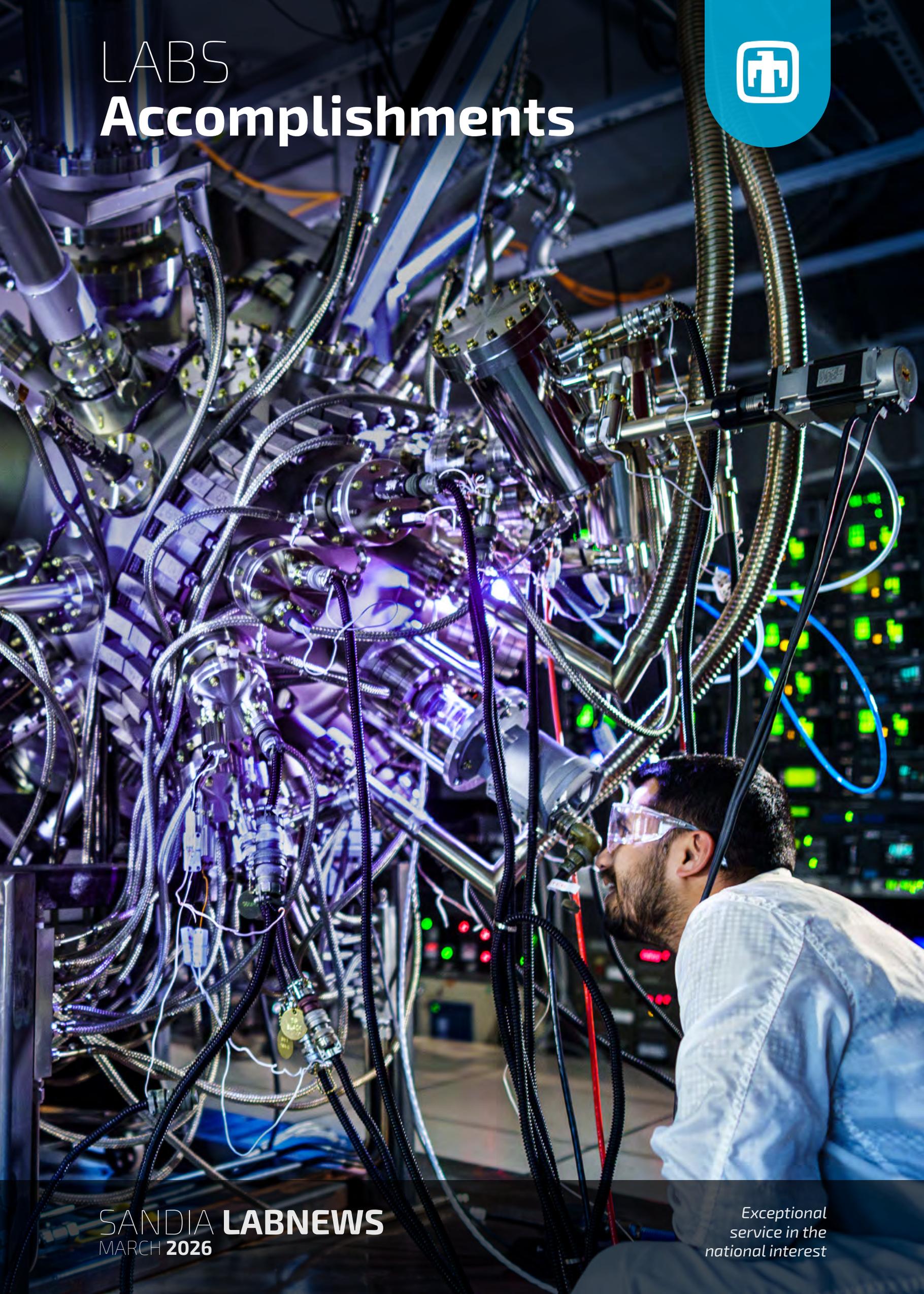


LABS

# Accomplishments



SANDIA LABNEWS  
MARCH 2026

*Exceptional  
service in the  
national interest*



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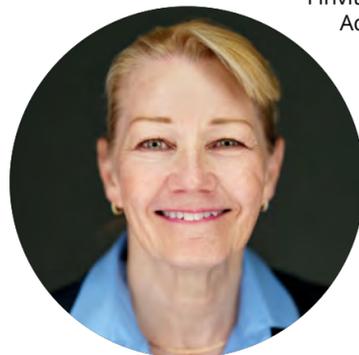
# A LETTER FROM THE Labs Director

Welcome to the 2026 edition of Labs Accomplishments, our annual look at the work Sandians delivered throughout the previous fiscal year. This publication offers a window into the talent, creativity and determination that define our laboratory. It captures what we achieved and how we achieved it through collaboration, technical excellence and dedication to our national security mission.

Inside these pages, you'll see Sandia at its best. You'll see advances in our stockpile readiness, progress in next-generation engineering and modeling, breakthroughs in microelectronics and materials science, and important contributions in AI, cybersecurity, energy security and global partnerships. You'll also read about the work that strengthens our foundation in such areas as safety, quality, operational excellence and the well-being of our workforce and community.

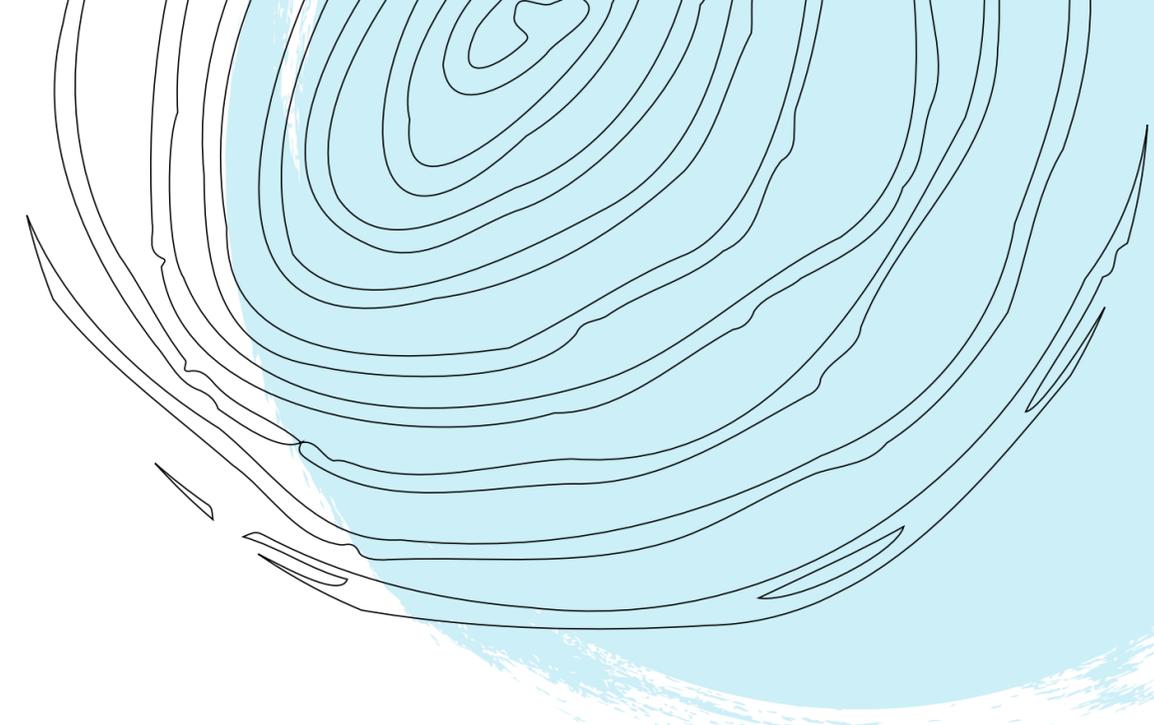
Much of Sandia's national security work takes place out of the public eye. Even so, the stories in this volume offer a clear picture of how we tackle challenges and deliver solutions that make a difference. They highlight a laboratory operating with purpose, pushing the boundaries of what is possible and bringing deep expertise to problems that demand the very best of us.

The importance of Sandia's mission has never been greater as the world becomes more complex and geopolitical risks continue to evolve. Our role in ensuring the safety, reliability and effectiveness of the U.S. nuclear deterrent remains central to the nation's security. Our science and engineering strength gives us the ability to anticipate what's coming and help protect the country in ways few others can.



I invite you to sit back with Labs Accomplishments and explore the outstanding work done by Sandians united in their dedication to this country and its citizens. It will be time well spent.

**Laura McGill**  
Sandia Laboratories Director



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**COVER FEATURES**  
Photos by Craig Fritz



**FRONT COVER**  
A materials scientist at Sandia gazes into a viewport of a molecular beam epitaxy reactor, highly specialized equipment Sandia will use to build experimental photonic cooling plates designed at startup Maxwell Labs for testing.



**BACK COVER**  
An engineer and technologist prepare an inert B61-13 vibration fly-around unit for testing.

# NUCLEAR

# » Deterrence



## Helium-neon lasers now calibrated on-site

A new frequency-comb system enables in-house calibration of Sandia's high-precision helium-neon lasers. These lasers, which are essential for the most accurate length measurements, were previously sent overseas for calibration, introducing unnecessary risks and delays. The new system streamlines the calibration process and positions Sandia for the upcoming redefinition of the second in the International System of Units. The future definition will use advanced optical clocks, promising unprecedented stability and accuracy. **2000**

◀ *Innovative frequency comb system calibrates Sandia's high-precision helium-neon lasers.*

## Resistor calibration time reduced from six months to one week

Sandia implemented a system that directly realizes the unit of resistance, called the ohm. This new tabletop quantum hall resistance system can calibrate resistors at the Labs rather than sending them off-site, slashing turnaround time from six months to one week. It is the only resistance standard traceable to the International System of Units for the nuclear security enterprise, and it supports more than 7,000 instruments. The advance boosts measurement confidence, ensures compliance with global standards and reinforces Sandia's position as a leader in collaborative research. **2000**

◀ *Table-top quantum hall resistance system*

## System flight testing demonstrates readiness of nuclear weapons

Readiness across the nuclear triad was demonstrated with 32 flight tests of inert weapons systems: Three W78 and two W87 weapons were tested in U.S. Air Force intercontinental ballistic missiles tests flown to the Reagan Test Site; seven W76 and five W88 weapons were tested in submarine-launched missiles flown on the U.S. Navy D5 system in the Atlantic and Pacific ranges; one air-launched cruise missile test with the W80 was conducted at the Utah Test and Training Range; and 14 total tests of the B61 gravity bomb were conducted at Tonopah Test Range — eleven B61-12, two B61-13 and one B61-11 earth-penetrator weapons. **2000, 8000**



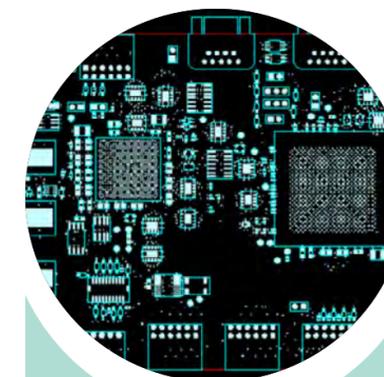
▶ *An F-35 aircraft prepares for a drop of B61-12 test at Tonopah Test Range.*



## B61-13 realized one year ahead of schedule

To reduce the weapon's production timeline by 50%, the B61-13 team developed a novel approach to system qualification resulting in completion of the newest weapon in the U.S. nuclear stockpile a year ahead of schedule. Activities included Pantex authorization basis reviews, final design review, system qualification evaluation releases, first production unit, flight and ground tests, and a design review and acceptance group review over only eight months. **1000, 2000, 3000, 5000, 7000, 8000**

▶ *B61-13 test unit*



▶ *Printed circuit board (PCB) design*

## Electronic CAD for printed circuit board design dramatically improved

Two major improvements in electronic computer-aided design for printed circuit boards have dramatically reduced workflow times and production defects. New library tools and process improvements have sped up the creation of printed circuit board library parts, cutting lead times from weeks or months to three days. In addition, implementation of a new configuration management system aligns printed circuit board definitions with industry standards, paving the way for digital engineering implementation across the nuclear security enterprise. **2000**



## Flight tests improve accuracy of simulated flight environments

The biggest risk for new weapon systems designs is damage from the conditions they face while flying. To address this, Sandia uses validated simulations to “fly on the ground” and accelerate delivery timelines for future systems. The Atrax-Birdeater flight tests, which featured highly instrumented reentry bodies, were flown out of Sandia’s Kauai Test Facility and collected valuable data that helps make simulations more accurate in predicting flight conditions. Sandia engineers are actively using these models for future system designs. [0002](#), [1000](#), [2000](#), [5000](#)

## KCNSC partnership reduces time from design to production

Sandia’s Engineering Data Management Team and Product Lifecycle Management Leadership Team worked closely with Design Engineering, Quality, Systems and Components teams to increase the number of first-time releases of engineering authorizations and product definition to the Kansas City National Security Campus. In fall 2024, more than 10% of releases required rework for quality or form-fit-function clarification for acceptance into the KCNSC Matrix system. By summer 2025, the teams achieved a 95% first-time release rate, resulting in shortened time from design to procurement or production. [2000](#), [7000](#), [8000](#), [KCNSC](#)

## New -supporting facility launches

The Enterprise Assurance department launched operations at a new leased facility supporting the Center for Advanced Manufacturing and Innovation on Development Road — and the first piece of equipment became operational for . Safety and security experts collaborated with Advanced Manufacturing to create essential safety documents, including hazard analyses and worker qualifications, and to ensure a secure environment. Readiness reviews identified gaps before work began, and with more than a dozen pieces of equipment to assess, Enterprise Assurance coordinated permits and developed comprehensive training for all users. [7000](#)



A technologist installs a new base plate on a system for additive manufacturing at CAMINO.

## Production deliveries include firsts

Sandia Production successfully delivered more than 18,000 critical nuclear weapon components in support of seven stockpile systems and five modernization programs. Among these deliveries are two significant milestones for Sandia and the stockpile: the first electronic neutron generator delivered to replace an explosive neutron generator; and the first microsystem accepted as a war reserve component, called the Electrical Environmental Sensing Device. [5000](#), [7000](#), [10000](#)

The electronic neutron generator replaces an explosive neutron generator.



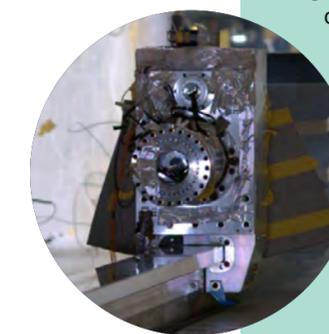
## W87-1 program replan completed

While progressing on Phase 6.3, development engineering, of the weapon lifecycle process, the W87-1 team completed a program replan that includes updating and integrating schedules and cost plans, aligning hardware and major tests, and integrating with Sentinel and Mk21A Air Force programs. The replan met the NNSA target schedule for the first production unit, incorporated scope updates and extended the program of record. This effort required collaboration between project controls teams and technical staff over nine months to replan and rebaseline the program. [2000](#), [5000](#), [7000](#), [8000](#), [10000](#)

W87-1 lift and assembly area.

