonium pits are built.

A rare glimpse inside

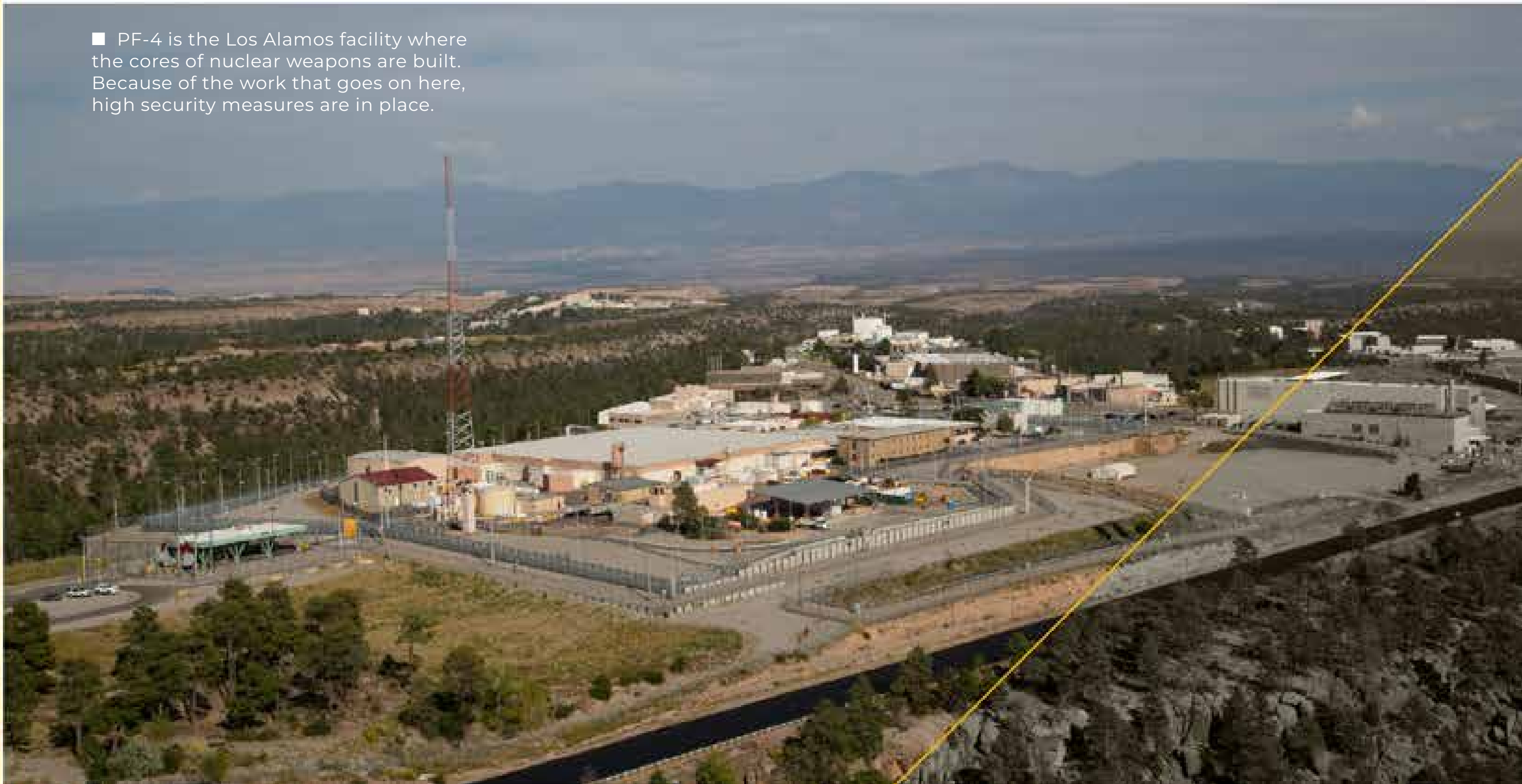
Visits to PF-4 are limited because of a combination of strong security measures and the facility simply being too busy to accommodate guests. I'm able to join an informational tour that is not geared toward training glovebox operators, but I hope it will provide some insights into the work and the plutonium facility.

To enter the building, we pass through numerous security checkpoints, including a state-of-the-art metal detector portal. Armed guards ensure no one gets in without thorough screening—a complicated process that doesn't just apply to visitors. More than 1,000 employees pass through these checkpoints each day.

> "I wanted (literal) hands-on experience as a glovebox worker at Los Alamos National Laboratory."
> —JILL GIBSON

As a visitor, I am instructed to not wear any metal (including jewelry, an underwire bra, or outfits with a lot of snaps or zippers). Over my clothes, I wear a lab coat and shoe covers, but most employees wear yellow coveralls, adding hard hats and other personal protection equipment (sometimes including respirators), depending on the requirements of their jobs.

Most staff members work 10-hour shifts, and once inside the windowless 233,000-square-foot building, many will stay there all day. There are breakrooms and a cafeteria in a nearby building, plus picnic tables and even food trucks just outside for employees to use during breaks.



PF-4 is the Los Alamos facility where the cores of nuclear weapons are built. Because of the work that goes on here, high security measures are in place.

> NET Academy is vital in providing those hires that foundation of knowledge for safety, for security, and for the work that they're going to be able to do."
>
> **—KRISTAN CISNEROS**

With staggered entry times and the recent addition of night and weekend shifts, PF-4 is always busy. When production teams aren't doing hands-on tasks (and sometimes even when they are working), construction crews swarm in to chip away at a plethora of facility modernization and expansion projects.

Our group visits several labs where the various processes related to pit-building take place. The rooms are filled with rows of gloveboxes, those overhead elevator-like trolleys, and a complex series of tubes, vents, cables, and other equipment.

Unlike my workplace, the rooms have no chairs or desks. Glovebox work must be performed while standing. Anti-fatigue mats soften the strain of concrete floors, and step blocks allow technicians of all heights to reach the glove ports and see inside the contained areas where they perform their work.

Signs, monitors, radiation detectors, and a highly structured sequence of procedures are in place to maintain worker safety. Employees must master important rules and processes related to working inside this nuclear facility—and that's in addition to learning to conduct procedures with their hands inside a glovebox and developing the specific technical skills related to their roles.

After two hours in the facility, I have learned a lot, but the main thing I've learned is …there's a lot to learn. My goal had been to try my hand at an introduction to glovebox training. Now, I'm wondering, "Could I do this?" The next week, I head back to NET Academy to find out.

A chance to try my hand

Daniel Garcia will be my trainer. He has been at the Lab for 31 years and has spent 19 of those working in gloveboxes in PF-4 and 6 years as a technical trainer. We will be training in what is called a cold lab—there are no "hot" radioactive materials here. The room where I will learn to work inside a glovebox is a mock facility.

With Garcia's help, I suit up in the yellow coveralls, shoe covers, safety glasses, and the rubber gloves that I will wear the entire time I am "working," including when inserting my hands into the gloves of the glovebox. He helps me secure the edge of my gloves to my coveralls with masking tape to create a secure seal. "This is your anti-C—anti contamination—gear," he explains. But, before we can enter the lab, Garcia instructs me on the entry procedures, which include checking signage on the door, reviewing documents, and looking through the window into the lab to ensure there are no problems or issues inside. I'm starting to get impatient, but Garcia insists we do everything by the book.

Finally, inside the cold lab, I see rows of gloveboxes similar to the ones in PF-4. Garcia instructs me on how to check the gloves, the front of the glovebox, glass windows, and the port and ring holding the gloves. We swipe across every surface with a cloth, repeatedly surveying for radiological contamination (of course, there isn't any in this mock facility) and examining the gloves for any discoloration, tears, or defects. "There are many controls in place that are meant to keep you safe," Garcia says.

After what feels like forever—and is actually about 20 minutes—it's time for me to insert my gloved hands into the lead-lined gloves attached to the glovebox.

"Put your hand in, and push it inside the box across your body," Garcia says. I struggle with the long, heavy glove, finally managing to get my hand and fingers inside and push my arm into the glovebox. The glove is cumbersome, longer than my fingers, and difficult to bend.

"Now the other hand," says Garcia. He instructs me on ergonometric approaches to moving my fingers. "Use a power grip with your hand in a neutral position, not pincers," he urges me, demonstrating by slipping his hands into the glovebox beside mine and picking up a roll of tape that's inside the box. My first inclination is to pinch my index finger and thumb together, but Gracia explains that using my fingers as pincers could cause muscle strain. Following his guidance, I try to hold my hand level (the neutral position) and grasp objects using all my fingers curled like a letter "c" (a power grip). After a few tries, I can lift the tape and hand it back and forth to Garcia, but my fine-motor-control is limited. "We use different gloves depending on the task and the amount of radiation shielding needed," explains Garcia. "The ones you are using right now are the thickest."

I angle my body against the glovebox, straining to look inside the glass window. "It's hard to see in different positions so you have to learn how to work in your area," Garcia says. "You must have an intense mental concentration on the task that you're performing while also considering everything else—the glovebox, the zone of ventilation, your position, the documents you're required to refer to and maintain." When I say I feel fortunate to get individual instruction, Garcia replies, "We have a ratio of three students to one instructor to maintain the attention of the individuals participating and to get more interaction between the instructor and the students. But when it comes time for evaluation, it is one-on-one."

There are also procedures for removing my hands from the glovebox, checking for radiological contamination, and tying the gloves together, inside out,

■ Garcia teaches Gibson the proper method for removing her hands from the glovebox. As with all procedures related to glovebox operations, workers follow strict safety procedures to prevent radiological contamination.

outside the box to indicate they are not being used. Ending a glovebox session takes almost as long as beginning one. As a writer, I reflect that it rarely takes more than a minute for me to begin and end a project—turn on the computer and open a Microsoft Word document, save, and turn off the computer when done. I am unaccustomed to the level of detail Garcia expects from me. “You can’t be sloppy or haphazard,” he says. “You must conduct your work in certain ways to keep you and your coworkers safe and keep the equipment and the facility in operation.”

