

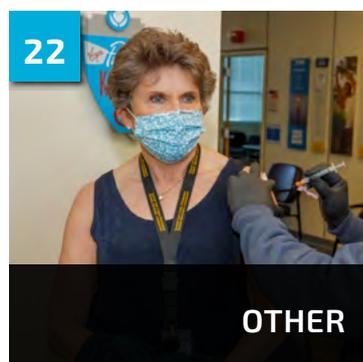
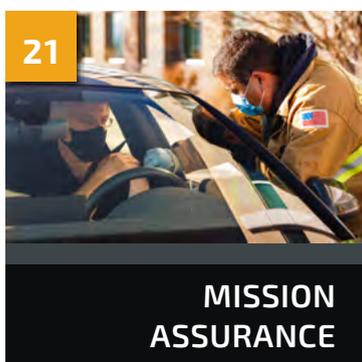
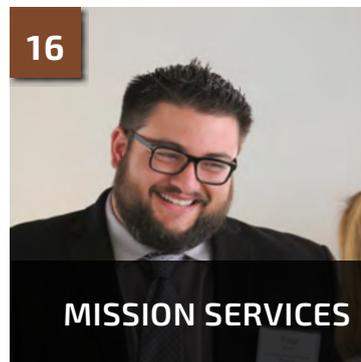
# LABS ACCOMPLISHMENTS



SANDIA LABNEWS  
March 2022

*Exceptional service in the  
national interest*

# CONTENTS



## COVER FEATURES

Photos by  
**Randy Montoya**



## FRONT COVER

*Solar tower manager Margaret Gordon performs a final heliostat field inspection for an upcoming test.*



## BACK COVER

*When COVID-19 vaccines became available in the spring, Sandia medical staff set up on-site clinics in New Mexico and California to distribute doses to the workforce. Medical staff member Rocio Jaramillo prepares a dose during one of these vaccine clinics.*

## A letter from the Labs Director



Welcome to the 2022 edition of the Labs Accomplishments, published annually by *Sandia Lab News*. The scope and significance of the work you'll read about in these pages — all completed during the 2021 fiscal year — is truly amazing. The achievements are even more meaningful considering the challenges we have navigated with the COVID-19 pandemic, which continues to touch every corner of our institution. But Sandians came through once again, delivering exceptional service in the national interest.

This publication is a record of the remarkable accomplishments of Sandians united in their dedication to the security of this country and its citizens. It is filled with successes by the Sandia staff who met critical milestones in key mission areas, advanced our support operations and made scientific breakthroughs supported by federal partners and Laboratory Directed Research and Development. It shows Sandians using multidisciplinary skills to fulfill our national security missions in meeting a wide range of threats.

It's impossible to collect all Sandia's work in a single volume. But you will read about Sandia's contributions to stockpile stewardship, nonproliferation, homeland protection, energy security, national security and international partnerships. You'll read about leadership in safety, quality and employee benefits. And you'll read about Sandians' generosity in a time of great need.

The list goes on. All Sandians play a vital role in our missions and each accomplishment comes from talented and dedicated staff performing at the top of their game.

Sandia's work is needed now more than ever. Our national security missions, including maintaining the safety, reliability and effectiveness of the U.S. nuclear deterrent, are more critical every day. The broad range of what we do sets us apart. Sandia's deep science and engineering foundations give us cross-disciplinary advantages, so we can solve some of the nation's toughest problems and make the world a safer place.

Enjoy this look at our work. I promise it will be time well spent.

**James S. Peery**, Labs Director

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## Sandia National Laboratories

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## NUCLEAR DETERRENCE



*A first production capability unit built into a development joint test assembly.*

## B61-12 program initiates landmark build processes



The B61-12 program produced four first production capability units that exercised the multisite nuclear security enterprise's build processes, critical in proving readiness for war reserve, full-scale production. This effort included Sandia as system integrator, Kansas City National Security Campus' hardware provisioning, Pantex's build processes and Los Alamos National Laboratory's design agency activities and surveillance. Two first production capability units built into development joint test assemblies were flight tested at Tonopah Test Range, concluding the test series for F-35 baseline certification. (2000, KCNSC, Pantex, LANL)