## Digital thread makes significant advances across ND

The Power Sources Technology group demonstrated a fully integrated and automated digital thread that ties requirements, functional models and Creo software design definition together using a central definition file managed through GitLab. Sandia also developed a digital thread vision to integrate requirements, design guides and testing data into a single web-based interface for design trade exploration for neutron generators. A digital thread has the potential to save hundreds of hours of labor, optimize internal processes and improve overall efficiency in nuclear deterrence. [0002](#), [1000](#), [6000](#), [7000](#)



Sled at the Linear Actuator facility

## Prototype for reducing rapid deceleration damage

Sandia engineers responded to an innovation challenge to reduce damage from rapid deceleration by designing and testing prototype assemblies with new impact mitigation techniques. Prototypes employed different materials arranged to absorb or guide energy around critical components, minimizing damage in key locations. The successful performance of these tests in sudden deceleration at the Linear Actuator facility validated digital modeling and simulation and boosted confidence in new design approaches to robust mechanical design. [0003](#), [1000](#)



### Lab transformed for explosive production a year ahead of schedule

Sandia teams fast-tracked transformation of an existing laboratory and stood up an internal production capability for headers for explosive components. This initiative involved installation of two new furnaces essential for manufacturing. By addressing increasing production demand, the team completed the project ahead of schedule and under budget, providing a one-year head start on future production plans. **4000, 7000**

### Innovative nondestructive technique measures tritium content in metal hydrides

Engineers developed a new nondestructive way to directly measure tritium content in metal hydride films. Traditionally, determining a tritium-to-metal ratio has required destructive techniques. The new method, called Beta-Induced X-ray Spectroscopy, preserves the target, reduces analysis time by about 80% and eliminates the need for destructive gas analysis. This represents a major advancement in tritium quantification and target characterization, improving the process for neutron generation via deuterium-tritium fusion reactions. **7000**

### Strong production of power sources parts

The Power Sources Technology group delivered 1,149 diamond-stamped parts. The group produced the last production unit of thermal batteries for the B61-12 and made significant progress toward last production unit of two other product lines. Additionally, the group built a robust program to maintain production readiness in anticipation of future demands from new programs or for additional lots of products that have ceased production. **0003, 7000**

*The B61-12 incorporated the last production unit of thermal batteries delivered by the Power Sources Technology group.*



### Chemical decapsulation capability clears testing backlog

The Electronic Parts Program established a chemical decapsulation capability that cleared a significant backlog of electrical part testing for commercial electronic parts assurance and nuclear deterrence electronic part surveillance programs. This new capability also allowed the program to complete all W80-4 piece-part radiation testing and is a critical resource in the execution of the newly released drawings. **7000**



*The W80-4 team completed all piece-part radiation testing early with help from a new chemical decapsulation capability.*

### SLCM-N warhead down-selected to W80 family

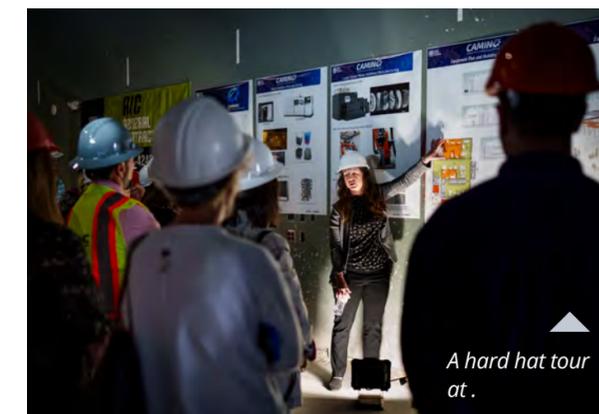
After significant consideration, the NNSA signed a memorandum validating the Sea-Launched Cruise Missile-Nuclear warhead down-selection to the W80 weapons system family. Numerous analyses of alternatives, white papers, Weapon Intern Program projects and proposals contributed ideas for which warhead configuration would be optimal in a modern SLCM-N. Prior to the SLCM-N team's efforts to generate a consistent ranking matrix, no single source contained the information needed by stakeholders for this complex, multifaceted decision. **0003**



*An inert W80-5 unit*

### CAMINO and the DREA<sup>2</sup>M LDRD Mission Campaign launch

The Center for Advanced Manufacturing and Innovation facility on Development Road and the Digitally Realized and Enabled Agile Advanced Manufacturing campaign address mission demand by establishing trust in advanced manufacturing. opened a facility, delivered product demonstrators and forged cross-site partnerships to reinforce trust and agility. DREA<sup>2</sup>M, a seven-year, \$45 million Laboratory Directed Research and Development Mission Campaign, selected 13 proposals for \$6 million in total funding. Both projects provide funding, equipment, space, tools and partnerships to erase knowledge gaps and accelerate production. **1000, 7000, LDRD**



*A hard hat tour at .*

### New W87-0 Firing Set Assembly facilitates rebuilds of the W87-0 warhead

One of the Major Component Firing Set Assembly Project Realization teams achieved first production unit for the -06 suffix, a showcase of extensive collaboration across the nuclear security enterprise. Production of the -06 suffix is planned through fiscal year 2036, facilitating Pantex rebuilds of the W87-0 warhead to meet the needs of U.S. Strategic Command. **7000**



*W87-0 Firing Set Assembly*



### Pioneering supplier assessment process implemented

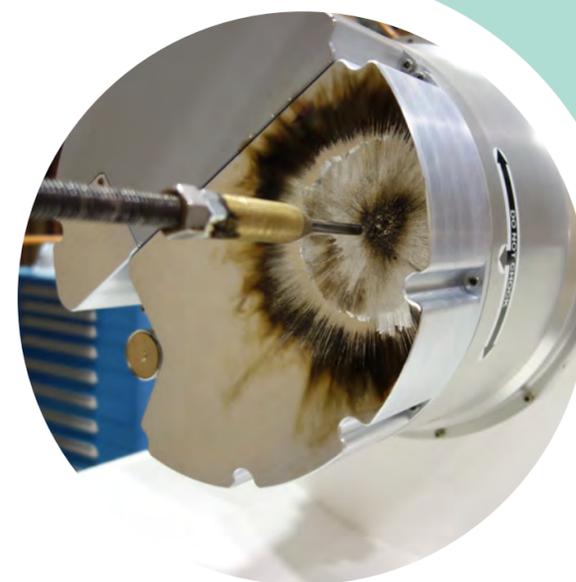
Sandia implemented a new process that transforms supplier assessments at the Labs and across the national security enterprise. The process aligns with industry standards to streamline certification of suppliers for mark quality, a designation for materials and components that are fit for nuclear weapons production. Teams updated all necessary documentation and enhanced IT infrastructure to meet the standards. These changes were implemented ahead of schedule, leading the way for all other sites in the national security enterprise. **2000, 7000**

### Additive manufacturing enhances production of cables

The W80-4 Detonator Stronglink team, which is introducing technology into the stockpile, achieved first production unit 68 days early, while the Firing Set Stronglink team accomplished this nine months ahead of the next level assembly need. Both teams collaborated closely with Kansas City National Security Campus to build, test, characterize and qualify designs, ensuring they meet or exceed rigorous requirements. These safety devices are critical for ensuring that the weapon remains safe throughout its lifetime, regardless of intended or unintended environments. **7000, KCNSC**

### Teams achieve early first production units for stronglinks

The W87-1 Cables Product Realization team used additive manufacturing to enhance design maturation and defect prevention. A three-phased approach was implemented to validate mechanical requirements and ensure design accuracy. This approach saved the program an estimated \$2.4 million and promoted meeting full production milestones. **7000**



A lightning strike is simulated on W80-4 warhead test unit during qualification testing.

### W80-4 system integration and qualification

The W80-4 program successfully completed several milestones that provided confidence in the final design to meet requirements and close knowledge gaps, including completion of all remaining war reserve component final design reviews. Additionally, the teams completed 15 system-level ground-test activities with final design development hardware, including fully functional lifetime mechanical and thermal testing, electromagnetic testing, benchtop electrical testing over a wide range of inputs and abnormal environment and use control testing, successfully compiling all evidence required for system final design review in fiscal year 2026. **1000, 2000, 8000**

### W80-4 Code Management System update

The W80-4 Code Management System was updated in support of its upcoming deployment. The Sandia W80-4 team developed, qualified and delivered several software updates to the Defense Threat Reduction Agency. These updates were installed at DOD sites with Sandia support, and DOD personnel were trained for the system recertification. The updated system is now in use in the U.S. nuclear stockpile. **8000**

### Simplified approach to onboarding nuclear deterrence staff

Weaponer Professional Development and Nuclear Deterrence Transformation teams developed an innovative onboarding program with the goal of fast-tracking proficiency for staff supporting Nuclear Deterrence. A single source of information with on-demand training, resources and insights into engineering, governance and mission drivers has received over 2,500 views since launch and fostered knowledge transfer and collaboration. Coupled with in-person networking opportunities, including tours of key facilities, this initiative has ensured consistent, scalable onboarding, empowering staff and strengthening the nation's nuclear deterrent. **0003**

Nuclear deterrence team members weigh the first B61-13 HiFi unit.

### Reliability-risk communications with nuclear weapons stakeholders improved

The Uncertainty Based on Recent Surveillance team successfully finalized innovative methodologies and toolsets that incorporate surveillance data currency into quantified nuclear warhead and bomb reliability uncertainty reporting. This update concludes a multiyear effort to better communicate reliability risk to nuclear weapons stakeholders and war planners. **0003, 2000, 5000, 8000**

### Standardized terminology takes guesswork out of ND documentation

An extensive eight-year effort to improve terminology associated with nuclear weapon safety, surety, weapon readiness and weapon effectiveness has reduced confusing, unclear or incomplete wording in nuclear weapon realization and operational activities and artifacts. Sandia's Independent Technical Assessment and Military Liaison teams partnered with the Defense Threat Reduction Agency to reach agreement across all U.S. nuclear deterrent stakeholders on new terminology for the DOD and DOE joint dictionary for nuclear weapons. **0003, 2000**



# » GLOBAL Security

## Real-time sensor processing system fully operational

Sandia has successfully designed and deployed a real-time processing system capable of managing 10 national sensors around the clock. The federal government declared the system fully operational. The robust system has over 4 million lines of code and 100 racks of equipment across four environments, including cloud infrastructure, has been declared fully operational by the U.S. government. With the successful transition of two new national sensors into operation with full mission capability, this achievement reflects five years of dedicated effort by Sandia's teams, building on more than a decade of innovation to enhance national security. **6000**



## Accelerating cesium irradiator replacement

In support of a congressional mandate, Sandia accelerated NNSA's initiative to eliminate cesium-137-based blood irradiators in the U.S. by the end of 2027. Through research and development studies and workshops, Sandia encouraged sites to participate voluntarily, resulting in the negotiation and awarding of 27 contracts for replacing devices and removing cesium-137 by Los Alamos National Laboratory or Idaho National Laboratory. By exceeding the goal of 15 contracts, Sandia enhanced NNSA's ability to fulfill its commitment and mitigate risks related to the misuse of radioactive materials. **6000, LANL, INL**

◀ Newly installed X-ray blood irradiator replacement for cesium-137-based blood irradiator

## Next-generation space sensor payload Red Door

The Space Mission program is tackling new challenges in space and advancing the nation's defense capabilities by developing Red Door, a next-generation space sensor payload. The project has secured customer funding to refine the sensor design and reach a system design review level of maturity, underscoring its importance. This project helps advance flight system technology, ultimately supporting the Golden Dome for America, and highlights Sandia's leadership in national security. **6000**

## Enhancing nuclear explosion monitoring capabilities

Experiments at Sandia's Large Centrifuge Facility advanced U.S. capabilities in monitoring low-yield underground nuclear explosions. The team used the superfuge to achieve acceleration-scaled yield and depth conditions that nearly matched those of field-scale experiments. These methods significantly lowered costs and increased the frequency of experiments compared to field-scale tests. Superfuge experiments produced multiphenomenological datasets that help develop and validate models for seismic signals generated by underground explosions, gas migration, damage and other geologic effects, such as the formation and evolution of geologic stress cages. **1000, 6000, 8000**

▶ The multiorganizational Superfuge experiment team performed two successful tests in support of NNSA's Low Yield Nuclear Monitoring program.





### Mission Systems Engineering experts validate critical information for national security

Mission Systems Engineering experts confirmed the effectiveness of new national sensors. Sandia developed and validated 100-plus tailored sensor mission configurations, using advanced modeling and simulation tools to create realistic scenarios for testing data-processing software. Following deployment, Sandia conducted a rigorous five-month, around-the-clock checkout to ensure precise sensor control and optimal data performance. This culminated in a monthlong multinational test campaign of 500 orchestrated strategic live events, successfully operationalizing sensors that provide real-time, critical national security information. **6000**

Mission Systems Engineering team leverages expertise to enhance national security and drive innovation.

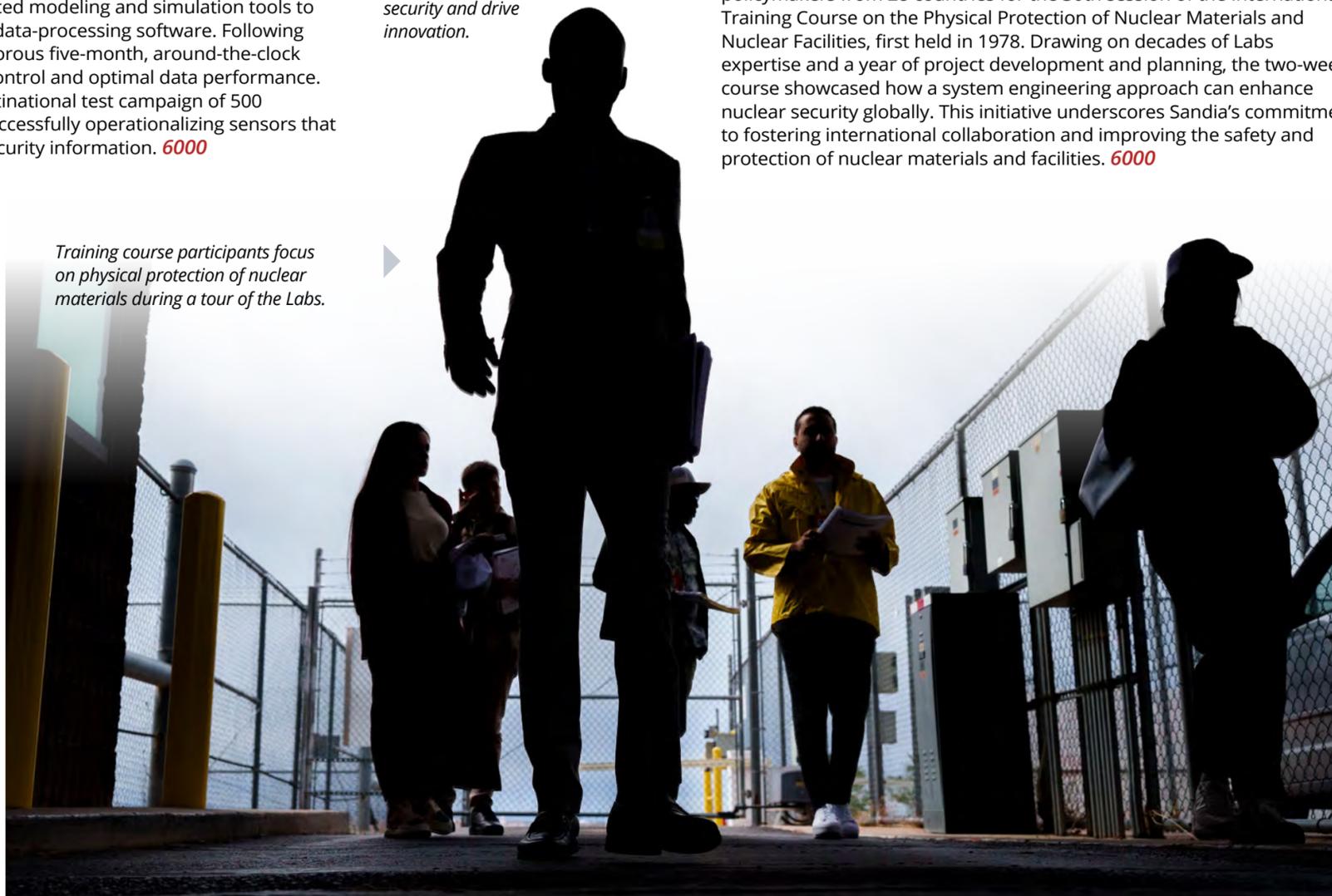


Accident Response Query System field kit

### ARQS delivers critical accident response capabilities

The Accident Response Query System team delivered its first units to the Accident Response Group Federal Program Office in September 2025, on time and within budget. This system fills a Nuclear Emergency Support Team Device Response Division requirement for the B61-12 by providing weapon system data through a rugged user interface. **6000**

Training course participants focus on physical protection of nuclear materials during a tour of the Labs.