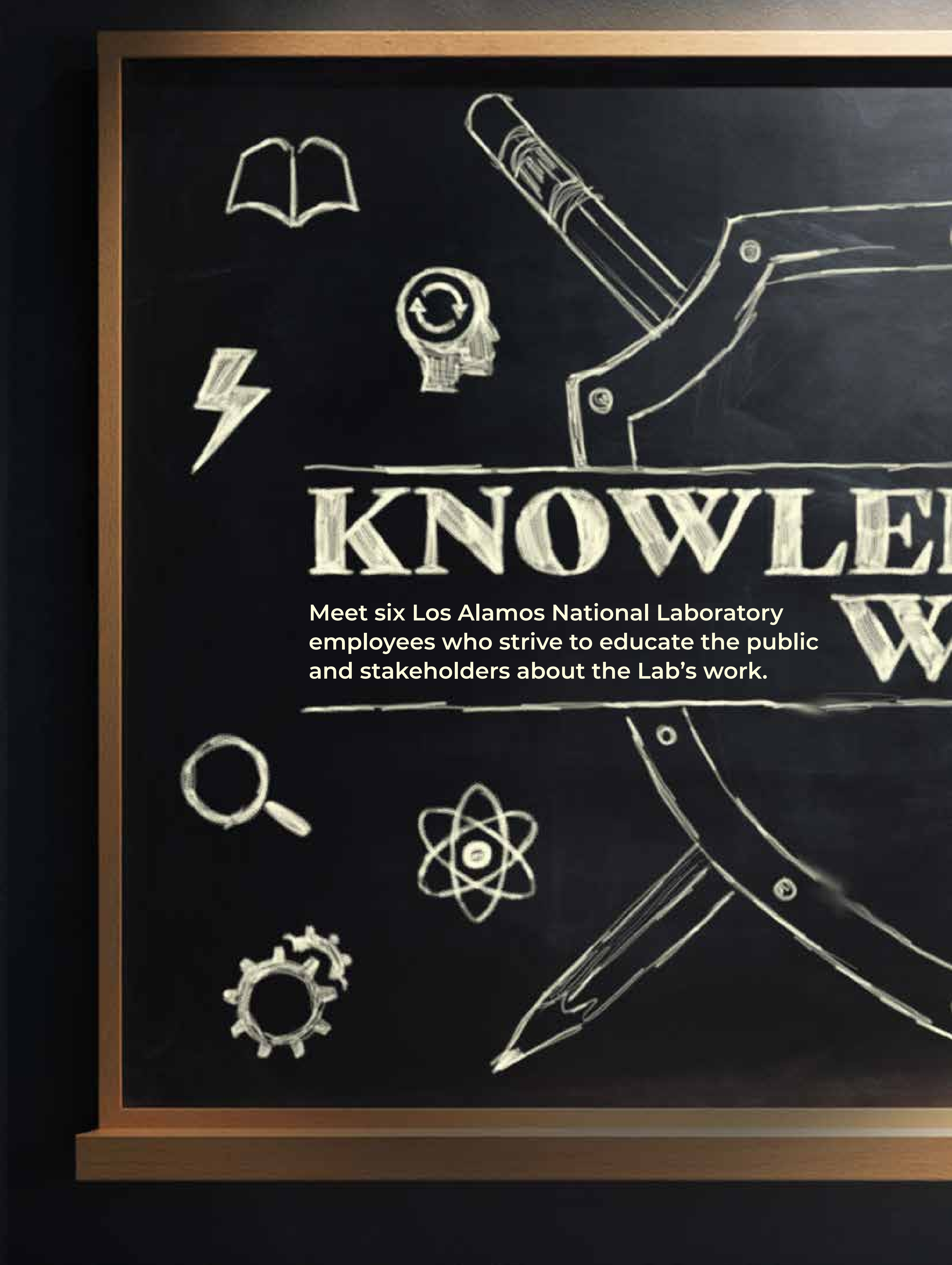
Garcia laughs when I tell him my hands are tired after just a few minutes in the glovebox. He points out that proper training and hand positioning helps with that, adding that dedicated ergonometric experts at the Lab provide guidance to help workers avoid fatigue and prevent injury. Although I don’t have time for a consultation with a glovebox ergonomist, later that day, I watch one of the ergonometric program’s glovebox worker stretching videos. Many of the stretches focus on the hands, and others involve the full body. Working in a glovebox can be a physically demanding job.

I’m accustomed to using my hands for typing, but I find that wearing the heavy gloves taxes a different set of muscles. “Do your hands get tired when using the glovebox?” I ask Garcia, who responds that as he has aged, he has lost some stamina and strength in his hands.

I ask Garcia how people respond to the three-hour glovebox training sessions. He says the new hires say they really enjoy the practical training and welcome the hands-on work. He adds that after the initial qualification and certification, glovebox operators move on to work with mentors who train them on specific processes. Once they begin work in PF-4, they must requalify and recertify every two years.

I am anxious to rip off my anti-contamination gear, but instead, I try to follow Garcia’s methodical instructions. I thank him for the training and for his thorough and patient instruction. “The approach to training is very deliberate so we can make it clear that safety is always first and foremost in people’s minds, but also that there’s a lot of support,” says Garcia. “Also, I want our new employees to have pride in their jobs, to understand that the work they do has an impact on our whole nation.”

I leave the cold lab with great respect for the glovebox operators, their trainers, and the work that goes on at PF-4. I have trained an hour in their gloves (okay, it was more like 15 minutes, but who’s counting), and now I have a much better understanding of the knowledge and skills required to be a glovebox operator and the important role these Los Alamos National Laboratory employees play in national security. Now, I must go home to rest my hands. ★



Meet six Los Alamos National Laboratory employees who strive to educate the public and stakeholders about the Lab's work.

BY WHITNEY SPIVEY

SENIOR HISTORIAN

"Science is not imperceptible to the public, but it's often spoken in a language most people have not learned," says Alan Carr. "As a historian, I strive to make our scientific history accessible—and even exciting—to broad audiences."

Carr, who has worked at Los Alamos National Laboratory since 2003, doesn't aim to persuade audiences about how past events unfolded. Instead, he seeks to create accurate, engaging portrayals of history that educate and inspire. Recovering forgotten stories is a bonus. "Few things are more satisfying than discovering an elusive fragment from the past that helps us better understand our present," he says.

For Carr, acquiring new information is an opportunity to grow as a historian. "Embrace opportunities to revise your understanding," he advises. "Consider unfamiliar possibilities and perspectives. Expect surprises. Treasure feedback. Never be afraid to ask questions or admit, 'I don't know.' And never stop listening."

Carr frequently lectures at the Laboratory and is a familiar voice in local and national media, as well as at historical conferences and panels across the country. An expert on Manhattan Project and Cold War history, he's also known for his engaging presentation style—marked by a subtle Texas accent, sharp wit, and rich multimedia that brings his stories to life. "The past is multidimensional," he says. "Our interpretation of it should be, too."

Regardless of audience or venue, Carr's goal remains the same: to illuminate the Laboratory's history to inspire the future. "Over the past 80 years, Los Alamos has built a nearly unmatched legacy of technical innovation and discovery," he says. "Remembering our scientific lineage can help create an even greater future." ◆

Jonathan Creel

PROGRAM MANAGER, MANHATTAN PROJECT NATIONAL HISTORICAL PARK

Many Manhattan Project structures were built hastily and with little documentation. Eighty years later, Jonathan Creel, the Lab's program manager for the Los Alamos branch of Manhattan Project National Historical Park, is responsible for preserving those fragile buildings—and for helping the public experience them.

Maintaining authenticity while ensuring safety is a balancing act. "These buildings have to be free of hazards like asbestos and rodents, but they also need to look and feel as they did in the 1940s," Creel says. "I want people to step into these spaces and feel like they are actually stepping back in time to the Manhattan Project."

That sense of history is palpable at places like the Slotin Building, where physicist Louis Slotin suffered a fatal criticality accident in 1946. "The building's period of significance is less than a fraction of a second," Creel notes, "but that moment forever changed how the Laboratory operates."

Getting the details right is sometimes a challenge. "We're trying to solve problems that no other preservation professionals have to solve," Creel says. "For example, no one else is trying to replicate the spark-resistant Hubbellite flooring that was used in high-explosives facilities." The solution, he adds, is surprisingly simple: red paint mixed with sand.

Tim Goorley

CHIEF SCIENTIST FOR NUCLEAR WEAPONS EFFECTS

Some days, Tim Goorley feels like a movie critic. "I talk a lot about what people see in the movies: *Terminator*, *Alien*, *Wolverine*, and now *Mission Impossible 8*," he explains. "I point out that Hollywood gets it wrong all the time—those effects are simply too big."

Goorley is talking about weapons effects—what happens when a nuclear weapon detonates. His audiences are often members of the military: potential users of nuclear weapons who are not necessarily technical experts. "Effects are sometimes difficult to explain," Goorley says. "So I try to relate scientific quantities to things most people can grasp—like the pressure you feel at the bottom of a pool, the pain of a second-degree sunburn, or the force of the wind on your hand when you stick it out of a car window going 100 miles per hour."

To help make those concepts even more tangible, Goorley often turns to the Lab's nuclear testing video archives, always mindful of classification limits. "They say a photo is worth a thousand words," he notes. "Well, a movie is worth a thousand photos. And a complicated Mach stem—when a shock wave and its reflection merge—captured on film is priceless."

When communicating with any audience, Goorley's goal is to serve as a trusted source—someone who can provide accurate, unbiased information about weapons effects, regardless of which laboratory (Los Alamos or Lawrence Livermore) designed the weapon. "I'm weapon-agnostic," he says. "I don't advocate for Los Alamos over Livermore. I'm just the guy who can tell you what a particular detonation will do."

Goorley acknowledges that discussions of weapons effects can be polarizing. "When I talk to people—especially members of the public—I try to be mindful and respectful of their experiences," he says. "Someone might be a Hiroshima or Nagasaki survivor. Someone might have lived downwind of the Trinity test. We should never deny people their experiences or emotions. Sometimes we're called to go beyond science and engage on a human level." ◆

Because the park sites are on restricted Laboratory property, public access is limited. Some structures—such as the Slotin Building—can be visited during guided tours offered through a lottery system. In 2025, more than 3,000 people vied for just 180 tour spots. Since the release of *Oppenheimer*, "people are flying in from all over the country for a four-hour tour—which most of them say feels too short," Creel says. "We aren't likely to make the tours longer, but every year we do manage to give more tours to more people."

During tours, Creel likes to emphasize the creativeness and resourcefulness of the Manhattan Project scientists. "When they realized that high explosives melt like chocolate, they called major candy companies—and that's why we have two giant candy kettles out at V-Site," he says. "Kettles like these were used to make the explosive lenses for the Trinity Gadget and the Fat Man bomb. That kind of ingenuity is really fascinating to me." ◆

Paula Knepper

DEPUTY DIRECTOR, CENTER FOR NATIONAL SECURITY AND INTERNATIONAL STUDIES

The Center for National Security and International Studies helps connect Los Alamos science and technology with the broader policy and strategy conversations that shape national and global security. "As the Center's deputy director, much of my work involves translation between disciplines," says Paula Knepper. "I help scientists understand what policymakers need, and I help policy audiences grasp the scientific and technical foundations of national security."

During her 30 years at Los Alamos, Knepper has seen those conversations evolve. "A decade ago, discussions centered more on legacy nuclear issues—stockpile stewardship, nonproliferation, arms control, and deterrence," she explains. "Those topics remain vital, but today's audiences are equally focused on emerging technologies such as AI, biothreats, and cyber."

Whether she's hosting an interactive workshop or mentoring new employees, Knepper focuses on context. "Even when the details of our work can't be shared publicly, the why almost always can," she says. "Framing science in terms of its national purpose—whether that's safety, deterrence, nonproliferation, emerging technologies, or crisis decision-making—helps audiences see the relevance of what we do."

Equally important, she says, is connection. "Connection is how we invest in knowledge itself," Knepper explains. "In a world of increasing polarization and misinformation, building understanding around national security science is both an act of service and an act of stewardship."

For Knepper, sharing knowledge is essential to the Laboratory's mission. "Knowledge doesn't serve its purpose if it stays locked within institutional walls or remains accessible only to experts," she says. "It needs to flow, to be passed forward. That's especially true in national security, where today's emerging challenges will be tomorrow's crises. The next generation of leaders needs both the technical foundation and the contextual wisdom to navigate them effectively. Strengthening the bridge between knowledge and trust is how we ensure the Lab's expertise continues to serve the nation for generations to come." ◆

Patrick Moore

DIRECTOR, BRADBURY SCIENCE MUSEUM

As a kid growing up in Los Alamos, Patrick Moore and his family often took visitors to the Laboratory's Bradbury Science Museum. Back then, the unclassified museum was located at the Lab's main technical area, its entrance flanked by replicas of Fat Man and Little Boy.