### Cross-cutting impact of Nuclear Deterrence governance improvements

The technical governance and system analysis center developed the Find It Now search tool that uses artificial intelligence and machine learning to enable collection and sharing of lessons learned. The Global Futures briefing series was reestablished, informing Labs leadership on emerging trends that influence global and national security, covering such topics as hyperconnectivity, space futures, collective security and climate change. The center successfully completed requisite Nuclear Deterrence assessments in support of the Cycle 26 Annual Assessment Review that culminated in the Lab director's stockpile assessment letter to the secretaries of energy and defense. (5000)

### The hostile survivability baseline capability



*New platforms, like the thermo-mechanical shock platform at the Z Pulsed Power Facility, support completion of the milestone. The thermo-mechanical shock platform measures mechanical shock propagation in materials irradiated by high-fluence X-rays.*

Sandia, in collaboration with Lawrence Livermore and Los Alamos national laboratories, completed an NNSA Defense Programs milestone to establish a baseline of capabilities to assess and deliver weapons that meet hostile environment survivability requirements for U.S. nuclear deterrence. The five-year effort culminated in the development of multiple new platforms at facilities across the NNSA (including Sandia's Annular Core Research Reactor, Saturn and Z Pulsed Power Facility, and LLNL's National Ignition Facility) and advances in modeling and simulation tools that enable the science of discovery, model development and testing components and materials in extreme radiation environments. (1000, 2000, 5000, LANL, LLNL)

## NUCLEAR DETERRENCE



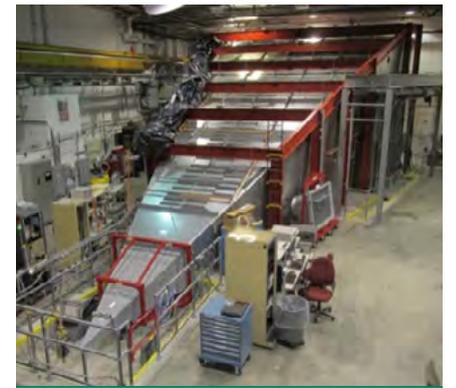
Mechanical engineer Ryan Schultz adjusts a microphone for an acoustic test on a B61-12 system.

### B61-12 EA1 first production unit

The B61-12 Electronics Assembly 1 Product Realization Team achieved its first production unit, the culmination of more than 10 years of collaboration with organizations across Sandia and the Kansas City National Security Campus. (2000, 5000, 7000, 8000, KCNSC)

### B61-12 component and system electromagnetic qualification

B61-12 qualification became a top priority to NNSA and Sandia in fiscal years 2020 and 2021. Qualification in electromagnetic environments was of particular concern due to technical and schedule drivers with hard deadlines. Preplanning by the team eliminated single point failures, minimizing electromagnetic qualification risks. The qualification was completed months ahead of schedule, thanks to the team's dedication. The systems partner said this was the best executed qualification test series he had experienced. (1000, 2000)



Gigahertz transverse electromagnetic facility used for qualification of B61-12 components and system.

A new automated calibration system measures wide ranges of voltages and frequencies. The caution tape indicates high voltages around the system.



### Calibration system for electrical standards

The Primary Standards Lab developed a new automated calibration system for alternating current measurement standards. The new system covers a wide range of voltages from 600 microvolts to 1,000 volts and frequencies from 10 hertz to 50 megahertz.

The new system allows calibrations to be performed in-house instead of outsourced. The new process reduces calibration time and cost, eliminates the possibility of damage during shipment and results in improved physical control of the assets. (2000)

### W80-4 WCS3/WSS3 integration testing success

The W80-4 Life Extension Program team performed successful integration testing of warhead communication simulators to support W80-4 rapid and agile design maturation. The W80-4 team conducted significant, critical electrical and mechanical testing at the Sandia Programs Engineering and Assembly Research facility to prepare for successful integration tests at both Sandia and Raytheon. (2000, 8000)

### New nondestructive parts verification method

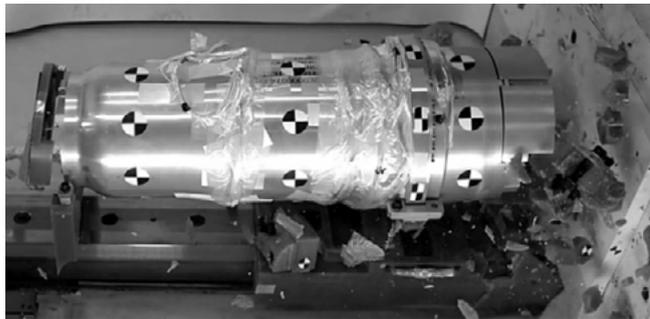
Verification of part conformance, particularly verifying the thickness of coatings, often relies on a statistical evaluation of destructive physical analysis of parts pulled from a population. Sandia engineers teamed with the Kansas City National Security Campus to enable a new, more comprehensive X-ray fluorescence methodology for nondestructive verification of thin film coatings thicknesses. This new application of X-ray fluorescence results in 100% nondestructive screening and verification without large-scale destructive sampling. (1000, 2000, 5000, 6000, 9000, KCNSC)