### WEPAR delivers final milestone in transforming Y-12 Protected Area

The West End Protected Area Reduction project achieved interim beneficial occupancy, implementing a western Protected Area boundary at the Y-12 National Security Complex. The project cleaned up Y-12 legacy site conditions and constructed state-of-the-art Perimeter Intrusion Detection, an Analysis System and Entry Control Facility. Once these were active, the Y-12 Protected Area was reduced by about 70 acres, allowing less restricted access to Cold War-era contaminated facilities for demolition and further site cleanup. **6000, Y-12**

### 30th International Training Course enhances nuclear safety

Sandia hosted more than 40 nuclear site operators, regulators and policymakers from 28 countries for the 30th session of the International Training Course on the Physical Protection of Nuclear Materials and Nuclear Facilities, first held in 1978. Drawing on decades of Labs expertise and a year of project development and planning, the two-week course showcased how a system engineering approach can enhance nuclear security globally. This initiative underscores Sandia's commitment to fostering international collaboration and improving the safety and protection of nuclear materials and facilities. **6000**

Consolidated Nuclear Solutions, Sandia and prime contractor Aleut Remediation Solutions teams pose in front of the new entry control facility.



A bank of capacitors mounted inside a multiwalled container prior to Diagnostic Heavy Replay Testing.

### Diagnostic Heavy Replay Tests advance insights into component failures

The Diagnostic Heavy Replay Tests used advanced equipment and techniques to evaluate how electrical components and containers perform and fail when used in improvised fire sets. This test series included a diverse selection of components, including capacitors, sensors, connectors and multiple container materials. The team captured different signatures from the test objects, and data processing and analysis provided valuable insight into component failure. The results significantly enhanced the ability to predict performance under unusual conditions. **6000**



A new facility at F.E. Warren Air Force Base, where Sandia assisted with government acceptance testing. (Photo courtesy of the U.S. Army Corps of Engineers)

### Security system upgrade for vital security assets

The Sandia Weapons and Force Protection program expertly executed the design, implementation and acceptance testing for an Air Force Lifecycle Management Center project aimed at a significant security at a system upgrade at F.E. Warren Air Force Base in Wyoming. These advanced systems bolster the protection and resilience of critical national security assets. This milestone signifies a key step in the ongoing effort to modernize the Air Force's vital infrastructure. Following the successful tests, the Air Force has officially embraced the new systems and will collaborate with its contractor partners to ensure a seamless transition to full government ownership. **6000**

### Global Burst Detector team marks critical milestone

The Global Burst Detector IIF team successfully completed a critical milestone in the design phase of the next-generation flight system. This review confirmed that the Global Burst Detector payload, hosted on GPS satellites, meets all mission requirements for detecting aboveground nuclear detonations globally. Multiple Sandia divisions contributed to its success. Partnership with Los Alamos National Laboratory ensured integration of six advanced subsystems, enhancing nuclear detection capabilities and bolstering national and global security. **5000, 6000, 10000, LANL**

GBD team members prepare the system for thermal vacuum testing, a key verification activity to certify the system for space flight.



The MGT team at a milestone event



### MGT establishes baseline for next-gen secure transport

The Mobile Guardian Transporter program is developing next-generation secure transportation solutions for the NNSA. It recently achieved a significant milestone by holding the Delta System baseline design review, which demonstrated closure of the integrated Mobile Guardian Transport system design. Experts from Sandia and Kansas City National Security Campus New Mexico Operations evaluated this integration. Positive feedback allowed the program to establish a technical baseline for final development, qualification and production, enhancing NNSA's fleet and ensuring the security of critical national assets. **6000, KCNSC**

### NATO arms control visit

On behalf of the NNSA and the Department of State, Sandia hosted a delegation of more than 37 members from the North Atlantic Treaty Organization Arms Control, Deterrence and Nonproliferation Committee, representing 22 countries. This visit reaffirmed the U.S. government's commitment to nuclear nonproliferation, advanced global security initiatives and international partnerships. The event included in-depth briefings on Sandia's critical contributions to stockpile readiness and nonproliferation, as well as a tour showcasing advanced capabilities for countering unmanned aerial systems, underscoring the importance of collaborative efforts in enhancing global security. **6000**

Delegates from 22 countries discussed nuclear nonproliferation and global security initiatives during their visit to Sandia.



### SIRP transforms Y-12 security with innovative improvements

The Y-12 Security Infrastructure Revitalization Project improved parts of the legacy Protected Area boundary and installed modern communication pathways to support the new perimeter and security systems for the West End Protected Area Reduction. The Physical Security Center of Excellence reduced project scope to meet the minimum NNSA Office of Security Operations and Programmatic Planning requirements through engineering and system design changes while reducing costs. **6000, Y-12**

Site restoration at Post 8 included drainage control.

# » NATIONAL Security

## Cybersecurity advances in hypersonic weapons

The Cyber Threat Center's Secure Engineering team successfully developed a security-enhanced bootloader for a hypersonic weapon system, crucial for initializing hardware and loading the operating system. They implemented cybersecurity improvements, enabling software signing and secure communication, building on an existing open-source project. A comprehensive security assessment was conducted concurrently with development, allowing for feedback integration before final delivery. The team met all objectives, delivered on time and exceeded expectations. **5000**

## Successful radio frequency test in challenging environments

The Strategic Radio Frequency and Electronic Systems team participated in an electronics field test with a sponsor in Colorado, successfully demonstrating interoperability of aircraft and ground-based interrogators with radio frequency tags. The testing allowed for user training, new software feature validation and full mission profiles in real-world disadvantaged environments, such as mountainous regions. **5000**



▲ *Multimission RF Tags being demonstrated in real environments*

## MESA Silicon Microfabrication team reduces production cycle time

The Microsystems Engineering, Science and Applications Silicon Microfabrication team has significantly reduced production cycle times, enabling early wafer deliveries and accelerating product teams' learning cycles and risk mitigation testing. They have made important improvements, including faster processing of Complementary Metal-Oxide-Semiconductor 8 risk mitigation lots. As of January 2025, the team delivered 186 consecutive lots on or ahead of schedule, cutting production cycles for CMOS7, CMOS8, Silicon Photonics and Quantum Ion Trap in half. **5000**

▶ *A researcher measures film thickness on wafers at MESA.*



## CMOS8 advances in maturity and manufacturability

Sandia's Complementary Metal-Oxide-Semiconductor 8 process has achieved level-five technology readiness and level-four manufacturing readiness, key milestones in technical maturity and manufacturability. These achievements demonstrate the readiness of the Microsystems Engineering, Science and Applications facility to support future stockpile needs, enabled by accelerated fabrication, design improvements and reduced programmatic risk through comprehensive chip testing. The progress enhances confidence in future deliverables. The success of these milestones reflects the collaboration and dedication of the silicon-fab, post-fab, radiation effects and broader CMOS8 teams. **5000**

▶ *Wafers are sorted after their fabrication at MESA.*





### Novel nuclear threat assessment team

With significant support from Sandia's Proliferation Assessments and Monitoring Systems Centers, a trilab team received the DOE Office of Intelligence and Counterintelligence Director's Alsos Award and the Administrator's NNSA Achievement Award. The Alsos Award recognized the team for their analyses of a nuclear weapon system threatening U.S. national security. Their assessments provided critical insights for policymakers, earning praise from senior officials and highlighting the essential role of NNSA and its national laboratories in addressing national security threats. **5000, 6000**

### Conventional Prompt Strike and Long-Range Hypersonic Weapon tests

The Conventional Prompt Strike and Long-Range Hypersonic Weapon programs had two successful flight tests. The first was a live-fire event for the Long-Range Hypersonic Weapon system using a battery operations center and transporter erector launcher — the second end-to-end flight test of the all-up round. The other flight test was the next step in the Navy's program of the common all-up round that is being developed in partnership with the Army Rapid Capabilities and Critical Technologies Office. The Conventional Prompt Strike program team has been diligently planning and executing engineering and test efforts to prepare for the first Navy fielding aboard the USS Zumwalt. **5000**

### Improved fentanyl detection

The Fentanyl Analog Independent Detector is portable technology that revolutionizes public safety by delivering critical detection capabilities to the field. Unlike older detection tools, FAID can recognize the basic chemical patterns found in fentanyl, which allows it to identify current and new versions of the drug. FAID can find fentanyl and its variations even in very small amounts and even when mixed with other substances. The technology is a significant step forward in chemical detection, helping to protect our military personnel, emergency responders and law enforcement. **8000**

*The fentanyl detection system is housed in a portable protective case. External push buttons and a screen make it easy to operate.*

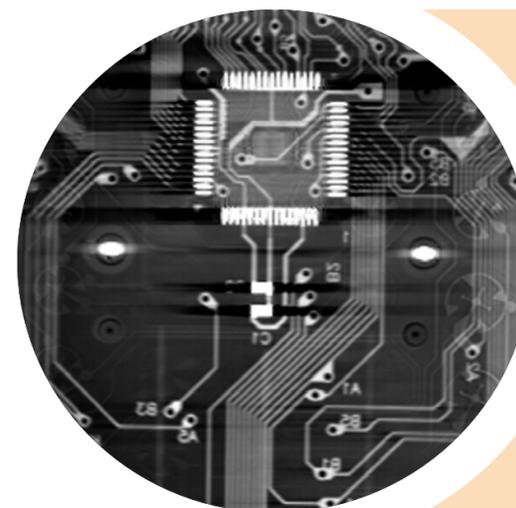


### W80-4 controller qualification

The Cross Verification Platform generated qualification evidence to achieve level-six technology readiness for the W80-4 controller. The platform allows for full hardware-in-the-loop testing of application-specific integrated circuits and of software packages used in production and during deployment. A combination of custom hardware and software developed by Sandia, the Cross Verification Platform provides the first capability, including in a classified environment, of testing at full operational speed. It accelerates testing and scoring of hardware and software against requirements, enabling agile controller solutions. **5000**



A W80-4 test unit.



### Sandia hosts X-ray Computed Tomography Symposium

At the request of a national security programs partner, Sandia hosted the 2025 X-ray Computed Tomography Symposium in February 2025. This collaborative effort drew 80-plus representatives from government, federally funded research and development centers and other partners for three days of technical briefings, tours of Sandia's capabilities, a vendor show, demos and discussions about current and anticipated needs. Sandia's cutting-edge research, partnerships and expertise were highlighted throughout the event. **1000, 5000**

*CT image of a circuit board*

### New technology expands high-power microwave capabilities

The Integrated Military System team has advanced pulsed power technology to expand and support a variety of High-Power Microwave missions for the DOD. With the Air Force Research Laboratory, the team developed a pulsed power system designed to fit in a Group IV Unmanned Aerial Vehicle. Using innovative solid-state technology, the team has enabled high-repetition-rate operation with a deep magazine, improving the overall system's range. This was a major step toward using High-Power Microwave to protect high-value air assets. **5000**

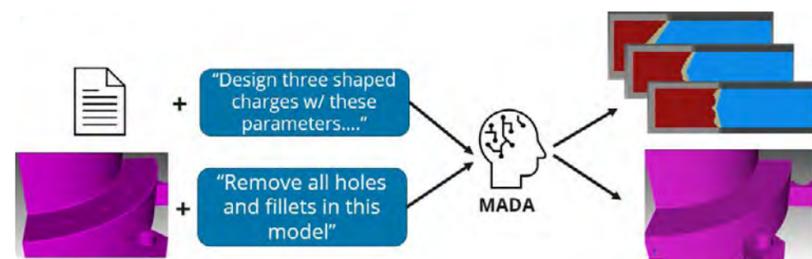
*The AFRL-developed XQ-58A Valkyrie, Group IV UAV, considered by the joint Air Force and Sandia team for the integration platform.*



### AI-informed tool shortens design time

Data scientists developed a tool that interprets user instructions and learns from software guides to rapidly produce ready-to-run scripts for model creation, meshing, simulation and analysis — eliminating the need for point-and-click interactions. The Multi-Agent Design Assistant revolutionizes the design and simulation process by using generative AI. It has demonstrated a significant acceleration in modeling creation, preparation and meshing tasks, reducing design time. As a result, engineers increase productivity and efficiency in their projects, enabling further innovation. This accomplishment marks a transformative step forward in Sandia’s design capabilities. **5000**

*MADA enables a user to rapidly carry out design, mesh and model preparation steps using natural language prompts.*



### Multiservice Advanced Capability Hypersonics Testbed subscale test

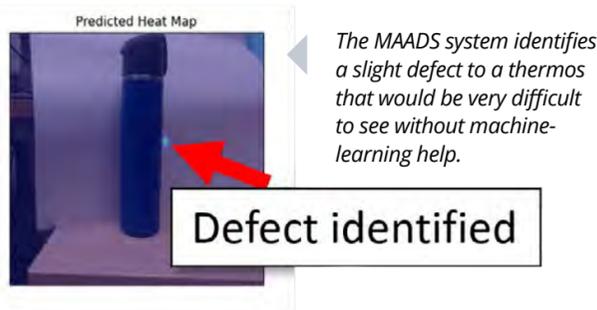
The Integrated Military Systems team launched three sounding rocket test flights from the Kauai Test Facility. This test presented opportunities for valuable flight test experience and data collection in relevant ballistic reentry environments for a variety of payloads across multiple government agencies and programs, including Sandia projects funded by the DOE and NNSA. The effort included development of a new rocket configuration to support payload performance requirements while remaining within tight budget and schedule constraints. **1000, 5000**



*A new Nēnē I flight vehicle during pre-launch rehearsals, when the team verifies configuration before launch.*

### Machine-assisted anomaly detection

The Machine Assisted Anomaly Detection System team developed and demonstrated a prototype system that uses both proprietary and open-source image analysis algorithms to automate visual inspection of nuclear deterrent components. The system delivers faster, lower cost inspections with heightened defect sensitivity. By mining rich inspection imagery, it identified early anomalies and uncovered hidden quality issues. The system operates alongside human inspectors, providing objective judgments that augment expertise, reduce bias and boost verification confidence. It is now funded for production integration to support inspection of a nuclear deterrent component. **5000, 7000**



*Pre-shot and post-shot*

### New system safely neutralizes chemical weapons

Sandia’s Explosive Destruction System successfully designed and tested a new 14-pack configuration to neutralize a 4.2-inch chemical weapon round at the Explosives Test Facility in Albuquerque. Once implemented, this process configuration will increase efficiency by about 230%, up to 28 rounds per shot, of the new Explosive Destruction System Phase 3 vessel, delivered to the U.S. Army in February 2026. The new system and process configuration will be used in a decades-long campaign to safely neutralize tens of thousands of recovered chemical rounds at Redstone Arsenal in Huntsville, Alabama. **5000**

### Exploratory Signal Processing Platform

The Exploratory Signal Processing Platform team demonstrated a circumvent-and-recover navigation system in an airborne flight test. It combined a state-of-the-art system-on-chip with a radiation-hardened processor in a six-degrees-of-freedom environment, using real-time GPS and inertial data to test how position uncertainty changed during disruptions. This enhanced solutions for combining advanced and threat-resilient computing. The team won an Employee Recognition Award for this work along with its broader investigation into commercial-off-the-shelf devices in high-consequence missions, paving the way for future flight computers. **5000**



*A technologist removes a silicon wafer from a diffusion furnace at MESA.*

### MESA futures

Sandia secured budget requests from NNSA and the Presidential Budget Request for the Microsystems Engineering, Science and Applications Photolithography Capability and Microelectronics Components Capability initiatives. This funding, totaling \$30 million for the Photolithography Capability, is crucial for advancing Sandia’s silicon fabrication capabilities. This initiative will create new cleanroom space for advanced photolithography tools, while the Microelectronics Components Capability initiative will modernize the aging Silicon Fabrication Facility. These initiatives are vital for enhancing Sandia’s ability to deliver silicon-based microelectronics to the national stockpile and are set to reach critical decision zero in fiscal year 2026. **5000**



### Hypersonic missile defense test

Sandia supported the Missile Defense Agency by designing and providing a front end for a Hypersonic Target Vehicle 1, used for a Medium Range Ballistic Missile, and participated in the air-launch process. The target vehicle is engineered to test and defeat various hypersonic threats. The flight test also provided a data collection opportunity for the Hypersonic and Ballistic Tracking Space Sensor demonstration satellite. **5000**



▲ An MRBM with a Hypersonic Target Vehicle front end is air launched from a C-17 aircraft off the coast of the Pacific Missile Range Facility in Hawaii.