Some 40 years later—after a career spanning research, historic interpretation, and preservation at organizations including NASA, the National Park Service, the U.S. Navy, and the Smithsonian Institution—Moore returned home as the Bradbury's director. His mission is to inspire the next generation of Los Alamos kids and visitors to the small mountain town.

"I make a point of taking time each day to engage with the public," says Moore, noting that the museum, now located in downtown Los Alamos, welcomes up to 70,000 visitors annually. He's observed a shift in recent years. "For a long time, the museum primarily attracted people who already had a connection to the Lab," he explains. "Now, since Christopher Nolan's *Oppenheimer* movie, people are discovering Los Alamos for the first time—and coming here specifically to learn more."

Moore also notes that today's audiences are increasingly aware of global tensions and are curious about the Laboratory's role in national

Anna Llobet

SCIENTIST, DIRECTOR OF THE SUMMER PHYSICS CAMP, MEMBER OF THE OPPENHEIMER MEMORIAL COMMITTEE

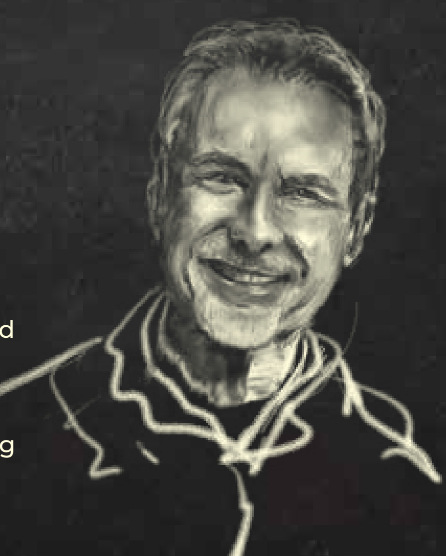
Experimental physicist Anna Llobet believes that science belongs to all. “It’s important that we bring the love and thrill of knowledge to everyone,” she says.

To that end, Llobet founded the Summer Physics Camp, a two-week program that introduces students from New Mexico and Hawaii to careers in science, technology, engineering, and math (STEM). The camp blends hands-on experimentation with mentorship from scientists across the Laboratory—an approach that has inspired many participants to pursue STEM degrees.

In 2023, Llobet was elected vice-chair of the J. Robert Oppenheimer Memorial Committee, which honors the Lab’s first director by promoting science education and preserving his legacy. The physics camp and the committee share a common goal: to make science accessible and relevant to people of all backgrounds. “Science and technology have brought longevity to humanity,” she says. “But for science to guide public policy and shape our future, society must first trust it from an educated standpoint.”

Originally from Barcelona, Spain, Llobet joined Los Alamos as a postdoctoral researcher in 2001. Her career has evolved from materials science and neutron scattering to shock physics—the study of how materials behave under extreme pressure. At the Los Alamos Neutron Science Center, she conducts experiments that, combined with supercomputing simulations, help ensure the safety and reliability of the nation’s nuclear deterrent.

After more than two decades at the Lab, she feels deeply connected to both her colleagues and her community. “Very few of us were born and raised here, but after 22 years, they’re my family away from home,” she says. “This town and the Laboratory are amazing spaces where knowledge and creativity feed one another,” she adds. “As a scientist and as a person, I want to contribute to my community, to society, and to the world’s future—and that’s exactly what working here allows me to do.” ◆



security. In 2024, a new exhibit was installed to highlight the Lab’s contributions to stockpile stewardship. “The work we’re doing to maintain and advance the nation’s nuclear deterrent is just as important as the work done during World War II and every single day of the Cold War,” Moore says. “There’s a growing awareness of new adversaries, and the sense of discomfort that brings is precisely why our work matters.”

Educating visitors about the Lab’s mission can be complex—not only because of the breadth of research conducted at Los Alamos but also because visitors have different levels of knowledge and curiosity, as well as different learning styles. “Every visitor is important, and we have to meet them where they are—not where we want them to be,” Moore says. “At the Bradbury, we’re as cutting edge as the Laboratory itself.” ◆

TRANSFORMING LEARNING

New approaches to preserving and passing along knowledge play a key role in national security.

BY JILL GIBSON

Nobody majors in nuclear weapons in college. Although students can study nuclear physics and engineering, the specifics of how nuclear weapons work and the complexities of their history, design, operation, and certification cannot be taught outside of a secure environment. Much of the information that Los Alamos National Laboratory employees need to know is classified and can only be shared with people who have security clearances (see p. 21). Once employees are granted their clearances, they have a lot to learn.

Engineer Dominic Simone started at the Lab about two years ago. "Although I had some nuclear background from my time in the U.S. Navy, I had no direct engagement or work on the design and qualification of nuclear weapons," he says.

Simone is part of the team developing the nation's first new weapon in nearly 30 years—the W93, a Los Alamos–designed warhead that will be carried on the Navy's current Ohio-class submarines and the forthcoming Columbia-class submarines. "To understand the goals and specifications of the W93, you need dedicated time to get the information on what's been done with past weapons designs," Simone says. "I needed to learn about the larger national security complex and how weapons work. I needed to know how other weapons systems developers have solved problems and what experiments have been done."

Fortunately for Simone and his colleagues, Los Alamos is revamping its approach to nuclear weapons education. Paired with a commitment to capturing and preserving knowledge and making it easier to share and retrieve information, this initiative aims to increase efficiency and decrease the amount of time it takes for new employees to get up to speed.

"When I started working at the Lab, I didn't know what I didn't know," Simone says. "It's really important to have a structure that makes learning a priority."

■ Alan Scarlett leads the Lab's Nuclear Fundamentals Orientation.

■ Jocelyn Widmer leads a Lab initiative called Weapons Learning Transformation.

A classified virtual classroom

Jocelyn Widmer, a digital learning scientist with a background in higher education, leads a Lab initiative called Weapons Learning Transformation. "Our goal is to accelerate and personalize learning," she says. "Consider the investment the Lab makes in the staff, the need to retain employees, and the urgency of the national security mission," says Widmer, whose title, Dean of Weapons Learning Transformation, gives a nod to the academic focus of her role. "Efficient and effective weapons learning is crucial for success."

Widmer notes that Weapons Learning Transformation complements numerous other training programs at the Lab; however, employees working in classified weapons physics and engineering have specific education and training needs. These areas also tend to have steep learning curves. "In weapons design physics, it takes 5 to 10 years to become truly productive," explains physicist Leslie Sherrill. "So, there's a lot of learning that goes on here." Additionally, new employees come to the Lab with varied backgrounds, facing different requirements on the path to proficiency.

"Onboarding and orientation are a beast," Widmer says. "I've heard many employees say it takes at least three years to really know the Lab because it is so large and complex." She points out that, over the decades, numerous weapons education programs have evolved, but, until now, there hasn't been a systematic approach.

So, Widmer and her team began developing what she calls a "digital learning environment and infrastructure." This includes a course catalog, a registration and enrollment process, an online platform for delivering and managing classified online learning, and a transcript that captures a record of each employee's learning history and progress.

As she worked on the learning infrastructure, Widmer discovered that "the Lab had myriad weapons-related educational assets but lacked a robust way to deliver the content, particularly on the classified side." Those assets include records, data, videos, and publications created and archived by the Lab's National Security Research Center (p. 18), which houses a vast collection of material related to the Los Alamos Weapons Program as well as historical documents dating back to the first days of the Manhattan Project. The Bradbury Science Museum (p. 34) and the Manhattan Project National Historical Park (p. 34) have also created material that can boost employee knowledge. "We have access to an amazing treasure trove of assets that have been produced in a very high-quality way," Widmer says. "We're able to use and package this content to achieve different objectives when creating learning pathways. Our aim is to provide access to these assets in a systematic learner-focused way."

Until recently, almost all weapons education at Los Alamos took place face-to-face, according to Widmer. "Our early career employees who have recently completed graduate school are accustomed to learning online and having access to digital resources to augment their learning. We were bringing these brilliant young minds into the Lab and expecting them to learn in ways they had never learned before." Widmer says now her team is developing several pilot programs that incorporate best practices for online instructional delivery to meet this new generation's learning preferences and needs.

> "Do you know what happens to knowledge that isn't shared? It disappears. It goes away."
>
> —ALAN SCARLETT

One of those pilots involves the Theoretical Institute for Thermonuclear and Nuclear Studies (TITANS). Often referred to as a graduate program in nuclear weapons, TITANS is a three-year course in which 10 to 15 students from the Lab's Theoretical Design and Computational Physics divisions spend up to 20 hours a week advancing their knowledge and familiarity with the science and tools necessary for maintaining the nation's nuclear weapons. John Scott, the Lab's Theoretical Design division leader and TITANS instructor, recently piloted a TITANS course that incorporated digital tools and online learning. He and his students say they were pleased with the change.

"It was well received and allowed students to spend time on their own developing knowledge," Scott says. "It helped me manage the class better and maintain records and content all in one place." Scott says that thanks to this successful pilot class, online components will be added to all the TITANS classes. He also plans to add video-recorded lectures so students can access the class content asynchronously on demand.

The digital transformation also extends to class assignments. "We turned the TITANS homework sessions into a digital format with classified online submissions," explains Widmer. She notes that managing hard copy classified material requires strict physical security, manual tracking, and controlled storage and lacks the digital safeguards that protect electronic data. "So, moving to digital submissions took away a lot of the burden of hard copy classified homework submissions and all that entails."

Rachel Smullen, a computational physicist, is enrolled in the TITANS program. She says she is excited about the changes. "I was pleased to see modern tools being applied." Smullen describes the effort as "a step in the right direction" and says she looks forward to the time when more digital resources are incorporated.

Another learning pilot focuses on the W93 team. The Weapons Learning Transformation staff has helped develop an online repository of learning, referred to as a Technical Development Card, that each member of the W93 organization must complete. "We curated the information for new employees in the W93 program—organized it, integrated knowledge checks and analytics, and developed a framework for online delivery of that information," Widmer says, adding, "We estimate that we save each employee 55 hours in search and discovery of the information that has now been packaged into the Technical Development Card."

Employees say they appreciate the support that the Technical Development Card provides them. "This has been an efficient way of doing things," says Landon Cartwright, an engineer who recently joined the W93 team. "The information is not generic—it is tailored specifically to our organization, and it gets you up to speed. I really appreciated that development of such a complex system with a clear sense of direction regarding what is important."

Simone has also taken advantage of this learning resource. "It was all laid out, and any time I would get stumped I knew where to go to find the information," he says.

Cartwright points out that the amount of information that new employees must master can be overwhelming. "The learning curve is steep, but at least I have a set of things to go on." He adds, "At Los Alamos National Laboratory, learning is part of the job."

The W93 team is also paving the way for future learning by carefully documenting the decisions and processes behind the development of the new warhead. "In building the W93, we are, in many ways, working in uncharted territory," Simone says. "Thanks to our current approach to documenting our processes, when we start building the next weapons system, we will save time."

Cartwright agrees, saying, "The way we are managing this system will help future systems. We are publishing internally, planning for the future, maintaining records, and enabling efficient searches. We are doing what we can to make the next system easier."

Widmer points out that learning at the Lab is never finished. "Our staff needs to continue enhancing their knowledge and skills, and we are creating easily accessible materials and learning options that make this possible." From organizing experiential options like facility tours or classified museum visits to working with external online course providers such as Coursera to develop personalized upskilling classes, Widmer is finding new ways for Lab employees to learn more effectively and efficiently.

■ Trinity Overmyer discusses knowledge management during a Nuclear Fundamentals Orientation session.