## NUCLEAR DETERRENCE

## W88 ALT 370 systems successfully achieve FPU and DRAAG approval

The W88-0/Mk5 Alteration 370 system successfully delivered the first production unit July 1, signifying completion of the first mark-quality war reserve W88 ALT 370 system. In October 2021, a Design Review and Acceptance Group evaluated the weapons system design relative to DOD requirements. At the review's conclusion, the group recommended the W88-0/Mk5 ALT 370 as a standard stockpile item. These accomplishments represent years of work and successful completion of numerous qualifications and cross-site activities. (2000)

*The Trident D5 submarine-launched ballistic missile takes off.*



## W80-4 program completes abnormal shock test series

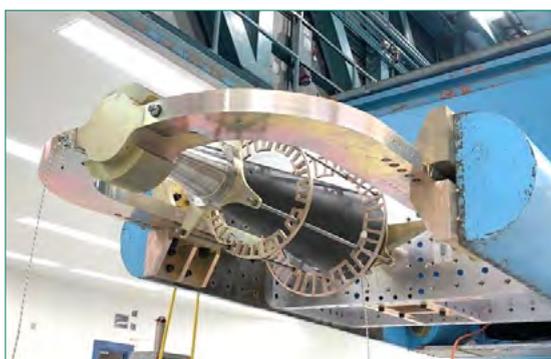
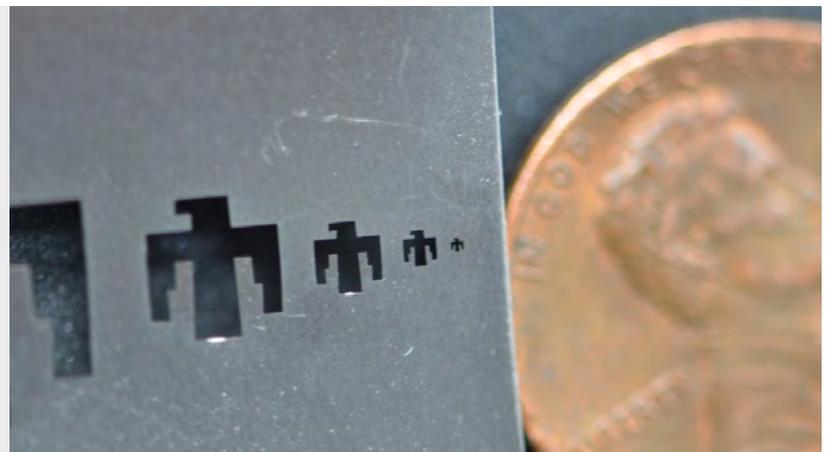
Two impact tests executed with Lawrence Livermore National Laboratory successfully completed the W80-4 Abnormal Shock Breach Phase 2 test series. The tests provided information about abnormal mechanical shock environments for nuclear safety assessments and model calibration. (2000, LLNL)

*A W80-4 test unit collides with a rigid target during the Abnormal Shock Breach Phase 2 series in April.*

## Advanced manufacturing of war reserve components

The Neutron Generator Enterprise Advanced Manufacturing Lab successfully demonstrated the use of its laser-cutting capabilities to rapidly develop and produce parts for war reserve applications. Averting a stoppage threat posed by lost suppliers and stringent specifications, this cross-organizational effort by production, design and applied sciences executed process development and qualification in only six months. With consistently high yields, the new technology is one of the options being explored for qualifying a future vendor. (1000, 2000, 7000)

*Example of the laser ablation capabilities in the Advanced Manufacturing Laboratory.*



## Full-system superfuge test development

A team of Sandia engineers developed a new testing capability in support of its nuclear weapons mission. The team completed its first combined-environments test on a full-scale weapons system at the Sandia Superfuge/Centrifuge Complex. In a successful test, weapons engineers simulated three environments — acceleration, vibration and spin — simultaneously on an inert experimental test system built by Sandia and used in collaboration with Lawrence Livermore National Laboratory. (1000, 2000, LLNL)