### SkyFox hypersonic test platform

SkyFox is a low-cost, high-risk, high-reward approach for rapidly developing hypersonic test vehicles. Originally funded in October 2024, the SkyFox team designed, manufactured and assembled two test vehicles that were successfully fielded at Dugway Proving Ground in August 2025. Combining a high-altitude balloon launch platform with a custom parachute recovery system allowed the program to move fast while minimizing cost. Building off lessons learned, multiple flight campaigns are scheduled for 2026. **1000, 5000**

▶ An electrical engineer works on soldering for Core Skyfox.

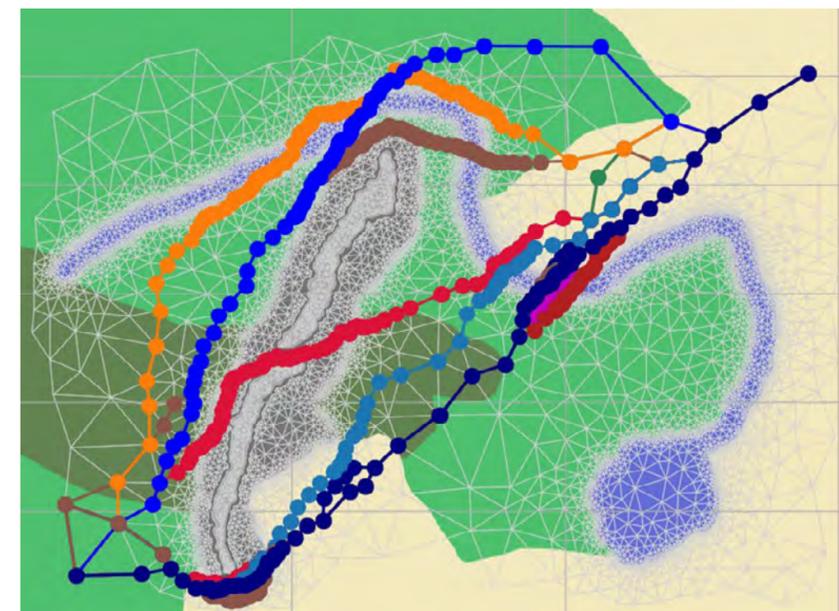


◀ Quantum Systems Accelerator personnel meet at the University of New Mexico in Albuquerque.

### Sandia secures \$125 million over five years in National Quantum Research Center renewal

The DOE Office of Science has awarded funding for the Quantum Systems Accelerator 2.0 proposal, co-led by Sandia and Lawrence Berkeley National Laboratory. The initiative will receive \$125 million over the next five years to advance quantum systems. As the co-lead of this National Quantum Information Science Research Center, Sandia will play a pivotal role in driving innovation and delivering results that advance quantum research and technology, benefiting both science and society. Additionally, Sandia leads the ecosystem development team, enhancing meaningful industry partnerships and preparing the next generation quantum workforce. **1000, 5000, 8000, LBNL**

▼ GORP generates plausible trajectories for a set of goals and constraints over a terrain, which are then refined for vehicle physics and used for planning.



### Route prediction without historical track data

Researchers developed Goal-Oriented Route Prediction, which enables anticipatory path analysis without relying on representative historical track data. It generates trajectories that are consistent with scenario goals, such as minimizing travel time or fuel usage, and constraints, such as terrain mobility limitations. The technology provides rich options for robust path planning or infers likely routes of mobile threats. It was developed to analyze travel over any mix of networks and open terrain considering vehicle physics. Goal-Oriented Route Prediction has been nominated for the Military Operations Research Society 2026 Barchi Prize and received considerable sponsor interest. **1000, 5000, LDRD**

# » SCIENCE & Technology

## New LDRD Mission Campaigns

Two new Laboratory Directed Research and Development Mission Campaigns were selected this year at \$45 million each over seven years. The Radiation Assured Design and Testing for Electronics and Computational Hardening campaign is assessing and advancing radiation hardness of state-of-the-art microelectronics needed for nuclear weapons in strategic radiation scenarios. The Digitally Realized and Enabled Agile and Advanced Manufacturing campaign is maturing advanced manufacturing to accelerate nuclear deterrence and hypersonics product realization. While both campaigns fully launch in fiscal year 2026, seedling funds from 2025 paid for several potentially high-impact initial investments. **1000**

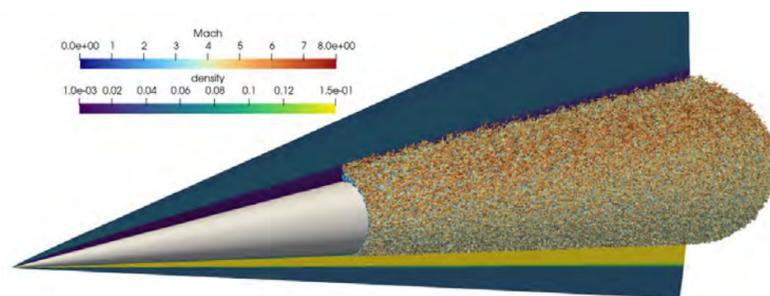


DREA²M and RAD-TECH logos

## Virtual flight test for hypersonic vehicles

The Sandia Parallel Aerodynamics and Reentry Code software team has optimized code performance to enable unprecedented simulations for Sandia's nuclear deterrence mission. SPARC is Sandia's computational fluid dynamics simulation code for reentry, generic hypersonic flight and transonic flight. Using Lawrence Livermore National Laboratory's El Capitan system and SPARC, researchers have performed large-scale simulations, demonstrating significant progress toward the creation of a credible full-system virtual flight-testing platform for hypersonic vehicles. **1000, LLNL**

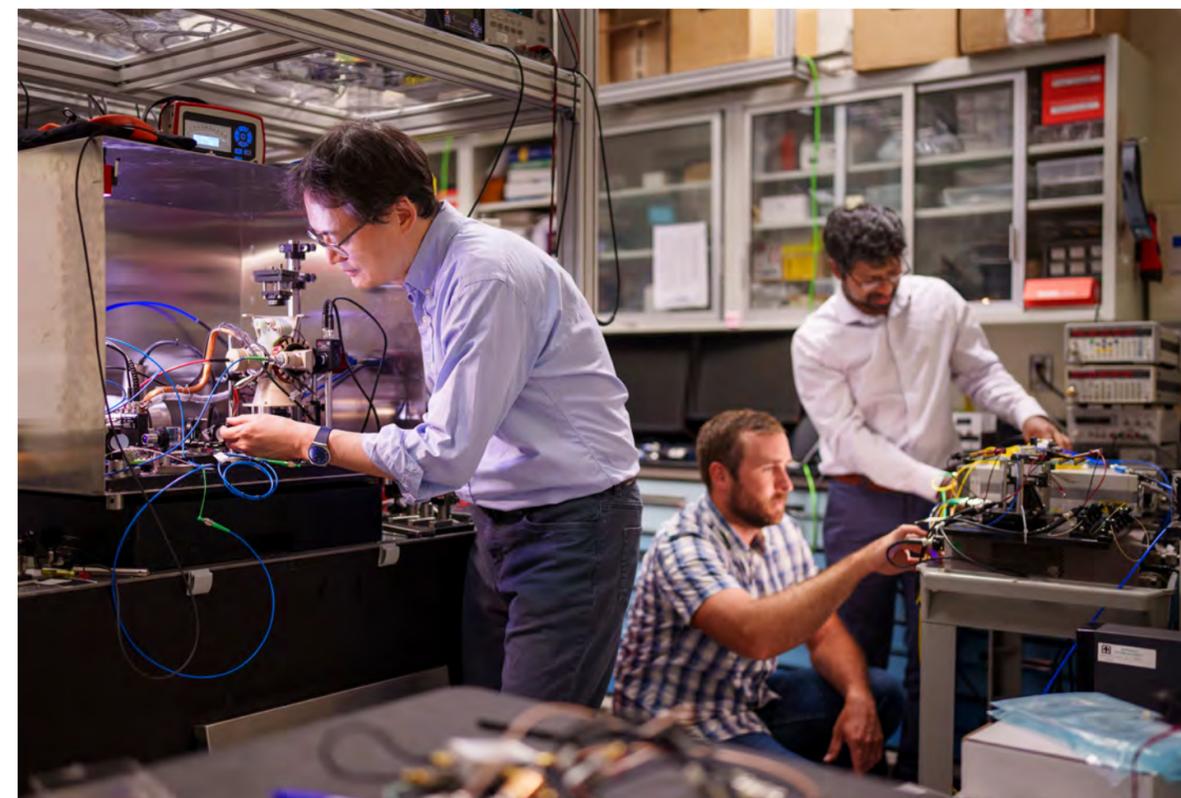
*High-fidelity hypersonic turbulence simulation over a representative reentry body at an 8-degree angle-of-attack. The tubelike turbulent structures are colored by the Mach number.*



## Joint appointments increase university collaborations

Sandia added four new joint appointment agreements, bringing the total number of partnerships to 20 universities and increasing the Labs' collaboration with academic institutions. The program includes 25 joint appointments. About a dozen more joint appointments are in progress, which will enhance research capabilities and knowledge exchange between Sandia and university partners, ultimately driving innovation and scientific advancement. **1000**

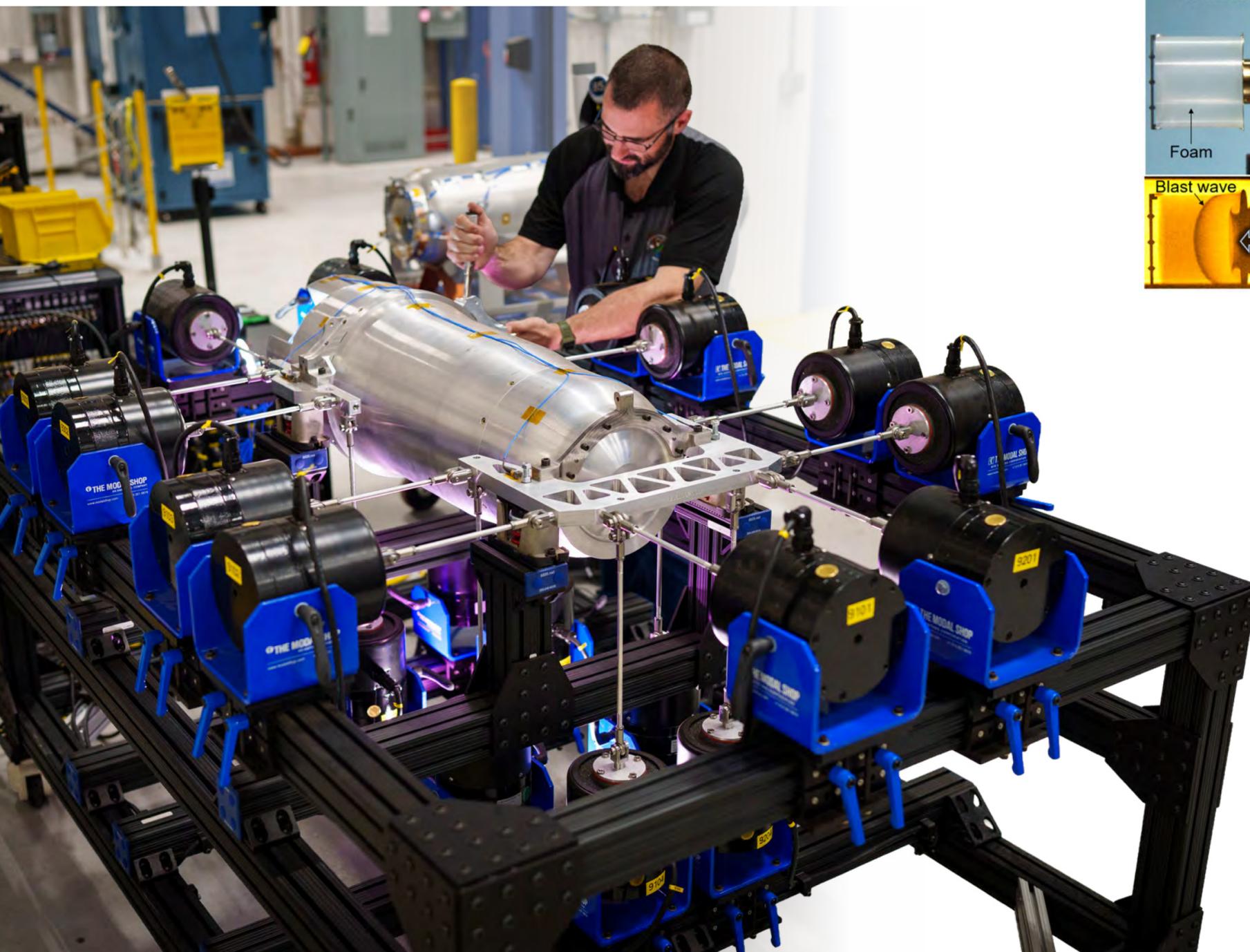
*A University of New Mexico joint appointee, left, examines a quantum inertial sensor as engineers initialize controls for a packaged single-side modulator chip.*



## Shock and vibration testing cuts assessment time

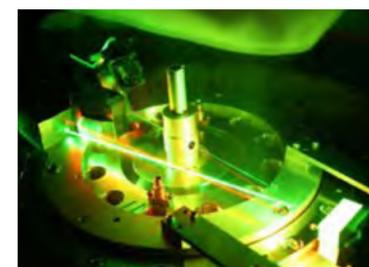
Multi-Input/Multi-Output shock and vibration testing is a significant advancement in creating real-world conditions in laboratory testing. MIMO enhances system and component evaluation by integrating modeling and simulation, analysis of environments and multiple test teams into a workflow. This methodology exemplifies rapid transition of research and development into practical applications. For the W80-4 program, testing time was cut in half as MIMO provides a more realistic test environment, preventing over- and undertesting of components. **1000, 8000**

*An engineer torques the clevis bolt that enables off center axis motion on the W80 MIMO shock and vibration test frame, holding an inert W80-4 unit.*