At the service of science

A large portion of the online videos, presentations, and information Widmer is incorporating in the Weapons Learning Transformation infrastructure originates from

What is knowledge?

Knowledge is the understanding, awareness, or familiarity gained through experience, education, reasoning, or discovery. Knowledge helps individuals make sense of facts and apply them effectively. Knowledge management systems aim to capture, preserve, retrieve, and share knowledge to sustain organizational learning. In knowledge management, knowledge is seen as an organizational asset that supports the following:

- Better decision making
- Innovation and continuous improvement
- Risk reduction (by preventing knowledge loss)
- Efficiency (avoiding duplication of effort)

What is learning?

Learning is the process by which knowledge is acquired, modified, or expanded.

Learning at Los Alamos National Laboratory

Learning at the Lab is delivered in person, online on-demand, virtually in real time, and through exposure to experiences and problem-solving.

The Lab's Weapons learning infrastructure includes a catalog showing the available course; a registration system for enrollment; an online platform that organizes, delivers, and tracks courses for learners and facilitates evaluation of learners' progress; and a transcript that creates a record of learning achievements.

The knowledge ecosystem

KNOWLEDGE CAPTURE
Gathering knowledge from individuals, projects, and systems.

KNOWLEDGE PRESERVATION
Ensuring that captured knowledge is stored, maintained, and kept secure over time.

KNOWLEDGE RETRIEVAL
Enabling access to preserved knowledge.

KNOWLEDGE SHARING
Transferring or communicating knowledge to others.

a team known as Weapons Knowledge Management, or KM. The KM team works to capture, preserve, retrieve, and share knowledge to sustain learning. KM's work largely consists of recording and editing videos featuring longtime Lab experts discussing processes and decision-making. The team also hosts a classified video series called Unlocking the Vault designed to share technical weapons videos from the past.

Trinity Overmyer, who leads the KM team, says the goal is to help the Lab meet a critical need for knowledge transfer and retention. "Knowledge is in people," Overmyer says. "Everyone at the Lab is a knowledge worker; their expertise is important to the mission, and our team is here to help them preserve and pass along what they know."

Over the past eight years since its founding, KM has made more than 100 video recordings of Lab employees sharing their technical and professional wisdom. Many of these employees are close to retirement when they decide to participate in the knowledge capture process. Lab leaders encourage staff to take the initiative to ensure their expertise is preserved for when they leave Los Alamos.

"We rely on things learned by our predecessors, and that's why knowledge management is important," Laboratory Director Thom Mason says. "There's a lot captured in the brains of the people who did the work."

Overmyer notes that her team's work is heading off knowledge loss and avoiding duplication of efforts. "Effective knowledge management leads to better decision-making, increased innovation, and continuous improvement," she says.

Ron Cosimi, a retired Los Alamos physicist and former nuclear test director, urges current employees to take the time to record their knowledge. He says that during the years he spent working on full-scale nuclear detonation tests, scientists were extremely busy and not focused on preserving knowledge. When the United States declared a moratorium on full-scale testing, a certain amount of information was lost. "In the past, we didn't manage knowledge. It went from one brain to another, and now a lot of it is gone," says Cosimi. "It's very important for scientists to document what they are doing, how they are doing it, and why they are doing it," he notes. "And then you put everything in one place so if someone wants to look up something, they know where it is."

To facilitate that ease of retrieval, Overmyer and Widmer are working together to ensure the videos and other assets that KM captures get integrated into the new digital learning infrastructure. "Anything the Knowledge Management team can do to give people more time to do their work rather than searching for resources helps employees get things done faster," Overmyer says. "Being able to support people to make learning easier supports the mission of the Lab."

On the front lines of knowledge

Another component of the KM work involves delivering classes on the Lab's Weapons programs, nuclear weapons, and the national security enterprise. This program, called Nuclear Fundamentals Orientation (NFO), started in 2019, and 4,000 Los Alamos employees have gone through the course since it began. While NFO is not a requirement for most Lab employees, many supervisors encourage their staff to attend it. NFO consists of two online sessions that take place synchronously through video conferencing and a three-half-day in-person classified component. Additional online sessions and in-person tours supplement this training.

Alan Scarlett leads the program. A retired U.S. Air Force nuclear weapons specialist with more than 20 years of weapons instruction experience, Scarlett says he has a passion for nuclear weapons education. "It's important to pass on this information. We must understand the history of our nuclear weapons program—our past capabilities, the present, and our plans. We must understand the purpose of the national security enterprise. We must create a shared understanding of the weapons program and an appreciation of the mission."

Whether online or in person, Scarlett teaches with great energy and a sense of urgency, conveying that the stakes are high. "The next Lab leaders and weapons designers could be in this class," he says. "They need this knowledge. Do you know what happens to knowledge that isn't shared? It disappears. It goes away."

The audience comes from across the Lab, although most are in the Weapons program. Anyone in the nuclear security enterprise may attend the course. Scarlett says it offers key information for those interested in the fundamental mission, the national security enterprise at large, and how the labs, plants, and sites within the enterprise coordinate efforts. "We have many new employees across the enterprise who need this background," he notes.

Scarlett concludes the final session of NFO by discussing every weapon design that has been introduced into the nation's nuclear stockpile, pointing out several lesser-known weapons that were developed many years ago. "Do any of you know that the United States once had a nuclear drone?" he asks the audience. Several people shake their heads, sparking a flurry of questions. The participants' interest and engagement are evident. The audience is hungry for the information that Scarlett provides.

Scarlett says the course offers more than just history. "Past concepts can spark new ideas," he explains. "Right now, we need innovation in every conceivable manner to manage the changing geopolitical landscape."

He stresses that knowledge plays a crucial role in national security, and he sees his role as an important part of preserving and passing along that knowledge. "When I teach, I think about my son," says Scarlett. "I do not want my son to ever have to fight a war that I could help prevent today." ★

THE MENTOR IN THE COC

Lieutenant Colonel Mike Marchand, a B-52 pilot and Air Force fellow at Los Alamos National Laboratory, has trained air crews for the nuclear mission and more.

BY JAKE BARTMAN

CKPIT

◆ A B-52H Stratofortress takes off during exercise Global Thunder 19 at Minot Air Force Base, North Dakota, in 2018.
Photo: U.S. Air Force/Jared Denton

◆ Marchand and his crew prepare to board a B-52 at Barksdale Air Force Base in Louisiana for a 2016 North Atlantic Treaty Organization mission. Photo: Mike Marchand

Not long after finishing his initial training as a B-52 pilot, Mike "Cash" Marchand found himself in the middle of one of the U.S. military's largest training exercises. Called Global Thunder, the annual exercise involves more than 100,000 personnel who simulate a response to a realistic attack on the United States, ensuring that the military's strategic forces—including bomber crews, submarine fleets, and missileers—are ready to field the nation's nuclear weapons at a moment's notice.

As part of the exercise, Air Force bomber crews are tasked with boarding their aircraft and taking off as quickly as possible. Marchand recalls the exhilaration and chaos of the exercise. "A klaxon goes off, and that means to get to the airplane and start the engines," Marchand says. "You and your crew all pile into your van, and you drive like maniacs to get out there as fast as possible. And then, when you get to the jet, everyone has a specific job to do. The pilot starts the engines, and then the navigator and the weapons-system operator start up the navigation systems as soon as there's power."

With the crew in place, the aircraft can taxi and take to the air, condensing a process that typically takes up to an hour to just five or six minutes. Taking off is no easy feat, however. Ordinarily, bombers wait two minutes or more to allow air turbulence to clear before following a jet down the runway. During Global Thunder, jets take off one after another, which means that the air is both rough and sufficiently exhaust-filled enough to reduce visibility. Pilots are also responsible for remembering their place in the queue and counting the jets that take off ahead of them, ensuring that they take off at the right time. "You're sitting there thinking, OK, am I number 12 or number 13? And then you can't even see where the other planes are going," Marchand says.

Such conditions are challenging for any pilot, let alone one who has just finished training. During the exercise, Marchand's B-52 suffered an engine fire during takeoff, necessitating a premature end to his plane's participation in Global Thunder. But despite the stress involved, Marchand remembers the experience fondly. He notes that in addition to ensuring that forces are prepared to respond to an attack, Global Thunder and other exercises demonstrate readiness to the United States' adversaries, helping to deter real-life attacks in the first place.

"The exercises are a critical piece of our deterrence strategy," Marchand says. "What we're really doing with exercises like

"WHAT WE'RE REALLY DOING WITH EXERCISES LIKE THAT IS DEMONSTRATING TO THE WORLD THAT A PREEMPTIVE STRIKE IS NOT GOING TO STOP THE UNITED STATES FROM RESPONDING."

—MIKE MARCHAND

that is demonstrating to the world that a preemptive strike is not going to stop the United States from responding."

Over the course of his Air Force career, Marchand, who is now a lieutenant colonel, has participated in Global Thunder several times—both as a pilot and in other roles, including inside the Cheyenne Mountain Air Force Station (now Space Force Station) as strike advisor for U.S. Northern Command. In a career that has involved everything from flying aircraft to leading an operations support squadron and briefing high-level officials, Marchand has trained and supported the next generation of pilots, support crew, and strategists to safeguard the nation's security.

Every year, Los Alamos National Laboratory brings one or two members of the Air Force to the Laboratory as Air Force fellows. At Los Alamos this year, Marchand is gaining familiarity with the nuclear enterprise, the better to help facilitate the transfer of knowledge between the national laboratories and the military—and within the Air Force itself.

"My goal is to learn what the Air Force needs to do to provide a more credible and more effective deterrent," Marchand says. "I have an opportunity to learn about that at Los Alamos."

A pilot's progress

Marchand joined the Air Force's Reserve Officers' Training Corps program while he was an undergraduate student at the University of Notre Dame. He studied engineering and enjoyed the kind of thinking that engineering involves, but reasoning that he could always quit being a pilot and become an engineer but not the other way around, he applied to the Air Force's pilot school and was selected.

After completing a joint pilot-training program with the Navy in Pensacola, Florida, Marchand relocated to Vance Air Force Base in Oklahoma, where for three years, he was an instructor pilot. In the Air Force, pilots who progress immediately from earning their wings to becoming instructor pilots are referred to as FAIPs (which stands for first assignment instructor pilot). Not all pilots are thrilled to be FAIPs, preferring operational assignments. But Marchand soon found that he enjoyed serving as an instructor.

◆ Marchand (right) with his brother after Marchand's last flight in an Air Force aircraft at Sheppard Air Force Base in 2025. Photo: Mike Marchand

◆ A B-52 piloted by Marchand is refueled over England in 2015.
Photo: Mike Marchand

> "IF YOU DON'T HAVE A CREDIBLE RESPONSE TO A NUCLEAR ATTACK, IT DOESN'T MATTER HOW GOOD YOU ARE AT CONVENTIONAL WARFARE."
>
> —MIKE MARCHAND

"When you go to pilot training, you're excited about flying, and you're excited to get to do real things," Marchand says. "What you don't want to do is stay in a training role and teach students. Well, I got FAIPed, and I loved it. I loved teaching students how to fly."

Having been selected to become a B-52 pilot, Marchand then moved to Barksdale Air Force Base in Louisiana, where he came to appreciate the tight-knit B-52 community and the aircraft's versatility. "The missions you have in the B-52 reflect pretty much everything that the Air Force can do," Marchand says. "So, you get to do some really neat stuff."