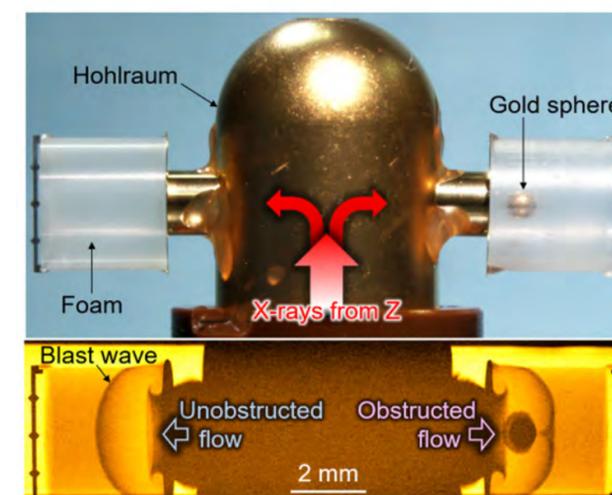


## Second year of record collaborations

Sandia entered into 72 Cooperative Research and Development Agreements with private sector and academic partners, matching last year's record and surpassing the average from the past decade by 93%. CRADAs enable Sandia and its partners to collaborate and share the results of jointly conducted research. Additionally, Sandia signed the first-of-its-kind agreement, called the ACCESS CRADA, which allows other national labs to join a Sandia CRADA and eliminates the need for a partner to go through separate negotiations with each lab. **1000**



*Lasers align diagnostics for the Z machine. Through CRADAs, Sandia partners with industry to accelerate next-generation pulsed power technologies.*



## Radiation-driven supersonic blast waves captured at Z machine

Z machine has used its world-class radiography capability to capture subsonic and supersonic radiation-driven blast waves in complex geometries. The 1-nanosecond-gated, 20-micron-resolution radiography data are unique in NNSA due to their wide field of view — 20 millimeters — and their ability to image large objects in the millimeter-to-centimeter scale driven by pulsed power. These images visualize the density enhancement at the front of radiatively driven shocks and are used to constrain Los Alamos National Laboratory models of radiation flow in complex hydrodynamics. **1000, LLNL**

*Top, a preshot photograph of Z machine radiation flow experiment. Bottom, an experimental X-ray radiograph with 1-nanosecond gate and 20-micron resolution.*



## Additively manufactured polymer components using SliceWrite

The Advanced Materials Laboratory developed technology to print complex 3D-polymer cushions. Direct-Ink-Write pads are 3D printed using silicones and a computer-controlled manufacturing process to build lattice structures with tunable properties. Sandia developed SliceWrite to design complex silicone pads in hours instead of weeks or months. SliceWrite couples conventional computer-aided design definition with open-source software to develop print paths for exceedingly complex shapes. **1000**

*Direct-Ink-Write printing of a silicone structure.*



### Z machine tackles plutonium mysteries

Through Z machine testing, the plutonium team made significant strides in high-pressure plutonium physics through reduced-scale targets to compress plutonium to unprecedented pressures, employing new diagnostics to measure plutonium temperature during dynamic compression events and increasing the allowable plutonium mass in single-shot experiments. The resulting data has reduced material response uncertainty, increased applicability of directly informed material model parameters and enabled new types of plutonium experiments that are essential for primary weapon physics assessments. **1000**

▲ NNSA and Sandia leaders listen to a presentation by the director of Z machine during a recent tour of the facility.

### Sugar formation in extraterrestrial settings

Researchers explored a new chemical reaction that produces sugarlike compounds in gas-phase conditions, mimicking environments thought to exist before life on Earth. This work, published in the Journal of the American Chemical Society, suggests that hydroxycarbene and aldehyde reactions could serve as plausible pathways for sugar synthesis in extraterrestrial settings, challenging traditional views on the necessity for aqueous environments for abiotic sugar formation. **8000**

### Magic states for quantum computing

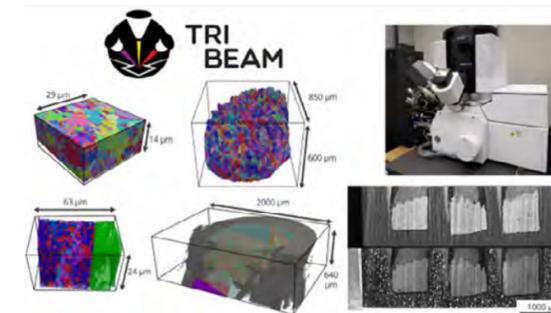
Sandia, in collaboration with University of California, Davis, and Quantinuum, validated a new algorithm for creating high-fidelity "magic states," which will enable future quantum computers to run programs even if one component fails. Featured in Physical Review X, the research demonstrates a method, code switching, which prepares magic states in one error-correcting code and then switches it to another. This enables quantum computers to reliably execute operations that cannot be performed directly, achieving a full set of error-resistant operations more efficiently using the magic states. **1000**



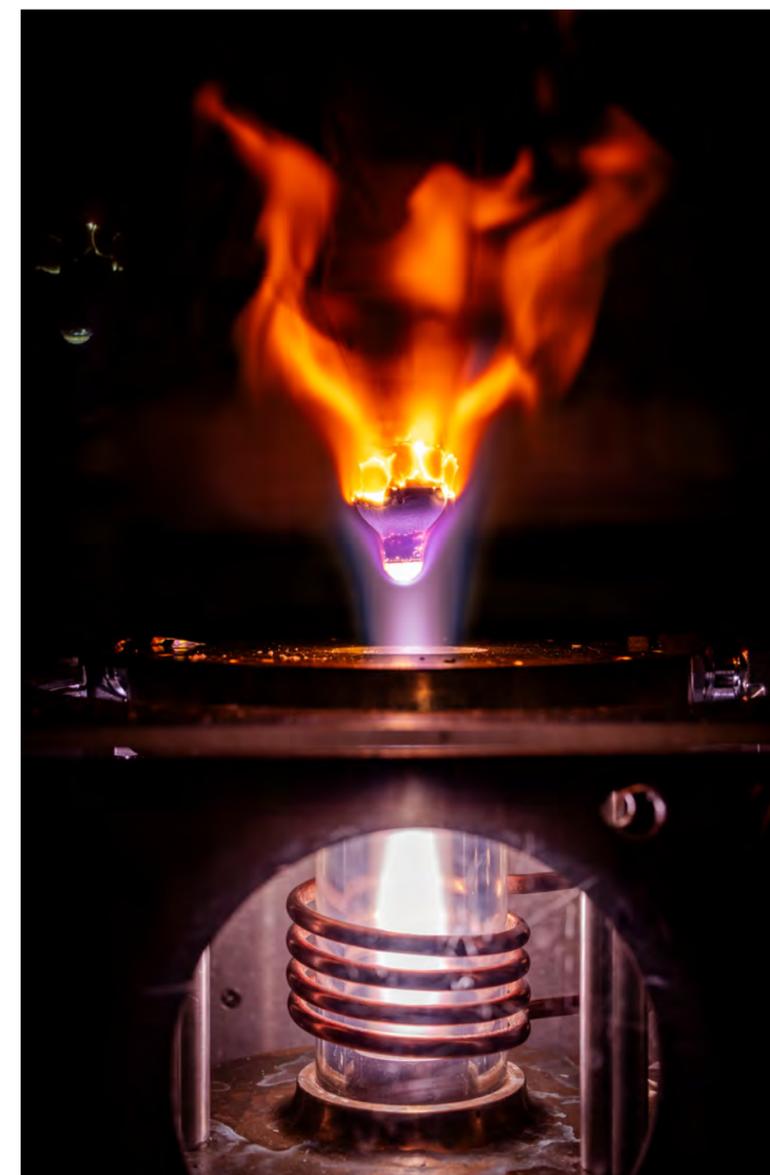
▲ A researcher holds models of 2D and 3D color codes used to produce high-fidelity magic states on a trapped-ion quantum computer.

### Automated microscope control with pyTriBeam

pyTriBeam is an automated scanning electron microscope control tool for 3D characterization, from submicron to millimeter-scale volumes. Released as open source in early 2025, it supports diverse research applications with flexible workflows for complex geometries and multimaterial systems. Adopted by Kansas City National Security Campus, National Laboratory of the Rockies and the University of California, Santa Barbara, it enhances reverse-engineering and failure-analysis tasks. Its modular architecture allows for customization, instrumentation integration and collaborative development, making it a scalable platform for next-generation characterization in government, academic and industrial research. **1000, KCNSC, NLR, UCSB**



▲ A selection of 3D chemical, crystallographic and imaging volumes characterized using pyTriBeam, including deformed metals, phase formation in ceramic-to-metal brazes and failure analysis in commercial electronics.



### Enabling rapid heat shield analysis

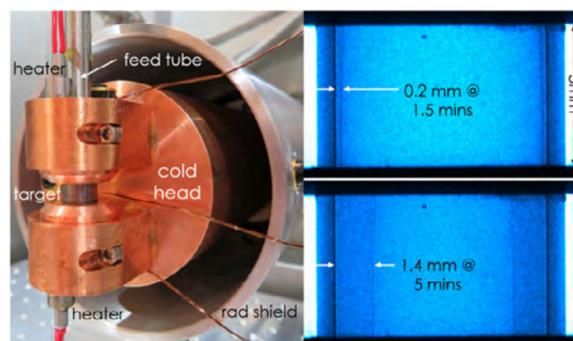
The thermal protection system grand challenge Laboratory Directed Research and Development team developed an end-to-end workflow to rapidly predict the performance of advanced thermal protection system materials in flight applications ahead of qualification opportunities. Over 40 Sandians and several federally funded research and development centers, industry and academic partners manufactured samples, collected ground and flight data, and developed a coupled aero-thermal-mechanical model that simulates a full trajectory. Using this full-physics model, the team developed a reduced-order model with 90% accuracy, but 25,000 times faster, enabling standalone workstations to conduct design efforts normally reserved for supercomputers. **1000, 5000, 8000, LDRD**

▲ A heat shield material in an inductively coupled plasma torch.



### CREST achieves critical decision approval

On Sept. 29, NNSA granted critical decision approval for the Combined Radiation Environments for Survivability Testing project, marking it as the largest capital acquisition in Sandia history to achieve this milestone. This approval enables the project to proceed to preliminary and final design phases. The new hazard category 2 nuclear facility will enhance reactor-based radiation capabilities in survivability testing, supporting national security objectives while improving operational efficiency and safety. **1000, 4000**



### Krypton-doped ice enhances fusion research

Sandia researchers formed krypton-doped ice shells in prototypic and actual Z machine target configurations. Krypton-dopant spectroscopy offers a promising method for measuring several critical plasma parameters in inertial confinement fusion experiments. Fielding cryogenic targets with dopants, however, is difficult since deuterium freezes and diffuses at different temperatures and rates than krypton. In an effort to better understand, characterize and improve fielding of future shots, a target metrology lab was established using an X-ray to enable offline detailed radiographic examination of the krypton doping process. **1000**

Experimental setup, left, and resulting X-ray images that show growth of krypton-doped deuterium ice inside a beryllium target over five minutes.

### Integrated approach to electromagnetic analysis

An integrated team of electromagnetic radiation experimentalists and modeling-simulation experts collaborated to assess shielding effectiveness for the Mk21 reentry vehicle, crucial for understanding electromagnetic energy penetration. The experimental team developed innovative measurement techniques for superior calibration data. Using Lawrence Livermore National Laboratory's El Capitan high-performance computing platform, the modeling team executed large-scale simulations, revealing key insights into electromagnetic field structure. This collaboration between the W87-1 modernization, Weapon Survivability and Advanced Simulation and Computing programs sets a new benchmark for collaborative electromagnetic testing. **1000, LLNL**

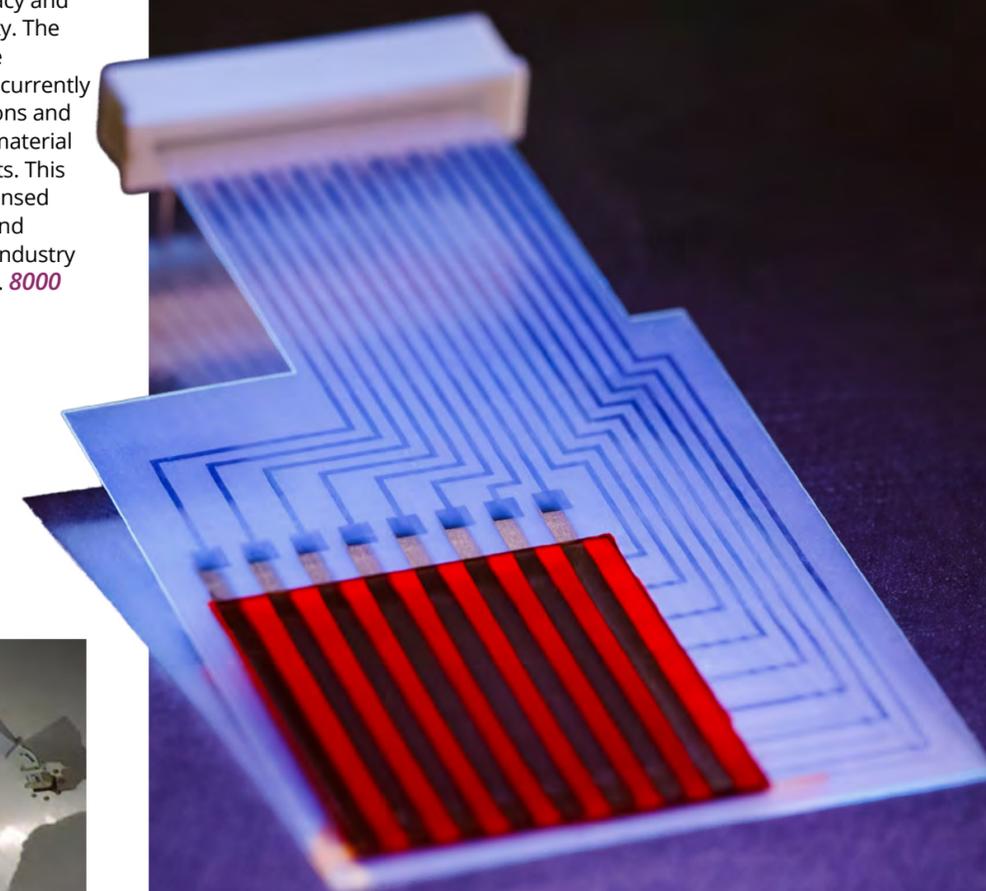
A reentry vehicle is tested in Sandia's electromagnetic testing facility.



### Wearable dosimeter for radiation therapy

Through the Royalty Fund Laboratory Directed Research and Development Program, a team developed a novel polymer-based radiation sensor. Fabricated using a 3D conformal etching technique only available at Sandia, this wearable dosimeter patch was designed to accurately detect and direct proton radiation beam therapy onto tumors with the goal of lowering cost, increasing treatment efficacy and enhancing treatment safety. The patent-pending solid-state disposable detector patch currently targets oncology applications and is being investigated as a material sensor for nuclear incidents. This technology is currently licensed to Cooperative Research and Development Agreement industry partner WearableDose Inc. **8000**

A wearable dosimeter patch designed to detect and direct proton radiation therapy so it accurately targets tumors.



# AI & Computing

## Enhancements to Sandia's flagship internal AI chat tool

Since its launch in May 2024, SandiaAI Chat has grown. The tool continues to be enhanced with the release of the "Bring Your Own Data" feature, allowing users to securely upload datasets for analysis. This capability enables users to submit results and receive immediate, insightful summaries and trends. The chat team is committed to continuous improvement, planning future upgrades based on user feedback to better support the workforce. [9000](#)



## AI solution to better understand and manage risks

Sandia is advancing AI across the Labs with innovative, cost-saving tools that streamline mission-critical and business processes. Tadpole, an AI solution developed by the Labs' internal audit and modern systems solutions departments, integrates exact-match and semantic search to quickly surface insights from complex, varied data without formatting or language inconsistencies. By accelerating document review and sharpening trend identification, Tadpole strengthens data-driven decisions. Capabilities first built for internal audits were expanded for Sandia's business development group, reducing process times and increasing consistency in discovery of mission needs. [ESD, 6000, 9000, 10000](#)

## Advancing Sandia's AI strategy

Sandia's AI Board of Directors advanced its strategic themes of awareness, readiness and advantage. Key achievements include a comprehensive Labswide AI vision, goals and governance. The board launched a dedicated website that offers guidance, events and training programs. Engagement with stakeholders, including DOE and DOD, reinforced Sandia's national role in AI and positioned it as a critical investment for fiscal year 2026. [1000, 5000, 7000, 9000, 10000](#)

## Federated AI model

Sandia, Los Alamos and Lawrence Livermore national laboratories have developed a federated machine-learning model prototype to advance AI for national security. Federated learning is a technique for training AI models on decentralized data. Each of the three labs possesses datasets that are not easily shareable, yet they hold valuable insights for collaboration in critical mission areas. Despite the challenges, the research team has successfully demonstrated a prototype that proves a shared model is possible while protecting data held by each laboratory. [1000, LANL, LLNL](#)

*Hops is one of the Sandia systems used to build the federated AI model.*



## Achieving operational readiness

A mission computing team replaced XNET with the Enterprise Research Network, an unclassified network environment to meet mission research computing needs. The team received the authority to operate and migrated over 30 customers' systems and more than 450 devices before the end of the fiscal year. This process, which typically takes 18 to 24 months, was completed in seven months. The team gathered requirements while simultaneously building the solution, engaging 12 departments and 78 personnel to bring the Enterprise Research Network to life. [9000](#)

## New supercomputer El Dorado unveiled

Sandia successfully deployed the El Dorado supercomputer, now ranked 20th globally on the latest Top500 list and the fastest in Sandia's history. Architecturally identical to Lawrence Livermore National Laboratory's El Capitan, El Dorado is the first leadership-class exascale system designed to support NNSA stockpile readiness, serving as an application-readiness test system. This achievement underscores Sandia's commitment to advancing computational capabilities for national security. [9000](#)

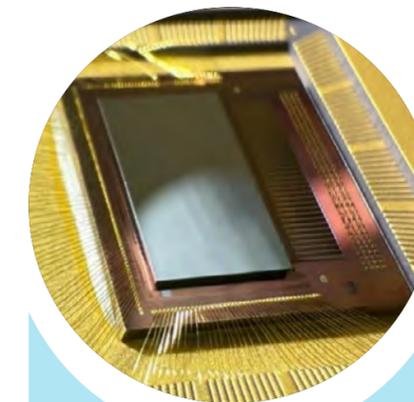
▼ *El Dorado supercomputer*



## griDNA helps secure electric grid

Researchers developed griDNA, AI technology designed to protect distributed critical infrastructure systems such as power grids, pipelines and transportation networks against disruptions caused by cyberattacks or system failures. The technology continuously gathers and analyzes cyber-physical system data, alerting operators and defenders with early detection of abnormal behavior that signals potential trouble, whether from inadvertent equipment failures or malicious cyberattacks. griDNA enhances grid reliability and comprehensive situational awareness, allowing for modern grid expansion. [9000](#)

▲ *Cybersecurity experts integrate a single-board computer with griDNA into the Public Service Company of New Mexico's test site. This code monitors the grid for cyberattacks and physical issues.*



## Reconfigurable electronics for edge processors

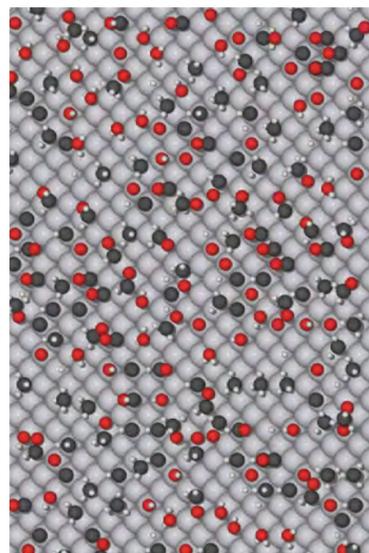
There has been a resurgence in analog signal processing due to increased demand for energy-efficient edge processing and AI capabilities. Edge processing refers to processing data where it is created rather than sending the data to a central cloud. Researchers recently demonstrated a programmable device that reconfigures itself to enable more efficient edge-processing tasks, including dynamic filtering, dynamic amplification and AI inference. The device, based on a Sandia-patented electrochemical cell, achieves orders-of-magnitude improvement in range and precision relative to other leading technologies. Sandia's recent demonstration of a working microprocessor creates new possibilities for edge computing. [5000](#), [8000](#)

▲ *A new programmable device that enables more efficient edge processing tasks.*

## Improving catalysis predictions with AI

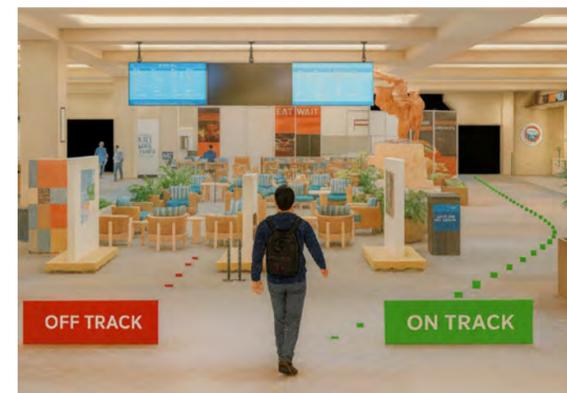
Sandia researchers developed an automated machine-learning framework that uses low data subgraph isomorphic decision tree models and efficiently predicts coverage-dependent parameters. This AI framework improves evaluation of lateral interactions, leading to more accurate predictions of catalytic processes. How neighboring adsorbates affect thermodynamics and kinetics is crucial to understanding how molecules react at catalytic surfaces. The new automated machine-learning framework addresses the challenge of calculating the number of possible co-adsorbed configurations, so researchers don't have to rely on oversimplified models that leave substantial gaps in understanding catalytic behavior. **8000**

Rendering of molecules reacting on catalytic surfaces.



## AI-enhanced curb-to-gate comprehensive airport security

Researchers demonstrated a modernized approach to airport security, envisioning a seamless process from curbside drop-off to boarding gates. Using next-generation sensors and AI-enhanced video analytics for anomalous behavior detection and predictive path modeling, the team showcased how real-time data could improve passenger flow and threat detection without disrupting travel by improving officer decision-making and incident response. The approach offers significant value to airports and passengers by improving efficiency, safety and the travel experience. **1000, 4000, 5000, 8000, 9000**

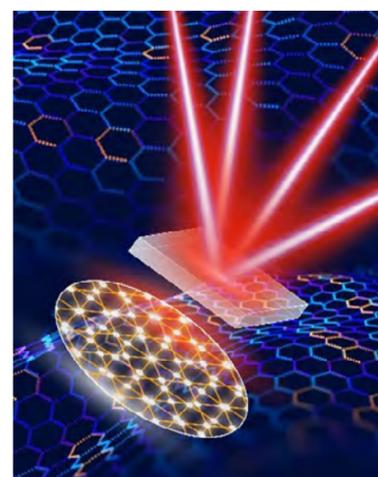


The entire Albuquerque Sunport was mapped with 3D scanning technology to visualize a passenger's journey through modernized security, including advanced AI path prediction that can detect anomalous behaviors based on movement patterns.

## Advanced Memory Technology program awarded

Sandia's Advanced Memory Technology program exceeded the application performance of molecular dynamic simulations on current exascale platforms by 750 times. The collaboration with Los Alamos and Lawrence Livermore national laboratories and Cerebras Systems was a finalist for the Gordon Bell prize for outstanding achievement in high-performance computing, and deemed an Exceptional Achievement by the Defense Programs Awards of Excellence. **1000, LANL, LLNL**

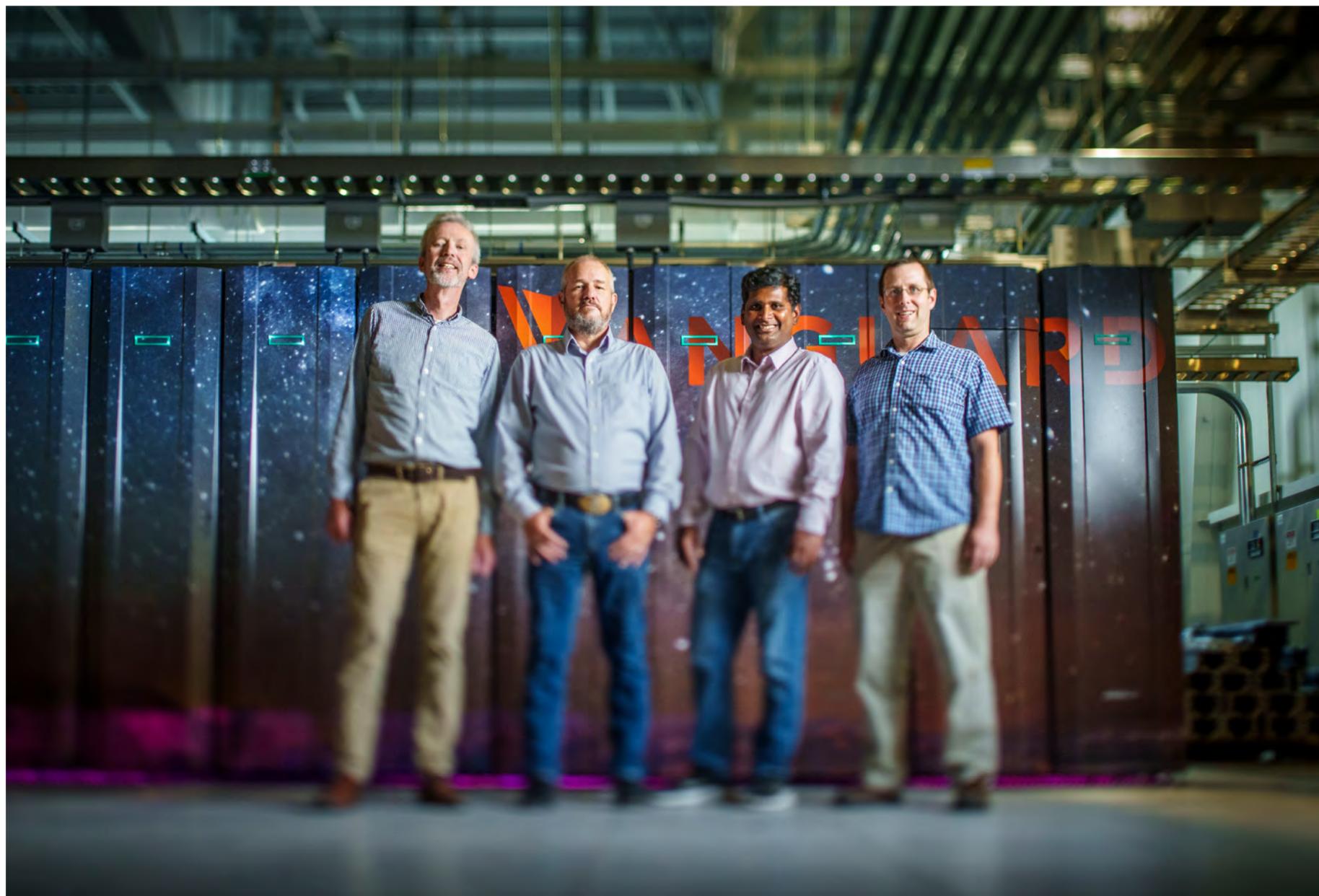
The Advanced Memory Technology program team in front of Vanguard supercomputer.



Artistic rendering of lithography-defined artificial quantum materials in semiconductor quantum wells.

## Lithography-defined artificial quantum materials

Quantum materials are gaining a lot of attention for their potential use in advanced microelectronics and quantum technologies. Researchers at Sandia, along with external collaborators, recently developed a method for creating lithography-defined artificial quantum materials, such as moiré superlattices, in semiconductor quantum wells. The work was published in Nano Letters and selected as a supplementary journal cover art article. This achievement opens up possibilities for creating novel quantum materials in conventional compound semiconductors, thus allowing future quantum materials applications to take advantage of state-of-the-art semiconductor synthesis and processing. **1000, 5000, 6000, 8000**



# » Energy



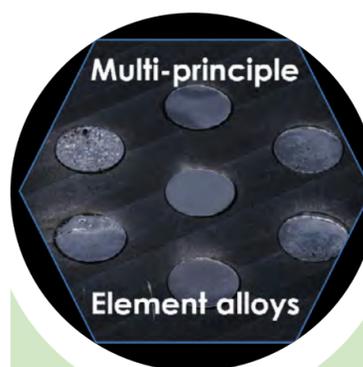
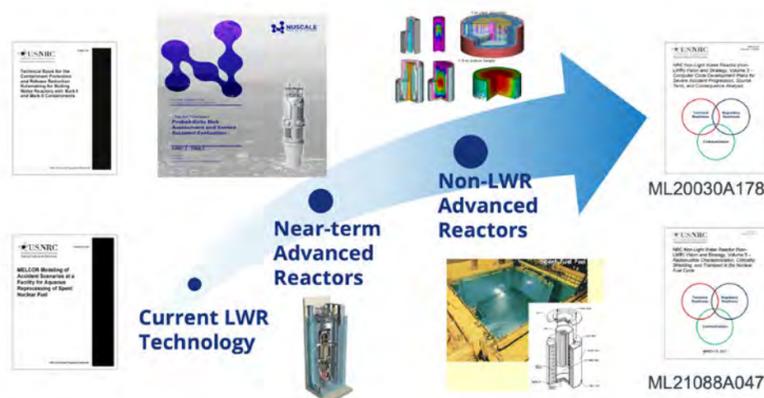
▲ A test operations engineer works in the new Medium Voltage Laboratory.