The B-52 is unique among the Air Force's three heavy bombers in the breadth of nuclear and conventional munitions it can carry. Since the 1990s, the B-1 hasn't carried nuclear weapons, and the stealth B-2 is designed to carry its payload—whether conventional or nuclear—internally, passing undetected through often-adversarial airspace to deliver precision strikes.

By contrast, the B-52, which has been part of the Air Force's fleet since the mid-1950s, was designed to fly intercontinental missions, delivering enormous payloads to targets on the other side of the world (the aircraft can travel some 8,800 miles without refueling). With its massive bomb bays and plentiful underwing "hard points" for munitions, the B-52 can carry up to 70,000 pounds of ordnance.

When the B-52 was designed in the 1950s, the bomber was intended to field nuclear gravity bombs, among other weapons. Due to shifting strategic needs, the B-52 ceased carrying nuclear bombs around five years ago (the B-2 continues to deliver B61 nuclear bomb variants). The B-52 still carries air-launched cruise missiles armed with nuclear warheads, however.

The B-52's flexibility is part of the reason why it has remained in service, with various upgrades, for seven decades. The aircraft isn't about to retire, either, with additional upgrades to the jet expected to keep it in service until the 2050s or longer.

Training for the nuclear mission

To Marchand's surprise, upon completing his B-52 training, he was selected to become an instructor for new B-52 pilots (due in part to his experience as an instructor at Vance). Marchand's time as a B-52 pilot instructor proved relatively short-lived, however. Just a year and a half later, he was selected to teach B-52 air crews about the nuclear part of their mission, helping to train warfighters to field a key component of the United States' strategic deterrent.

B-52 air crews that train for the nuclear mission study command and control procedures carefully, ensuring that they're able to authenticate the codes they receive that direct them to execute a nuclear strike or to "retarget"—that is, to change course—after a strike order has been given. Because of the tremendous responsibility that comes with carrying out nuclear missions, crews must be trained to the highest standards of professionalism. Training in areas such as tactics, delivery profiles, and safety checks is comprehensive and rigorous: There's no margin for error.

Although some of the knowledge necessary to conduct a nuclear mission can be acquired in classrooms, it is by putting such knowledge into practice during exercises such as Global Thunder that crews demonstrate their mastery. Global Thunder has been conducted annually since 2014, but the Air Force has a much longer history of conducting full-scale training exercises to ensure its readiness to field the nation's strategic deterrent.

Marchand traces these exercises to famed Air Force General Curtis LeMay. In the aftermath of World War II, LeMay was tasked with building up the Strategic Air Command (SAC), which, as a part of the Air Force, had responsibility for controlling and fielding the United States' strategic bombers and, later, intercontinental ballistic missiles. To ensure the readiness of SAC's bomber fleet, LeMay was reputed to arrive unannounced at Air Force bases and order their strategic bombers to take to the air as quickly as possible. If the fleet's response time was too slow, LeMay would relieve wing commanders of their duty.

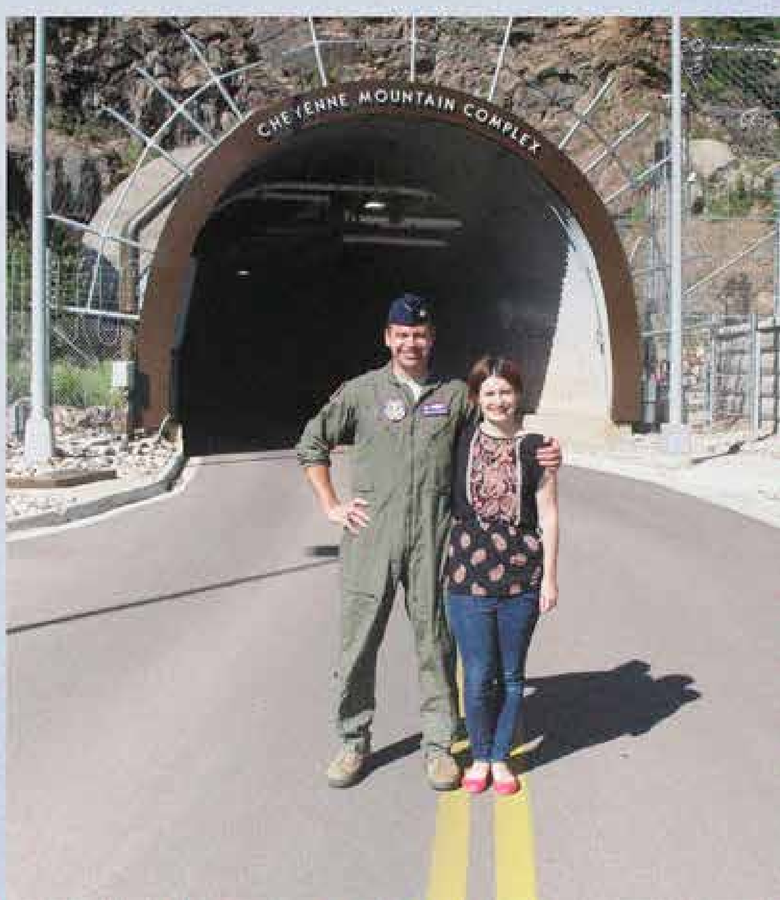
The goal of such exercises, Marchand says, was to ensure that if the United States were under attack, its bombers would be able to take to the air quickly enough to survive and deliver a counterattack. "The way that General LeMay approached the Cold War was with the mindset of, 'we're at war,'" Marchand says. "That mindset filtered through SAC." Indeed, air crews took such exercises so seriously that they'd hurry to their aircraft even if they were in the shower when a drill was announced (crews were reputed to keep extra flight suits on board their aircraft in case a "klaxon drill" necessitated running to one's jet clad only in a towel).

In 1992, at the end of the Cold War, SAC was dissolved, although the organization was reactivated and renamed Air Force Global Strike Command in 2009. Today, it is through coordinated exercises such as Global Thunder—rather than impromptu visits by high-ranking generals like LeMay—that Global Strike Command ensures the readiness of the United States' strategic bomber fleet.

The view from underground

Marchand found leading training for the nuclear mission at Barksdale to be remarkably fulfilling. "The nuclear mission is just about the biggest impact you can have," Marchand says. "It's got to be done, and it's got to be done well, or else you don't have an effective deterrent. If you don't have a credible response to a nuclear attack, it doesn't matter how good you are at conventional warfare."

In 2015, then-Los Alamos Director Charlie McMillan visited Barksdale. Having been introduced to McMillan, Marchand asked the Laboratory director to speak with a



◆ Marchand with his wife in front of the entrance to Cheyenne Mountain Air Force Station (now Cheyenne Mountain Space Force Station) in 2019. Photo: Mike Marchand cohort of students who were training for the nuclear mission. McMillan agreed, explaining to Marchand's students the role of national laboratories such as Los Alamos in providing a nuclear deterrent for the Air Force to field. In particular, McMillan discussed stockpile stewardship—the process by which the nation's national laboratories certify the safety, security, and reliability of the nuclear deterrent without full-scale testing.

The talk piqued Marchand's interest in Los Alamos, and when he learned about the Laboratory's Air Force Fellow program, he was even more intrigued. "From then on, I wanted to come to Los Alamos," Marchand says.

It would be another decade before Marchand would come to the Laboratory, however. In the meantime, he'd see the nuclear enterprise from another perspective when he accepted a role at the Cheyenne Mountain Air Force Station (as the facility was then known) in Colorado.

Cheyenne Mountain, which is near Colorado Springs, was built in the 1960s to withstand a nuclear attack: The facility was constructed inside a mountain beneath some 2,000 feet of rock. Today, the facility serves as the alternate command center for North American Aerospace Defense Command (better known as NORAD) and U.S. Northern Command (USNORTHCOM). NORAD is a joint United States–Canadian organization that monitors North American airspace—providing early warning of missile attacks, for example—and USNORTHCOM oversees a range of missions related to homeland and national security.

Marchand spent four years working at Cheyenne Mountain. In his capacity as a strike advisor, Marchand was responsible for advising USNORTHCOM's commander on strategic options in the event of a conflict. He was surprised to find that NORAD and USNORTHCOM were involved in Global Thunder, too, demonstrating the way in which many parts of the United States' military work together to maintain and field the nuclear deterrent. "When I was at Barksdale, teaching the nuclear mission, I thought, well, I know a lot about this," he says. "And then I got to Cheyenne Mountain and realized I didn't know a whole lot. It was an eye-opening experience."

A supporting role

Even at Cheyenne Mountain, Marchand found himself not just completing a job, but training others to work as strike advisors, too. It was during this time, he says, that he began considering what he was most interested in doing in his career. "I was trying to decide, you know, should I leave the Air Force and go fly for airlines, work half as hard, and have a great life?" he says. "A lot of my buddies were doing that at the time."

Ultimately, however, Marchand realized that his ambitions differed. "What I really like is having the opportunity to make an impact on someone in a positive way," he says. "And I thought, what are the jobs that have the most of that? The three that I thought of were your squadron commander, your first instructor pilot, and then whoever took you under their wing as a mentor. And those are the kinds of jobs that I realized I wanted to do."

◆ Air Force maintainers deployed from Barksdale Air Force Base, Louisiana, inspect the engines of a B-52H Stratofortress at Mihail Kogălniceanu Air Base, Romania, in 2024. Photo: U.S. Air Force/Seth Watson

◆ Marchand with his family and a T-6 Texan aircraft in 2024. Photo: Mike Marchand

Such considerations helped lead Marchand to accept a position as leader of the 80th Operations Support Squadron (OSS) at Sheppard Air Force Base in Texas. The 80th OSS is part of the 80th Operations Group, which is in turn under the 80th Flying Training Wing—a wing that conducts both basic and advanced pilot training.

If working at Cheyenne Mountain had opened Marchand's eyes to new aspects of the nation's strategic mission, leading the 80th OSS proved enlightening in a different way. With a staff of some 550 people, the 80th OSS carries out many key supporting functions at Sheppard, including operating and maintaining the airfield itself (ensuring that the pavement is in good condition and that the runway is well lit) as well as handling airfield operations—training and staffing the control tower with controllers, radar operators, and radio operators. Other 80th OSS employees provide and maintain life-support systems for air crews (parachutes, helmets, and survival kits) and more.

Although the 80th OSS is not itself responsible for training pilots, the squadron plays a critical role in enabling the 80th Flying Training Wing to fulfill its mission. "As a pilot, it was really eye opening to see just how much behind-the-scenes work went into getting me in the air," Marchand says. "It was a fantastic opportunity to get close to that. And it was also fantastic to get to know other communities in the Air Force. I learned a lot there, not just about leadership, but also about various other careers in the Air Force."

Marchand spent two years leading the 80th OSS before being promoted to deputy commander of the 80th Operations Group (of which the 80th OSS is a part), where he served for a year before coming to Los Alamos.

Destination: New Mexico

Nearly a decade had elapsed since, as a nuclear-mission instructor at Barksdale, Marchand met Los Alamos Director Charlie McMillan and learned about the possibility of spending a year at the Laboratory as an Air Force fellow. In the intervening years, while working in command and control and then as an operations support leader, Marchand retained his interest in Los Alamos. Having applied for and been offered the fellowship, he jumped at the opportunity to relocate for a year to northern New Mexico and learn about the nuclear enterprise from a national laboratory's perspective.

At Los Alamos, Marchand is steeping himself in the Laboratory's broad national security portfolio, learning about everything from weapon development to chemistry research, the better to bring this knowledge to the military and to support the Air Force's nuclear mission. (He is also enjoying a break from the 60-hour work weeks that came with serving in squadron command.)