## Electric Grid Medium Voltage Lab opens

The new Electric Grid Medium Voltage Laboratory enables research at medium voltage, or 15 kilovolts, a new capability for Sandia. This research is critical for optimizing energy systems, supporting energy integration and ensuring grid reliability, safety and efficiency. In parallel, Sandia is scoping an extension of the facility to expand its capabilities in this area, including high-inertia sources with realistic fault current capability. The lab will improve U.S. grid resilience and help deepen understanding of the nation's grid stability against outages and threats. **8000**

## MELCOR software for molten salt reactors

Sandia has released a new version of MELCOR, the go-to reactor safety code for utilities and nuclear regulators worldwide for more than 35 years. This update includes enhanced capabilities for modeling molten salt reactors and modern architecture for advanced nuclear safety analysis. It enables rapid safety assessments for a subset of new small modular reactor designs, including the generalized prismatic heat pipe reactor known as eVinci. The update also lays the groundwork for adding capabilities for other types of new reactor technologies in the future. **8000**



## Reconfigurable electronics for edge processors

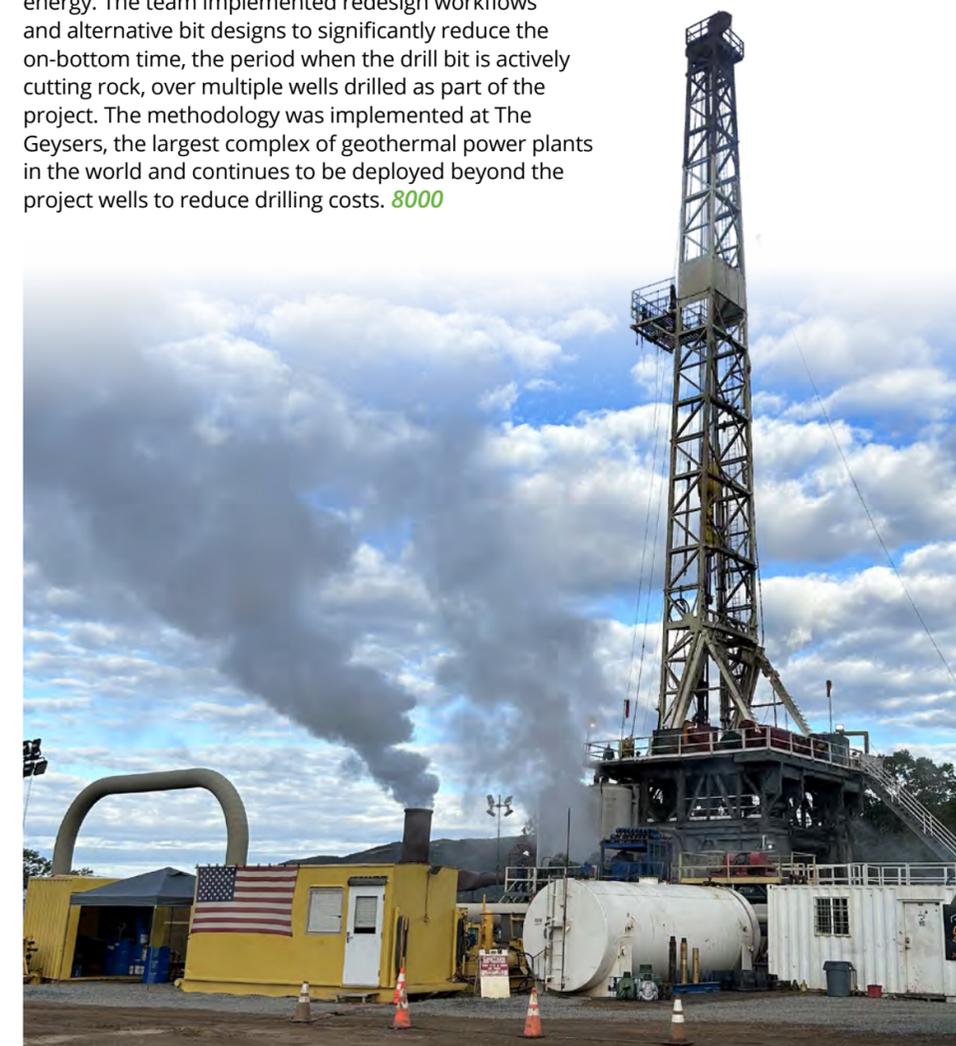
A main challenge in commercializing fusion energy is selecting materials for the first wall of the reactor that can withstand extreme temperatures, energetic particle bombardment and high-energy neutrons. Researchers have proposed various materials, such as refractory metal alloys, ceramics and liquid metals. To test how well these materials perform, Sandia led experiments at DOE DIII-D National Fusion Facility, testing 51 novel material samples from 20 organizations. Standardized testing conditions ensured all samples were exposed to fusion plasma in a consistent way, advancing materials selection for use in fusion reactors. **1000, 8000**

▲ Multi-principle element alloy samples tested at the DIII-D National Fusion Facility.

## Research improves geothermal energy drilling rates

Sandia partnered with Calpine Corp., Texas A&M University and the University of Utah to improve geothermal energy drilling rates, which are a major barrier to widespread deployment of geothermal energy. The team implemented redesign workflows and alternative bit designs to significantly reduce the on-bottom time, the period when the drill bit is actively cutting rock, over multiple wells drilled as part of the project. The methodology was implemented at The Geysers, the largest complex of geothermal power plants in the world and continues to be deployed beyond the project wells to reduce drilling costs. **8000**

▲ A rig drills production high-temperature geothermal wells at The Geysers in California.



# CYBER & Physical Security



## NNSA Security Team of the Year

Safeguards and Security Director Samantha Flores accepted the award on behalf of 70 dedicated individuals from five centers across divisions 1000, 4000, 6000 and 9000, and each individual contributor received a certificate.

NNSA recognized the Labs and the NNSA Sandia Field Office with the 2024 NNSA Randy D. Putt Security Team of the Year award for their successful planning and execution of the second-ever International Atomic Energy Agency International Physical Protection Advisory Service mission hosted by the U.S. NNSA Associate Administrator and Chief for the Office of Defense Nuclear Security Law Monroe III presented the prestigious award and noted that “the decision to select Sandia National Laboratories (for this mission) went all the way up to the Office of the President” and that “Sandia met every standard at the international level.” 1000, 4000, 6000, 9000, SFO

## Cybersecurity platform released to public

The Department of Homeland Security Cybersecurity and Infrastructure Security Agency released Thorium, Sandia’s platform to detect and analyze advanced malware threats, to the public. The software platform addresses the challenge of integrating a growing arsenal of analysis tools to respond to cyberattacks. Thorium serves as a central nervous system of this tool set, supporting automation and data processing, and allowing cyber analysts to efficiently assess, triage and prioritize threats using a range of commercial, custom and open-source tools. The highly scalable platform enhances the capabilities of cyber defenders. 8000

The cybersecurity team that developed Thorium, released to the public in 2025.





### Delivering new classified solutions

Sandia implemented commercial solutions for classified technology that were approved by the National Security agency, delivering a significant mobile classified solution to enhance NNSA's classified capabilities. The initiative enables secure remote access to the national security network via unclassified transport, allowing people to conduct classified work from various locations. The team's efforts enhance workforce development and reduce infrastructure costs by providing a unified network delivery system for both classified and unclassified information, marking a significant advance in operational efficiency and security. *9000*

### IT strategic portfolio modernization

Information Technology teams deployed a portfolio management solution to enable automated workflows and modernize its IT service portfolio. Strategic Portfolio Management offers a comprehensive suite of tools that supports the entire lifecycle of portfolio management processes, ensuring alignment with strategic priorities from planning and execution to monitoring and closure. Specific capabilities include strategic planning, work intake and prioritization and application portfolio management. *9000*

### Safeguards and security support SLCM-N mission work

In response to an urgent mission need from the Nuclear-Armed, Sea-Launched Cruise Missile program, Safeguards and Security professionals collaborated with partners from Environment, Safety and Health and the Sandia Field Office to quickly convert a non-Sandia space into a DOE-NNSA vault-type room for secure classified work. The team worked together to meet all safety and security requirements for operational readiness ahead of schedule, enabling the program to store and work on classified documents and materials to support development efforts. *4000, 9000, SFO*

### Award-winning cybersecurity work

Cybersecurity researcher Irbis Gallegos received an individual NNSA Chief Information Officer Achievement Award for his exceptional contributions to the Cyber Threat Intelligence Center of Excellence. Through the Cyber Situational Awareness Brief, a weekly meeting with key NNSA and Sandia personnel, he has significantly improved situational awareness of the threat landscape. Irbis provides programmatic updates, processes open-source intelligence and creates models to visualize threat actors, delivering critical insights into emerging attack vectors and geopolitical cyber dynamics. His efforts have notably strengthened the defensive posture of Center of Excellence members. *9000*

*Cybersecurity researcher Irbis Gallegos, left, accepts an award from NNSA Chief Information Officer Jamie Wolff for his exceptional work. (Photo courtesy of NNSA)*





# Infrastructure

## New biological opinion at Sandia California

In June, the U.S. Fish and Wildlife Service issued a new biological opinion to Sandia California after significant work to develop the site's biological assessment and recommendations for mitigations. The biological opinion concludes the Section 7 consultation of the Endangered Species Act, assessing whether a federal agency's actions jeopardize a listed species or its habitat. The opinion will guide future site development and maintenance, outline measures to minimize harm and set conservation requirements to help recover endangered species. **8000**

*The California tiger salamander, or *Ambystoma californiense*, discovered near new building construction at Sandia California.*



## Power upgrades for the mission

Substation 35 was at the end of its design life, running risk of failure. To avoid risk to the mission from power outages, the substation was completely reconstructed for \$1 million less than the \$10 million authorized budget, resulting in 30% more capacity and the comprehensive replacement of all components within the station. As a result, Substation 35 is expected to provide a reliable power source for up to 25 years, directly supporting Sandia's mission. **4000**

## Enhanced environmental testing capabilities

Infrastructure Operations, Engineering Sciences and Nuclear Deterrence System Modernization teams collaborated to design and build a cutting-edge package system for new six-degree-of-freedom shakers for mission use. This system is vital for W80-4 warhead qualifications, enhancing Engineering Science's testing capabilities, reliability and capacity for environmental testing. The new system mitigated disruptions in testing while another mission building was upgraded, which led to a long-term solution. The project highlights Sandia's commitment to advancing testing infrastructure, meeting mission milestones and maintaining high standards in nuclear deterrence and environmental safety. **2000, 4000, 6000**

*An engineer powers six-degree-of-freedom shakers, housed on the right, with cable from the mobile infrastructure unit.*

## In-house design and construction accelerate mission work

Infrastructure Operations design and construction teams saved Sandia time and money with their new in-house capabilities. The teams installed two new furnaces for Nuclear Deterrence's Component and Production team. The fast-track project allowed production to begin 18 months earlier than anticipated, significantly enhancing the capabilities of this critical program. The accelerated project took three months and was completed at a savings of \$180,000. **4000, 7000**

*Furnace for nuclear deterrence operations*





High Bay facility

### Implementing the first capital lease in the complex

In coordination with the NNSA and Sandia Field Office, Sandia became the first management and operations contractor in the DOE complex to enter into a capital lease using indirect funds. The exploration process ensured legal, accounting and Cost Accounting Standards implications were addressed appropriately. The lease was for the Center for Advanced Manufacturing and Innovation High Bay, a facility that will accommodate advanced manufacturing capabilities and lay the groundwork for future initiatives. **4000, 10000, 11000, SFO**



### Safety culture continues to mature

Sandia continues the transition from a reactive to a proactive approach to drive safety culture improvements. A new safety culture community of practice enabled workforce engagement, resulted in a new dedicated Safety Culture website and aligned Human Resources policies with Just Culture principles. The Labs prioritized education on learning teams and active monitoring, in addition to regular communication through Safety Syncs and the Safety Culture Academy. Sandia also engaged strategic partners and industry speakers, laying the groundwork for a safety culture self-assessment in fiscal year 2026. **4000**

◀ A systems engineer helps educate the workforce during the Looking Back, Moving Forward talk at Steve Schiff Auditorium.

### Improved chemical management

Sandia launched an innovative chemical management initiative, updating policies to reduce chemical-related risks and the total number of chemicals on site. A custom chemical risk matrix classifies substances by hazard level, leading to the successful disposition of 105 high-risk and 4,361 lower-risk chemicals. A shelf-life policy for peroxidizable organic chemicals significantly reduced expired inventory, disposing of 242 containers while retaining 224. A new dashboard monitors and helps manage the disposal of expired materials, further minimizing incident risks. **4000**

◀ A mock chemical drum is used during an annual emergency exercise.



### Securing a trades workforce for the future

Sandia's Metal Trades Council, New Mexico Department of Workforce Solutions, Central New Mexico Community College, IBEW 611 and the Joint Apprenticeship Training Committee collaborated to create a state-approved apprenticeship program that will greatly enhance grassroots talent development. This initiative equips participants with essential skills for an evolving trades workforce and fosters future success and resilience at Sandia. About 20 workers are enrolled in the five-year program. **4000**

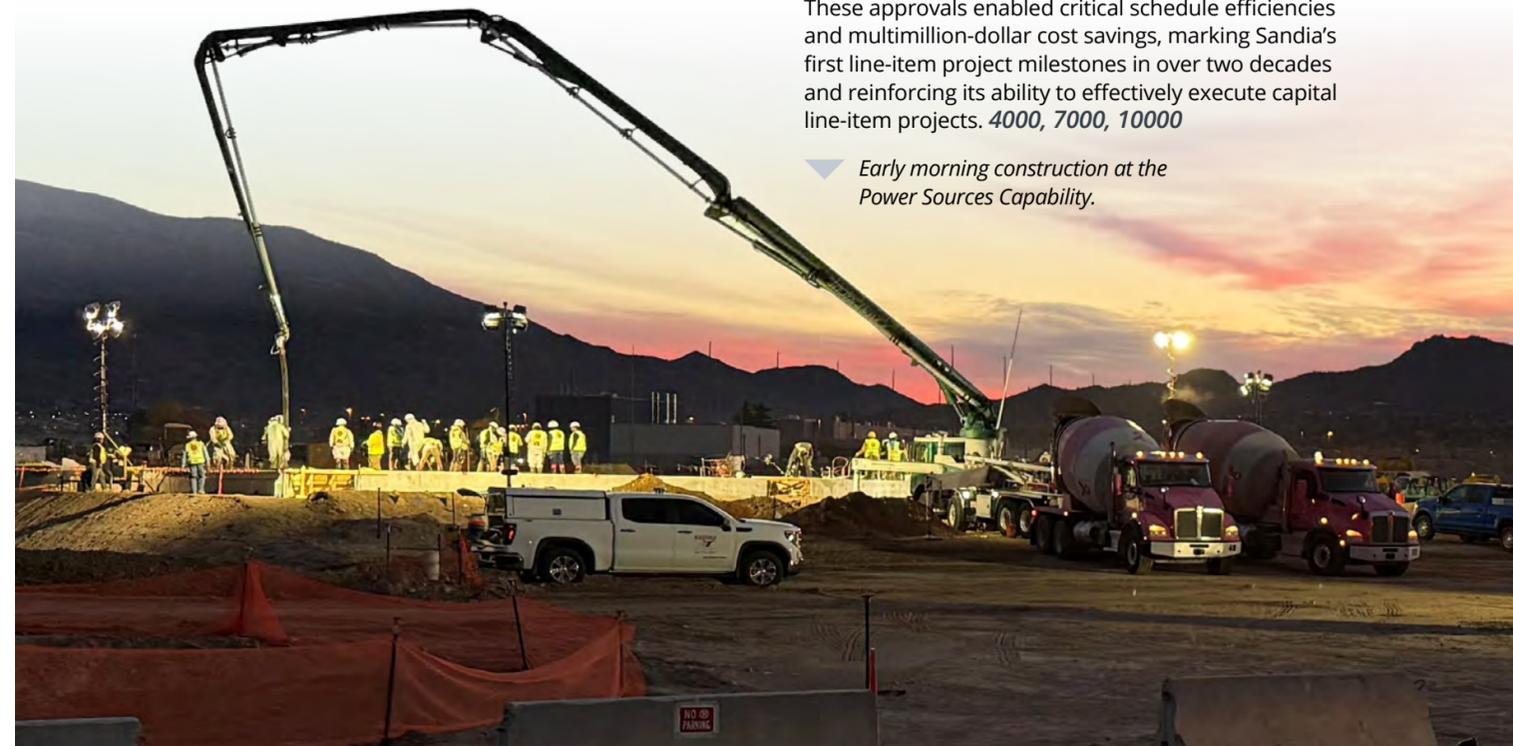
▶ Mechanical utility pipefitters fabricating a pipe spool piece.



### First line-item project milestones in 20-plus years achieved

The Power Sources Capability project team secured several critical decision approvals for long-lead procurements, authorization for early site work construction, award of the facility construction contract and authorization to begin construction activities. These approvals enabled critical schedule efficiencies and multimillion-dollar cost savings, marking Sandia's first line-item project milestones in over two decades and reinforcing its ability to effectively execute capital line-item projects. **4000, 7000, 10000**

▶ Early morning construction at the Power Sources Capability.



# » BUSINESS & Operations

## W80-5 Warhead Weapon Development Cost Report

The W80-5 program piloted a streamlined, top-down Weapon Development Cost Report process with partners across the nuclear security enterprise, completing the report in less than six months, less than a third of the time of recent reports. The cost estimates were well-received, and the new process enabled rapid execution of nuclear weapon modernization programs. The U.S. Nuclear Weapons Council authorized the W80-5 program to enter Phase 6.3, development engineering, further validating the approach. **8000**

## Simplified purchasing policy cuts procurement time in half

Expansion of commercial purchasing practices delivered faster results by simplifying requirements and cutting acquisition cycle times by up to 50%. This expansion builds on a successful pilot and an Enhanced Mission Delivery Initiative proposal approved by NNSA, allowing for streamlined procedures for lower-risk purchases. Training and rollout showed no negative impact on delivery. By adopting best commercial practices, Sandia has reduced administrative costs, accelerated procurement and strengthened its ability to support mission-critical work. **3000**

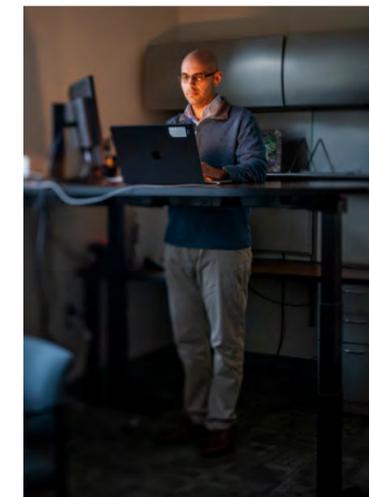
## Cultivating a thriving workplace

A new employee engagement system launched, providing leaders with quick insights to enhance engagement across the organization. The Culture Community of Practice met its membership goals, empowering people and teams to actively contribute to a thriving workplace. Adoption of recognition programs and tools continued to increase with over 6,300 employees receiving kudos, and more than 9,600 employees sending Sandia Greetings eCards through a new platform that allows multiple signatures. **3000**

## Preserving and leveraging knowledge

A dedicated team made significant progress standardizing and increasing adoption of knowledge management practices and tools across the Labs. Protecting and harnessing Sandia's knowledge helps every employee learn faster and contribute sooner, accelerates innovation, reduces the risk of losing knowledge through attrition and furthering Sandia's national security mission. The team will continue expanding this capability across the Labs, ensuring Sandia leads the way for the enterprise. **3000**

Sandia established its Knowledge Management office. ▼



## More ways to grow and advance

Sandia redesigned its promotion and advancement processes to provide year-round flexibility, increasing advancement opportunities for employees. The Labs' career development event expanded from one to multiple events, connecting more employees than ever before with resources and support to explore career options at Sandia. A new internal talent marketplace capability was introduced, which will give employees greater access to career paths, jobs and projects across the Labs once fully implemented. This initiative will also enhance networking, mentoring, and training and development opportunities for all employees. **3000**



Sandia staff chat with representatives from nuclear deterrence groups during Careerapalooza ▼

## Igniting innovation in our schools

Sandia's foundational goal to accelerate innovation extends into the community through student programs and initiatives. Volunteers from across the Labs are inspiring the next generation to pursue STEM careers in support of national security. Sandia's K-12 education programs reached over 14,000 students and 700 teachers and community members across New Mexico, a 40% increase in student participation and 99% increase in teachers. **ESD**



At the Thunderbird Hacks Hackathon, a Sandia computer engineer, right, mentors a high school student in coding a machine learning model in Python that predicts crime incidents using real data from Albuquerque's open-data initiative, promoting community safety. ▼



### Streamlined reporting and smarter systems save time and money

The Safeguards and Security business team eliminated redundant reporting and enhanced management systems for ProForce and Physical Security Systems in New Mexico and California, saving \$160,000 and 756 labor hours annually while improving accountability and decision-making. Additionally, an integrated team of business specialists across the mission-enabling portfolio enhanced management operating systems and tier boards across divisions. They introduced automated processes, standardized reviews and streamlined workflow, which sharpened communication, strengthened accountability and accelerated decisions. These improvements demonstrate Sandia's commitment to efficiency, cost savings and mission success. **10000**

### Positioning the labs for the future

Human Resources led a workforce restructuring effort to help Sandia address budget pressures, rising costs and changing program needs. This included developing a voluntary separation program and remobilization process to reduce workforce size while minimizing the need for involuntary separations. Human Resources provided leaders and employees with tools and resources, including custom dashboards, extended customer service hours, rapid response times, ongoing office hour sessions and career counseling services to support them through the transition. **3000**

### Project controls meet targets, launch phase-two modernization

More efficient project controls helped three nuclear modernization programs meet labor and cost targets, paving the way for phase two in fiscal year 2026. Building on the Project Management Value Optimization initiative launched in fiscal year 2023, the team focused on rethinking requirements, eliminating waste and incorporating technology and AI. With all targets achieved, Sandia entered phase two, setting new goals for four modernization programs in fiscal year 2026. This milestone underscores Sandia's commitment to accountability, streamlined processes and delivering excellence to mission partners in nuclear deterrence. **10000**

### Financial reporting transformation powers mission success

Sandia advanced mission success by standardizing financial reporting and expanding workforce development. Through collaborations with the Cost Management Improvement team, Integrated Business Management Office how-to guides, and the DevelopU mentoring series, Sandia introduced consistent practices and adopted PowerBI for streamlined reporting. These efforts improved quality, accuracy and usability of financial data, enabling program partners to focus on data-driven decisions. By investing in training, Sandia's business and financial community continues to strengthen capabilities that support national security and operational excellence. **10000**

### AI and automation drive smarter supply chains at Sandia

The Supply Chain team rolled out new comprehensive AI strategy, the ThinkAutomation campaign and tools to boost efficiency. The team deployed robotic process automation tools to streamline supplier reviews, capitalized assets and just-in-time processes. Custom AI solutions improved procurement taxonomy and enhanced just-in-time tools, while a proof-of-concept project enabled querying supply chain vulnerabilities. By aligning with broader Labs goals, Sandia is building a more efficient, resilient and responsive supply chain for the future. **10000**

### Making well-being central to our mission

Sandia hosted numerous events to promote employee health and well-being in five key dimensions: mental, physical, social, occupational and financial. A new digital platform was introduced to help employees achieve their well-being goals while earning points for their health reimbursement or health savings accounts. Sandia's on-site health clinic teams received recognition for delivering high-quality health care services, achieving the Accreditation Association for Ambulatory Health Care's highest accreditation at both the New Mexico and California sites. **3000**



### Simplified reporting for counterintelligence

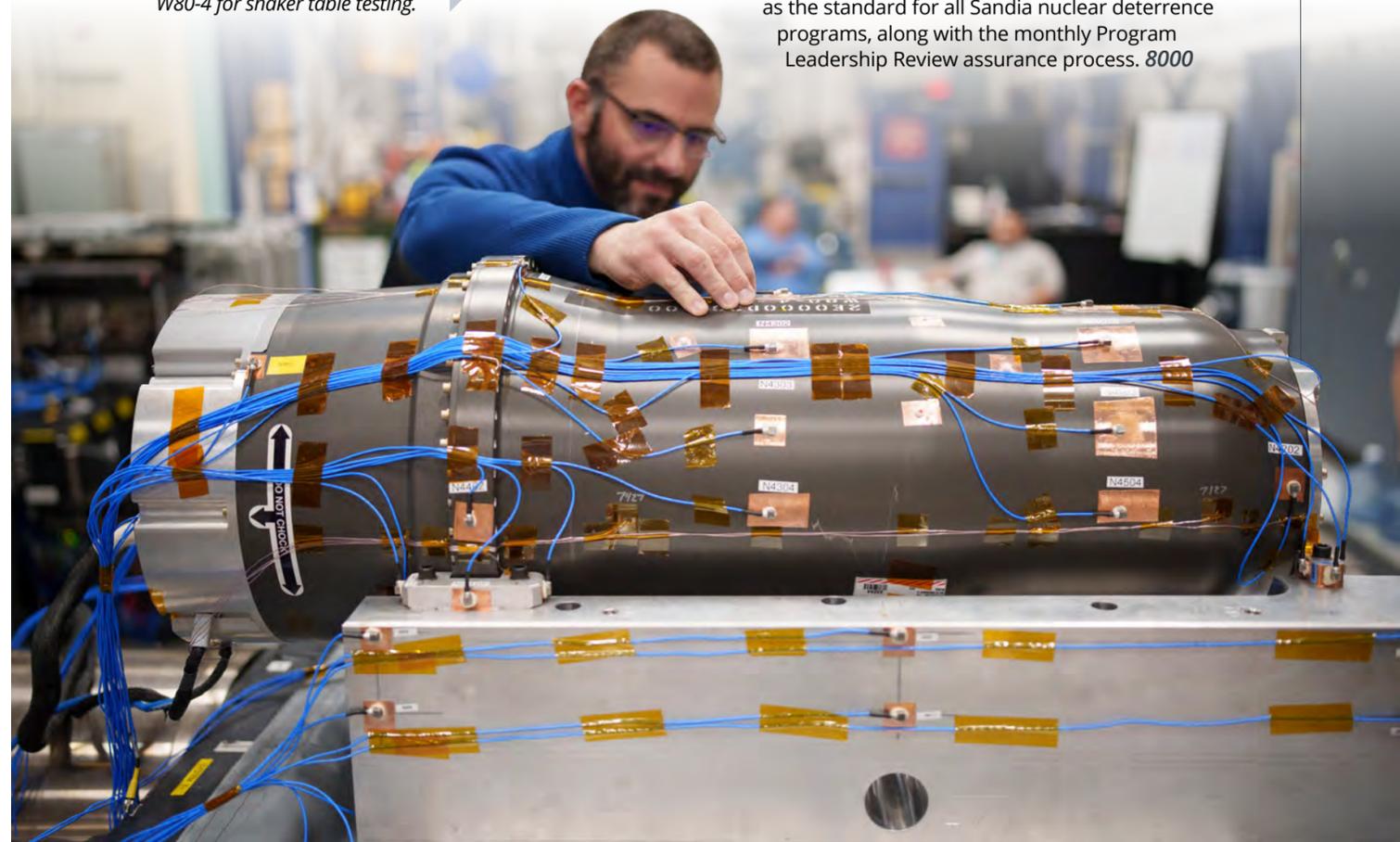
Sandia's Office of Counterintelligence is responsible for detecting and deterring threats and managing counterintelligence. The One Stop CI Activity Reporting Application, or OSCAR, is a new tool that gives Sandia's workforce a single, cohesive and consistent application for completing required reporting such as foreign contacts, travel and activities. The reporting process and information requirements often overlap for counterintelligence, personnel security and other programs. OSCAR is a single reporting app that saved the workforce over 250 hours a month. **ESD, 5000, 9000**

◀ Sandians participate in a class with Sandia Medical during Employee Health and Well-Being Day at Hardin Field. The class demonstrated offerings by the Preventive Health group.

### A new standard for ND assurance

NNSA Acting Deputy Administrator for Defense Programs David Hoagland and Sandia leadership highlighted the W80-4 program as the exemplar for how management assurance and program reporting status should be done for major nuclear deterrence programs. The reports for cost, schedule and critical hardware have been set as the standard for all Sandia nuclear deterrence programs, along with the monthly Program Leadership Review assurance process. **8000**

An engineer prepares an inert W80-4 for shaker table testing. ▶



### Improved estimating tools boost accuracy by 50%

A team of statisticians, communications experts and solutions architects improved the Cost Estimating Tool and Project Estimating Tool, increasing accuracy for monthly hours, total labor effort distributions and costs by 50%. The team collaborated to enhance source data and streamlined training requirements, improvements that reduce adjustments, simplify explanations and provide more reliable forecasts. By strengthening the estimating tools, Sandia enables program leaders to make better-informed decisions, ensuring resources are aligned with mission priorities and improving overall financial management. **10000**

### Bots save time and money as Sandia expands automation

Robotic process automation reached new heights in fiscal year 2025, with 10 bots saving \$215,000 annually and more in development to streamline finance and payroll tasks. New bots improved payroll reconciliation, cutting processing time by 87.5% and reduced manual work in purchase-order reclassification and payroll reconciliations, saving thousands of hours and tens of thousands of dollars each year. These innovations highlight Sandia's commitment to efficiency, cost savings and smarter operations across the enterprise. **10000**



### Sandia surpasses small-business milestone with \$975M in awards

For the eighth year in a row, Sandia exceeded its small-business subcontracting goals, awarding nearly \$975 million — or 54.5% of all procurement dollars — to small-business suppliers. The Labs also surpassed targets for disadvantaged, veteran-owned, women-owned and HUBZone businesses. Despite large construction contracts going to major firms, Sandia still beat its goal of 53%. These partnerships fuel innovation, strengthen local economies and support national security, highlighting Sandia's commitment to community-focused procurement and the agility of small enterprises. **10000**

*Sandia announces record-setting economic impact, including exceeding small-business subcontracting goals, during a news conference.*



### AI trained on retiring counsel's knowledge

To preserve the expertise of a retiring Legal deputy general counsel, Sandia developed the mArlanne AI tool — a proof-of-concept that uses large language models to capture and make decades of institutional knowledge searchable. Trained on over 20 years of the deputy general counsel's legal documents and correspondence, the tool enables natural-language queries and outperforms traditional search. mArlanne AI demonstrates how AI can extend the value of human expertise, supporting smarter onboarding, continuity and Sandia's future knowledge retention efforts. **ESD, 3000, 5000, 11000**



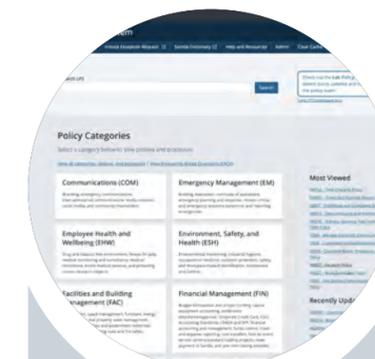
*Partial members of the team who worked on the project.*

### Innovation stories bring strategy to life

Sandia enhanced its communications and employee-engagement efforts to better highlight stories behind Labswide strategic goals, showcasing people who used intelligent risk-taking and bold innovation to spur progress across the Labs. Presenting these examples to the workforce helped accelerate a culture where new ideas flourish. In Sandia's 2025 employee survey, the percentage of employees who feel encouraged to suggest better ways of doing things rose from 73% to 84%. Favorable responses about managers rewarding appropriate risk-taking also increased, from 50% to 58%. **ESD, 1000, 2000, 3000, 4000, 5000, 6000, 8000, 9000, 10000, 11000**



*A researcher presents his project during the Labswide Innovation Faceoff event at Steve Schiff Auditorium.*



### Laboratory Policy System upgraded

Supporting safe and efficient execution of its mission and strengthening compliance, Sandia improved its Laboratory Policy System. The upgrade included a modern interface aligned with industry standards, better search capabilities, standardized formatting for greater readability, real-time visibility into most-viewed policies and a centralized space for timely communication from the Laboratory Policy Management team. Responsive to staff feedback, these improvements were designed to help staff access the right policy information faster and with greater clarity, reducing ambiguity and increasing efficiency. **9000, 11000**

*New policy website interface.*