Although Marchand isn't certain where he'll end up after his time in Los Alamos, he anticipates continuing to serve the Air Force's nuclear mission in some capacity. But he expects that wherever he goes next, training and mentoring will remain central to his work.

"For me, getting to fly and support the nuclear mission have always been more like side benefits," Marchand says. "What I really like the most is being able to make a positive impact on someone else. That's what makes it worth getting up in the morning." ★

◆ During his fellowship at Los Alamos, Steeves gave a presentation about his career as a pilot.

LEAVING—AND RETURNING TO—LOS ALAMOS

Two former Air Force fellows reflect on the paths that led them back to the Laboratory.

BY JAKE BARTMAN

Every year since 2004, Los Alamos National Laboratory has hosted one or two members of the U.S. Air Force for yearlong fellowships. The Air Force Fellow program is a chance for mid-career officers, many of whom work in roles related to nuclear weapons, to learn from the scientists and engineers who design and maintain these weapons.

But what do fellows do after their time at Los Alamos ends? Sometimes, they return to work at the Laboratory, as former Air Force fellows Mike Port and Geoff Steeves have.

Port first came to Los Alamos as the senior Air Force Fellow from 2010 to 2011. At the time, he was a lieutenant colonel who served as a missile launch and nuclear operations officer. “Everybody was so welcoming and inquisitive about what I did in the Air Force and what the Air Force was like,” Port recalls. “I looked forward to coming to work every single day because I knew I was going to learn something new and also because I was working among the smartest people on the planet, and they were all so down to Earth.”

After his fellowship, Port relocated to Albuquerque, New Mexico, where he led a team in the Air Force Inspection Agency, which provides, among other things, an independent perspective on aspects of the Air Force’s readiness. He later accepted a position at Barksdale Air Force Base in Louisiana and served as a leader in intercontinental ballistic missile operations and in cyber and nuclear command and control.

Port retired from the Air Force at the rank of colonel and spent two years as a high school Junior Reserve Officer Training Corps instructor before being recruited by Los Alamos to work in the Weapons program. Today, Port has returned to Barksdale not as an airman but as a Los Alamos employee, representing the Laboratory as its liaison to Air Force Global Strike Command, which is responsible for the Air Force’s nuclear deterrent.

Steeves was an Air Force Fellow at Los Alamos from 2019 to 2020. Prior to coming to the Laboratory as a lieutenant colonel, Steeves had served in both operational roles (as a B-2 pilot and instructor) and as a leader (he was deputy division chief of the United States Forces Korea in Seoul and commander of the 13th Bomb Squadron at Whiteman Air Force Base in Missouri, among other positions).

After his fellowship, Steeves held several leadership roles in the Air Force, including as leader of a team tasked with advancing aspects of the Air Force’s long-term strategy at the Pentagon, deputy director of the Air Force’s COVID response team, and commander of the B-2 bomber's 509th Operations Group. "The things I learned during my year as a fellow were extremely valuable," Steeves says. "I was able to return to the Air Force and remind airmen of the partnership between the departments of Defense and Energy. A vast team of talented people in Los Alamos are uniquely devoted to making sure that our warfighters are successful."

On leaving the Air Force in 2024 at the rank of colonel, Steeves returned to Los Alamos as an executive advisor in the Center for National Security and International Studies. In this role, he advises Laboratory leadership on the policy implications of world events and educates members of the military on Los Alamos' work. "The key point I emphasize to our military partners is that Los Alamos is not only a nuclear laboratory, but a comprehensive laboratory with a broad mission," he says. "The Laboratory touches nearly all aspects of national security."

Steeves and Port both cite their exposure to the breadth of the Laboratory's work as vital to the trajectory of their careers. "What I tell new Air Force Fellows is, definitely learn about weapons systems and what the Lab's Weapons program does," Port says. "But I also say, expand your horizons. Don't stay in your office. Get out and meet people and learn about different programs, because trust me, you'll use that knowledge later in your career"—perhaps even in returning to Los Alamos one day. ★

◆ Steeves and his wife, Brye, who is the director of Los Alamos' National Security Research Center, beside a T-38—a supersonic training jet often flown by B-2 pilots. Photo: Geoff Steeves

◆ Port (right) with his son, Andrew, in front of the Lab's National Security Sciences Building.

■ Steve Cambone

HAPPENSTANCE, CIRCUMSTANCE, AND GOOD LUCK

Steve Cambone, the former undersecretary of defense for intelligence who now leads Los Alamos National Laboratory's Office of Strategic Assessment and System Analysis, reflects on a 40-year career at the intersection of defense, intelligence, and policy.

BY WHITNEY SPIVEY

Shortly after Steve Cambone completed a Ph.D. in political science, a former schoolmate at Claremont Graduate School encouraged him to consider a job at Los Alamos Scientific Laboratory. "I said, 'that's terrific,'" Cambone remembers. "And then I didn't think very much more about it."

The schoolmate called again a week later and asked, "Well, do you want a job or don't you?" So, Cambone formally applied, interviewed, and in 1980 started in the Lab's Strategic Assessment office, which was tasked by then-Laboratory Director Don Kerr (p. 60) with bringing a policy perspective to the Lab's scientific and technical national security challenges.

Cambone went on to a successful career in private industry and the Department of Defense, eventually serving as special assistant to the Secretary of Defense, the Principal Deputy Undersecretary of Defense for Policy, and then as Director for Program Analysis and Evaluation. In March 2003, he was confirmed by the U.S. Senate as the first Undersecretary of Defense for Intelligence, a position he held through 2006.

In 2024, Cambone returned to Los Alamos to lead the Lab's Office of Strategic Assessment and System Analysis, a new organization tasked with identifying, analyzing, and presenting options that leverage the Laboratory's scientific and technical capabilities to shape and successfully implement national security programs.

Cambone sat down with *National Security Science* to reflect on his career, each step of which he says has been "a combination of happenstance, circumstance, and good luck."

As a young adult, you considered teaching as a profession. Was there a certain point when you committed to a career in national security?

I think it was more of an evolution. Over time, beginning with my first job at Los Alamos, it became increasingly clear that I had an opportunity to make contributions in the national security space. As long as I was able to contribute, it was a career path worth pursuing.

As important, national security is an interesting and intellectually challenging field. I was advised once to never take a job that I didn't find interesting. And I never did.

In certain respects, my work has never changed over 40 years. The positions differed, as did the responsibilities I was assigned. But in the end, I've been addressing similar issues from different seats. I truly have been privileged to hold each of the positions I have had.

In 2024, you returned to Los Alamos to lead the Office of Strategic Assessment and System Analysis (SASA). How did you make that decision after such a long career in Washington, D.C.?

In 2017, I was serving as an associate vice chancellor at Texas A&M University System (TAMUS). Subsequently, Texas A&M—along with the University of California and Battelle—was awarded the contract to operate the Lab. As a senior member of the TAMUS staff on campus with a clearance who had been in the nuclear, intelligence, and defense worlds, I was asked to serve on the Lab's Mission Committee and traveled back and forth.

Those visits reminded me how much I enjoyed living in New Mexico and of the charms of Santa Fe. When COVID arrived, my wife and I relocated from College Station to Santa Fe. I continued to work for the university until early 2022 and then did some consulting work at the Lab. One day, I was invited to a meeting to discuss the establishment of what became SASA and asked if I would like to take part in standing it up? The work certainly met the criteria of being interesting, and I said yes immediately.

Has it been worth it? That's best left to others to decide. Working with staff across the Lab, the SASA team has presented to Lab leaders insights they might not otherwise have had. If SASA continues to serve as a conduit for innovative thinking that leadership can appreciate and take action on, then I think it will have been judged a success.

What do you see as the Laboratory's most important contributions to national security in the coming decade?

The Laboratory's mission is clear: to assure that the weapons presently in the stockpile—and particularly those for which it is responsible—are properly maintained and are reliable, lending to the President the confidence that he needs to be able to manage the deterrence policies in the United States. That is our first challenge.

Second, the Laboratory will be asked to expand that mission to help in the development of new capabilities, which may entail new applications of what we've done in the past or doing something new. This requires that we think again about how we go about our work so that we're confident that the President can be confident in what we deliver.

The strategic landscape is changing. The United States is likely to develop new capabilities and ways of thinking that strengthen our deterrent capabilities so that any potential adversary understands there is nothing to gain by challenging the United States.

How do you approach a new subject or begin to think about a new capability?

If you take time to listen to what's being said and understand why it's being said, you'll find there is usually more to a subject. Think about what else might bear on that subject that the presenter either hasn't thought about or that he or she knew but didn't present.

Asking questions is as much for my own edification—please teach me more—as it is for helping a presenter to explore more deeply his or her own thinking on a subject.

Hardly anything that we do or create is without a reason. Knowing why something was, is, or should be done helps you decide whether to keep doing it or to make a change.

What advice do you give scientists and engineers at Los Alamos—and at other scientific institutions—about communicating effectively with policymakers?

Policymakers, particularly senior policymakers, are very busy people. Many and various things compete for their time and attention. To communicate effectively with them requires that we do our homework to understand what it is that concerns them and why it concerns them. What are the options they have in front of them to address what concerns them? Having done that, we can better assess whether those options include or should include insights that we here at Los Alamos can bring to them.

Senior policymakers know an awful lot. They don't get to be in those positions without being quite accomplished. An indication of that accomplishment is their willingness to seek help in resolving hard problems. Using plain English when engaging them is the best approach.

What mindset do you think the next generation of scientists should develop to stay relevant to national defense?

Curiosity. If you're not curious about your work, or about where your work fits in the mission, or where the mission fits into the national interest, it's difficult to know how to arrange your thinking or how your thinking ought to be arranged to be of assistance.

The world is hardly a set place. Curiosity about it will lead you to discovering things that you never might have anticipated and could be quite influential in affecting. If you're curious, you'll get a reputation for being so—and that's a good thing. ★

■ Cambone gives remarks at the Pentagon in the early 2000s.

The Favorites (both in yellow) are active in the Hill Stompers band and the public school system. Here, they perform in the Los Alamos county fair and rodeo parade. Photo: Los Alamos County

A SCIENTIST WITH CLASS

Los Alamos researcher Jeff Favorite finds purpose—and a lot of laughter—as a substitute teacher.

BY WHITNEY SPIVEY

One Friday morning in 2016, Los Alamos National Laboratory scientist Jeff Favorite was dropping off his son at Mountain Elementary School when he heard a call over the intercom for a substitute music teacher. Favorite, co-founder of the exuberant community band the Hill Stompers, thought "Well, I'm not a professional musician, but I could do that for a day!"

After a few logistical hurdles, he spent the day leading classes, loved it, and soon joined Los Alamos Public Schools as a part-time substitute. At least once a week for the past 10 years, Favorite has been in the classroom—usually at the local elementary schools and occasionally teaching math at the middle and high schools.

Though Favorite describes subbing a hobby, he takes it seriously. "Teachers need subs who can advance the class and not just babysit," he explains. "But I usually have great fun on my school days. If it weren't fun, I wouldn't do it."

Favorite's classes are lively and full of laughter—he's been known to juggle scissors (don't tell the principal)—but beneath the humor is a commitment to education. At the high school level, Favorite gives students practical advice about solving problems, reminding them that the skills they're learning will serve them later in life. "Even after 30 years at the Lab, I still fill engineering pads with calculus and algebra," he says. Favorite's work in the Lab's Radiation Transport Applications group involves complex calculations of radiation shielding and neutron criticality—proof that high school math does indeed provide a solid foundation for the real world.

In lower grades, Favorite channels his enthusiasm into all subjects, but he is particularly passionate about mathematics. "I make a huge deal about how math is the best part of the day," he says. "And I get pretend-mad if they disagree." One of his most popular lessons involves the 1999 Mars Climate Orbiter crash caused by a mismatch of metric and imperial units. "When students forget to include units, I tell them they've crashed the spaceship," he says. "When they remember, I cheer loudly. Hopefully, they remember the lesson."

Favorite is also a familiar figure around Mountain Elementary another way. As the beloved Mountain Lion mascot, he delights students during assemblies and special events. "It's very hot, very hard to breathe, and very hard to see," he says of

■ Favorite, dressed as the Mountain Lion from Mountain Elementary, participates in the Los Alamos homecoming parade. Younger kids typically don't know that Favorite is the Mountain Lion. "The older students generally know, but we all pretend that I'm not," Favorite says. Photo: *Los Alamos Daily Post*

wearing the faux-fur costume with its giant feline head, "but the hugs make it worth it."

Outside of school, Favorite and his wife, fourth-grade teacher Kandice Favorite, continue to lead the Hill Stompers, which have a presence at just about every community event from parades to fundraisers to local festivals. No musical experience is required to be in the band, but members are encouraged to be "colorful, creative, and just a little bit crazy." Wielding his signature snare drum, Favorite often performs in flamboyant outfits and sometimes as a fire-breathing chicken. (How did he learn to breathe fire? "YouTube," he says with a grin.)

In a town as small as Los Alamos, many students who know Favorite from the classroom will spot him performing with the Hill Stompers and say hello. Favorite says these interactions are meaningful for both him and Kandice. "We want the kids to remember that we cared about them and supported them and that we still do," he says.

Whether he's inspiring the next generation in the classroom or playing percussion dressed as a chicken, Favorite brings his best energy wherever he goes. "Things that are music-, theatre-, or kid-related are easy for me to be enthusiastic about," he says. "Things that are all three are the best!" ★

■ When it comes to substitute teaching, "I'm like the crazy uncle who takes the kids out for a day, then drops them back off at their parents' house," Favorite says. "They love their parents, but it's fun to see the crazy uncle once in a while." Here, Favorite breathes fire for second and third graders at Mountain Elementary. (This photo was arranged for *National Security Science* and is not representative of a normal school day.)

■ From 1979 to 1985, Don Kerr served as the fourth director of Los Alamos National Laboratory.

DON KERR, SCIENTIST, PUBLIC SERVANT, LEADER

Remembering Los Alamos National Laboratory's fourth director.

BY WHITNEY SPIVEY

In 1966, 27-year-old Donald Kerr had just earned a doctorate in microwave electronics from Cornell University. Several of his advisors—including physicist Hans Bethe—had strong connections to Los Alamos Scientific Laboratory. On their recommendation, Kerr accepted an offer to study ionospheric physics and its applications in high-altitude weapons effects. By that time, the Laboratory had conducted more than 500 nuclear tests and was deeply interested in how such detonations behaved in the atmosphere.

That year, Kerr, with his wife, Alison, their infant daughter, and their rottweiler puppy, drove cross-country from upstate New York to New Mexico, arriving in Los Alamos in July. "This was in the era of assigned housing," Alison recalls. "We were assigned a place that was fine—except we shared it with a lot of cockroaches."

Despite the unwanted roommates, Kerr thrived at the Laboratory. Alison notes that Don often traveled to support underground nuclear tests, including to the Nevada Test Site. He also visited Alaska to study auroras, which occur when charged particles from the sun collide with gases in the Earth's atmosphere. "As an applied physicist," Alison says, "he was into doing things."

Bethe agreed, telling *Science* magazine in 1979 that Kerr was "a good experimental physicist, no question."

Kerr also excelled as a manager. He was named a group leader in 1971, joined Director Harold Agnew's office as an assistant in 1973, and became a division leader for alternative energy in 1975.

This rapid rise into leadership came as no surprise to Alison, who explains that her husband's work ethic was developed while attending a Quaker school in Philadelphia from second grade through high school. "Friends schools emphasize the whole person and service to others," she says. "Students learn how to apply themselves and get things done, which was very typical of Don."

RETURNING AS DIRECTOR

In 1976, Kerr left the Laboratory to pursue an opportunity in Las Vegas as the deputy manager of the Nevada Operations Office, which helped coordinate work at the Nevada Test Site. He then moved to Washington, D.C., to serve as the deputy assistant secretary for Defense Programs and acting assistant secretary for Energy Technology in the newly formed Department of Energy (DOE).

"The first secretary of energy was Jim Schlesinger," Alison remembers. "He very much became Don's mentor."

When Schlesinger signed off on Kerr to be the fourth director of Los Alamos in 1979, Kerr—then just 40—returned to lead the Lab, succeeding Harold Agnew. A 1979 issue of *The Atom* magazine noted that Kerr differed from his predecessors in two key ways: He had not worked on the first atomic bombs, and he had experience in the federal government. When asked whether that background would benefit his directorship, Kerr replied, "The bureaucracy is a given, which must be accepted. Having been responsible for some of the bureaucracy myself, I can perhaps swim in those waters with some success."

Alison recalls that "Don was really interested in the director job. It was his first job where he was in charge of something big."

This time, the family lived in a historic Arts and Crafts house on Bathtub Row—so named because during the Manhattan Project, the homes on this street were the only ones with bathtubs. "It was a great house for entertaining," says Alison, recalling a memorable potluck where their dogs stole steak tartare off a low table.

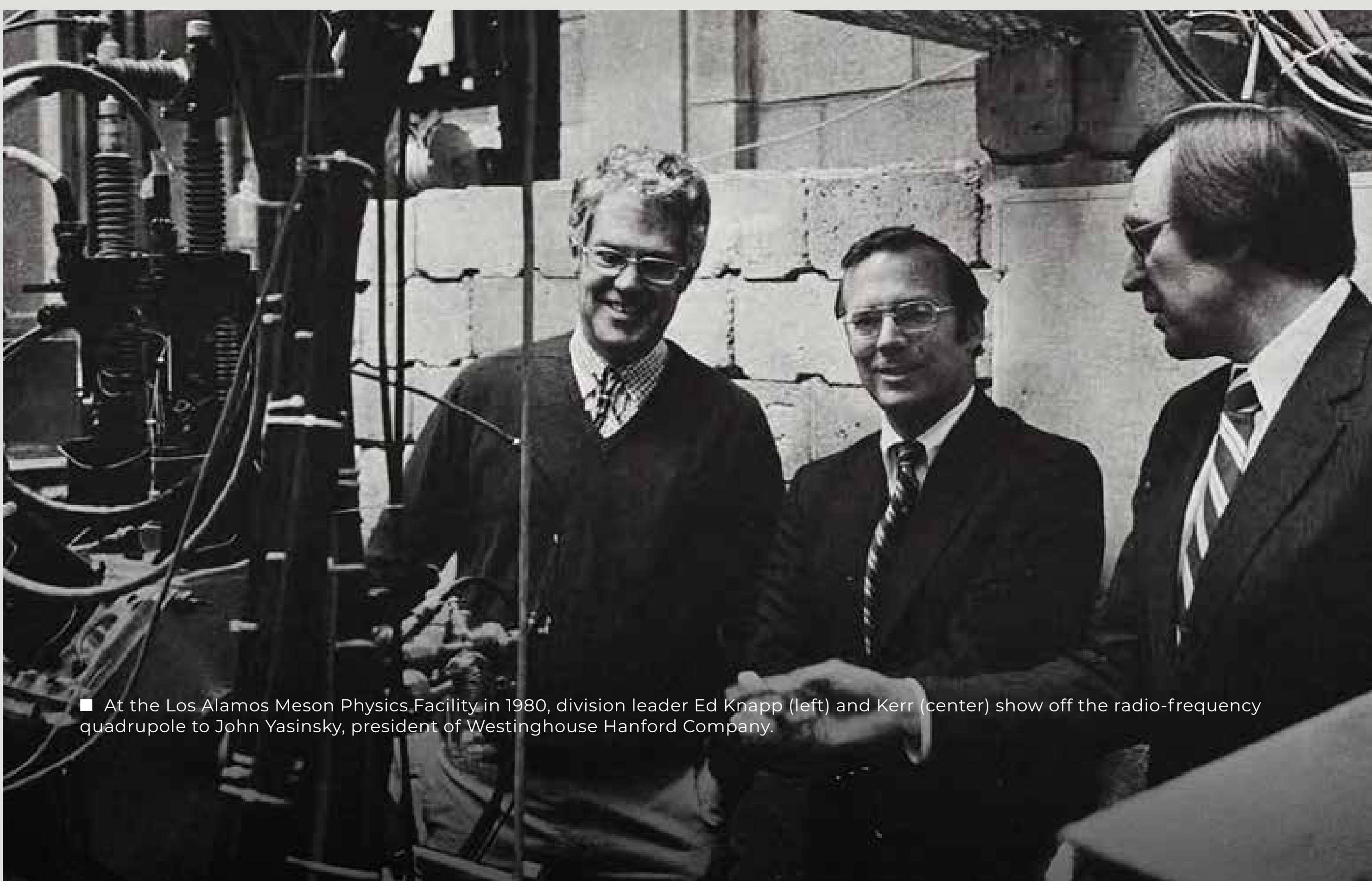
Among the many guests Don hosted were important visitors to the Lab, including actor and World War II veteran Charlton Heston. Heston came to narrate two classified films—*The Flavius Factor*, an overview of the Lab, and *Trust, but Verify*, about U.S.–Soviet scientific collaboration.

In a fitting full-circle moment, those short films were later declassified at the request of the Lab's National Security Research Center (NSRC, p. 18)—an organization that traces its roots to Kerr's directorship. During that time, a Manhattan Project–era file cabinet was discovered in the Lab's T Division. "Next thing I know, I'm going through these drawers of stuff," recalls Alison, who holds a degree in library science with a focus on archives. Working with historian Lillian Hoddeson, Alison proposed an official archives program. With Kerr's approval, they transformed part of a warehouse on DP Road into the Lab's first archives—the precursor to today's NSRC.

John Hopkins, who served as the head of weapons testing during this time, considers the creation of the archives among Kerr's most enduring accomplishments. "There are tens of thousands of documents in there, and they were organized in a fantastic fashion that made them usable," he says. "The archives are really a shining light for the Laboratory."

John Browne, who would in 1997 become the sixth Los Alamos director, rose through the ranks—from group leader to division leader to associate Lab director—during Kerr's tenure and became familiar with Kerr's leadership style. "Don was a very focused and decisive director," Browne says. "He was good at asking the opinion of his leadership team on major decisions, but it was clear that he was in charge and would make the decisions—it was not a consensus."

Browne recalls that as director, "Don made many changes at the Lab, some of which were roundly criticized by the staff and others warmly adopted." Chief among the initially unpopular reforms was the introduction of matrix management, which gave program managers responsibility for interacting directly with customers in the Departments of Energy and Defense.



■ At the Los Alamos Meson Physics Facility in 1980, division leader Ed Knapp (left) and Kerr (center) show off the radio-frequency quadrupole to John Yasinsky, president of Westinghouse Hanford Company.

"Prior to this change, technical divisions—line management—carried all the power in executing programs," Browne explains. "The decision was not popular, but Don felt we needed a better, unified interface with Washington. Matrix management, of course, still exists at the Lab today."

In 1980, Kerr told *The Atom* that "the reorganizations at the Laboratory are really a matter of catching up to the changing nature of our research and development programs. These have evolved in number from 1 in 1943 to anywhere from 50 to 200 today, depending on how you aggregate programs."

Among Kerr's more popular initiatives were the creation of the Laboratory Fellows program (p. 11) and the launch of Institutional Research and Development (ISRD), which funded long-term basic and applied research to build new capabilities. Funding for ISRD came from a 7 percent tax on all Lab programs. According to Browne, after some debate in DOE and Congress, the same concept—renamed Laboratory Directed Research and Development (LDRD)—was established at all DOE labs and continues to this day. "I consider this a *major* legacy of Don," Browne says.

In 2007, U.S. Senator Jeff Bingaman agreed, testifying before Congress that LDRD "was and continues to be a mechanism at the Laboratory that has allowed for some of the very best of the research that is done at not only Los Alamos but all of our national laboratories to occur."

According to a 1997 *Physics Today* article, Kerr's lasting contribution as director was diversifying the Lab. "Along with its traditional mission in nuclear weaponry, Los Alamos took on a multiprogram look, with activities in defense technology, microelectronics, materials research, life sciences, high-performance computing, applied mathematics, and basic and applied physics." Many of these programs had civilian applications—including genome sequencing, which led to the Lab's creation of a DNA database now used by the global research community.

■ U.S. Senator Pete Domenici, Kerr, and U.S. Senator John Warner share a laugh in the Lab's Study Center.

LIFE AFTER LOS ALAMOS

By 1985, Kerr's daughter had graduated from high school (alongside many students she'd gone to kindergarten with), and he felt the time was right to pursue new opportunities. He spent the next dozen years in private industry, first at EG&G, a Massachusetts-based engineering firm that operated the Nevada Test Site and other facilities, and later with Science Applications International Corporation (SAIC) in La Jolla, California. In 1996, he joined Information Systems Laboratories in San Diego as executive vice president.

The following year, Kerr was contacted by the Federal Bureau of Investigation (FBI). "He couldn't figure out if they wanted his advice about who to hire or if they wanted to hire him," Alison remembers.

It turned out to be the latter. In October 1997, Kerr became the assistant director in charge of the FBI Laboratory Division. FBI Director Louis Freeh said the Bureau needed "a scientific leader—someone who would bring the methodologies of science and the experience of managing scientists into that laboratory."

Kerr later told the American Physical Society that the FBI job "was not something I'd ever expected to do, but it was such an interesting opportunity."

In *Physics Today*, Kerr explained: "The scientific research and technology that I'm familiar with are exactly what's needed by the Bureau's lab to deal with new threats—nuclear, chemical, and biological terrorism, and computer and cyberspace crimes."

When Freeh left the FBI in 2001, Central Intelligence Agency (CIA) Director George Tenet recruited Kerr to serve as deputy director for science and technology at the CIA. "The CIA and FBI are very different culturally," Kerr told *Physics Today* in 2004, explaining that the FBI looks backward—to find out what happened—while intelligence looks forward, to predict what might happen. "Scientists are used to the way intelligence organizations think because a fundamental of physics is to be able to predict things theoretically."

In 2005, then–Under Secretary of Defense for Intelligence Steve Cambone (p. 56)—who had worked for Kerr at Los Alamos in the early '80s—recommended Kerr to lead the National Reconnaissance Office (NRO), the Department of Defense agency within the intelligence community that designs, builds, launches, and operates the nation's reconnaissance satellites. "The secretary of defense asked me who I would suggest to be the director of the NRO," Cambone remembers. "And I said, the guy you want is Don Kerr." Cambone says that in addition to being technically competent, Kerr was curious and thoughtful but also direct and confident. "There was ownership on his part of his responsibilities and authorities," Cambone says.

Kerr was sworn in that July as the 15th director of the NRO. By this time, Kerr had been out of technical work for decades but appreciated the importance of a technical perspective in intelligence work. "Physics is one part of applying all of the tools and techniques that one can think

■ Los Alamos directors gather for a photo in 2018. From left: Charlie McMillan, Mike Anastasio, John Browne, Bob Kuckuck, Don Kerr, Terry Wallace.

of to different parts of the intelligence problem. It's woven in," he told the American Physical Society in 2009. "You need a strong science and technology input, and at the same time, you need people who have field experience who know what kinds of things you can do in different places. You've got to build the whole team."

PRINCIPAL DEPUTY DIRECTOR OF NATIONAL INTELLIGENCE

In July 2007, President George W. Bush nominated Kerr to serve as principal deputy director of national intelligence, the person responsible for coordinating the activities of the nation's 16 intelligence agencies.

"It was the only job where he was appointed and confirmed by the Senate," Alison remembers. "As far as the process was concerned, one thing was interesting: No one ever asked if he was a Democrat or Republican." During his confirmation hearing, Kerr was introduced by Senators Jeff Bingaman and John Warner—one Democrat, one Republican. "I don't know that I've ever seen a more qualified individual than Don Kerr to entrust our nation's intelligence to," Warner said.

During the hearing, Kerr testified that "the intelligence community must deliver information without bias or prejudice. Intelligence analysis must be rigorous, timely, and independent from political considerations." He warned of challenges such as nuclear proliferation, catastrophic terrorism, and pandemic disease, emphasizing that intelligence "must think ahead to ensure capabilities are available when needed."

He was confirmed on October 4, 2007, and served until January 20, 2009.

A LEGACY OF SERVICE AND SCIENCE

In retirement, Kerr remained deeply engaged in national security and science policy. He served on advisory boards for several organizations, including MIT Lincoln Laboratory and the Potomac Institute for Policy Studies, and was a fellow of both the American Physical Society and the American Association for the Advancement of Science.

In 2009, Kerr joined the board of trustees of the Mitre Corporation, where he was reunited with Schlesinger, the board chairman. In 2015, Kerr became vice chairman. He was chairman from 2018 to 2021.

Nancy Jo Nicholas, associate Laboratory director for Global Security at Los Alamos, recalls working with Kerr on the Defense Science Board. "Don was witty, with a dry sense of humor and a patriotic focus on using deep science, technology, and engineering to give our country a true advantage," she says.

After moving to Denver in 2018, Kerr occasionally returned to Los Alamos. At the Lab's 75th anniversary in 2018, he identified "gray or hybrid warfare" as the greatest emerging national security challenge. "You have to ask how nuclear deterrence fits into this new construct," he said. "Social media has enabled things we never thought of years ago."

In 2020, Los Alamos dedicated the Donald M. Kerr Office Building—a new secure facility named in his honor. "It's very fitting," Nicholas noted, "that a building where important intelligence work will be performed bears his name."

Just three years later, Kerr suffered a stroke and never fully recovered. He died in Denver on July 13, 2025, at the age of 86. ★

BETTER SCIENCE = BETTER SECURITY

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

ACHIEVEMENTS OF LOS ALAMOS EMPLOYEES

Former Lab Director **Michael Anastasio** was honored at Lawrence Livermore National Laboratory with the 2025 John S. Foster Jr. Medal. He is the only person to have led both Livermore and Los Alamos, and the award recognizes his more than four decades of service to national security. Livermore Director Kimberly Budil said Anastasio exemplifies the integrity, technical excellence, and teamwork that define the Foster Medal—qualities embodied by its namesake, John S. "Johnny" Foster Jr.

Scientist **Larry Hill** was named a 2025 American Physical Society Compression of Condensed Matter Fellow. This fellowship recognizes Hill's "groundbreaking contributions to the innovative design and execution of shock physics experiments involving energetic materials; pioneering insights into the microstructural effects of high explosives; and significant advancements in the theoretical understanding of shock and detonation physics."

Scientist **Chris Fryer** won the Hans A. Bethe Prize from the American Physical Society for "broad and pioneering contributions to our understanding of stellar collapse, supernovae, and compact object formation, and for leadership in the field of time-domain multi-messenger nuclear astrophysics."

Scientist **Chris Morris** received the Tom W. Bonner Prize in Nuclear Physics from the American Physical Society for "pioneering work to develop an ultracold neutron source and establish ultracold-neutron-based physics research in the U.S., and for leadership in measuring the free neutron lifetime to unprecedented precision using a magneto-gravitational trap and in-situ detection of neutrons."

Four Los Alamos researchers were awarded Laboratory Fellows' Prizes: **Andrei Simakov** received the Fellows' Prize for Research, and **Matthew Biss**, **Sowjanya Gollapinni**, and **Etienne Vermeulen** received the Fellows' Prize for Leadership. Awarded by the Laboratory director, prize nominees are reviewed and recommended by a committee of Laboratory Fellows (p. 11).

As the technical lead for the Terrier program (p. 7), **Jennifer Roos** played a key role in establishing a cross-repository search tool on the classified network—something that would have been impossible only a few years ago. For this effort, she was awarded an Individual Distinguished Performance Award from the Laboratory.

The Lab's Parking and Transportation Services group won the Outstanding Innovative Partnership Award from the Association for Commuter Transportation, which honors institutions that creatively solve transportation demand-management issues. The Lab group developed the Express Bus pilot program and quickly stood up a new parking enforcement program at the Lab.

Mike Furlanetto, formerly the senior director of the Lab's Advanced Sources and Detectors–Scorpius Project, is the new senior director of the Lab's Weapons Infrastructure Program Office (WIPO). Furlanetto is responsible for overall strategy, capture, and leadership of WIPO's program elements, which include operations and maintenance, recapitalization, and capabilities-based infrastructure.

Don Haynes, former senior director of the Lab's Nevada Programs Office, is the new senior director of the Lab's National Security Artificial Intelligence Office. In this role, Haynes will establish the vision for AI at Los Alamos, influence external ecosystems, and guide integration across mission spaces. Haynes will also serve as the Los Alamos program director for the Genesis Mission, a national initiative to advance artificial intelligence and accelerate scientific and national security achievements. ★

QUOTED

"The lead in science and discovery that our laboratories uniquely provide will continue to ensure America's deterrence capability. Whether it is materials science, high-energy physics, hardened electronics, advanced manufacturing, and in many other fields, our scientists, engineers, and technicians are strengthening America and ensuring our continued freedom."

—Brandon Williams, administrator of the National Nuclear Security Administration (NNSA), in his inaugural address to employees on September 30, 2025. Los Alamos National Laboratory is an NNSA lab. ★

36 YEARS AGO

During World War II, the Navajo Code Talkers—a group of Native American Marines who used simple words and phrases from their unique tribal language to baffle Japanese code breakers—helped spur Allied victory in World War II. At a Los Alamos National Laboratory event in June 1990, Navajo Code Talker veterans (pictured here) demonstrated how the Navajo code was used on the battlefields of the Pacific.

Although the Navajo Code Talkers did not originate from Project Y—the Los Alamos branch of the Manhattan Project—many have direct connections to the modern Laboratory and are relatives of today's staff. ★

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THEN & NOW

Below, operators manually program the Electronic Numerical Integrator and Computer (ENIAC) circa 1946. Although ENIAC was housed at the University of Pennsylvania, Los Alamos scientists used it for thermonuclear calculations related to early hydrogen bomb feasibility studies.

Right, a Los Alamos National Laboratory employee installs the Venado supercomputer in April 2024. Ranked as the 19th-fastest supercomputer in the world, Venado uses Nvidia superchips to run OpenAI's reasoning models to address issues such as plutonium aging, biological threats, and other national security challenges. ★