*An experimental test system is mounted on the centrifuge arm prior to combined environments testing at the Sandia Superfuge/Centrifuge Complex.*

## Transformation initiative

Sandia's Commercial Off the Shelf Transformation Initiative developed a technical and supply chain assurance framework and policies to enable reliable, predictable and repeatable use of the commercial supply chain to provide electronic parts for Sandia's nuclear weapon component designs. Based on benchmarking of peer agencies, the initiative created a new approach for high-rigor engineering with commercial electronic parts for nuclear deterrence applications and, in partnership with Kansas City National Security Campus, increased Sandia's ability to transfer leading-edge research to these applications. (1000, 2000, 5000, 7000, 10000, KCNSC)

## W87-0 firing set assembly first production unit

Ensuring the W87-0 is sustained for the duration of its protected period in the stockpile, the W87-0 firing set assembly achieved first production unit status for the 107 suffix. The unit is a culmination of more than a decade of work and represents a significant milestone in the W87-0 program. The effort received contributions from Sandia's Strategic Firing Subsystem and W87-0 System Engineering teams, as well as several additional Kansas City National Security Campus and Sandia collaborators. (1000, 2000, 7000, 8000, 10000, KCNSC)

## ■ NUCLEAR DETERRENCE

### Redelegation of Sandia's independent inspection



In February 2021, Sandia renewed its delegation authority to conduct inspections and diamond stamp materials on behalf of NNSA quality assurance. This is a critical capability for Sandia's production agency mission and is only bestowed on fully qualified staff who conduct these activities per the applicable requirements of NNSA's Weapon Quality Policy. The renewed delegation was granted following NNSA's Quality Assurance Survey 2, which reevaluated the adequacy and effectiveness of Sandia's inspection program. The inspection concluded with zero findings and three remarks. (2000)

*Members of the Sandia Weapons Quality Assurance team are responsible for Sandia's independent inspection.*

### W87-1 team demonstrates system architecture

The W87-1 team, including NNSA, Lawrence Livermore National Laboratory and production agency partners, selected a warhead single architecture. It reviewed and validated source requirements and interfaces, decomposed warhead-level functions, created use control and nuclear safety themes, completed system design trades and allocated requirements to each major component. Since successfully passing the system feasibility gate, the team has positioned the program to enter the design definition and cost study phase. The program more than doubled in size and met all milestones in FY21. (2000, 8000, 10000, NNSA, LLNL)

### Component design via set-based concurrent engineering

Furthering the Labs' model-based design and advanced digital engineering initiatives, Sandia's Component Science, Engineering and Production team led adoption of component design via set-based concurrent engineering. Sandia successfully completed the baseline design review gate of a power source component, which was designed using set-based concurrent engineering principles that allow deep understanding, trade-offs and dependencies in design decisions, leading to more agile iterations and, ultimately, more robust designs. (1000, 2000, 7000)

### Military Liaison weapon lifecycle support

Military Liaison provided engineering weapon lifecycle support to the enduring stockpile and weapon modernization programs, resolving 549 weapon system-related anomalies, publishing 4,185 pages of technical procedures and conducting 114 technical training sessions. Staff met several key B61-12 program milestones, ensuring the DOD was well prepared to receive weapons in the field. Military Liaison collaborated with use control systems to deliver several publications and field training to the Air Force, enabling smooth transition of new equipment in the field. (7000)

*The Military Liaison team stands with a model of a Mark 5 bomb in front of the entrance to the Weapon Display Area, a key site to train stakeholders and partners.*



### War reserve parts delivered

Despite challenges related to the COVID-19 pandemic, Sandia's Production Agency delivered more than 34,500 war reserve parts affecting 53 major components in seven technology areas: power sources, explosives, neutron generators, application specific integrated circuits, heterojunction bipolar transistors, switch tubes, and timers and detonators. Sandia manufactured all neutron generator, application-specific integrated circuits and heterojunction bipolar transistors parts onsite, more than 26,800 parts for 24 major components. (5000, 7000, 9000)

### First internally produced explosive component

In response to supply chain issues that posed risk to the W88 ALT 370 Program, Sandia's Explosive Technologies Group stood up the Labs' first internal production capability for explosive components. The first lot of an internally produced detonator was delivered Aug. 19 after defect-free acceptance by the Sandia Field Office. The lot, which was delivered ahead of schedule, exhibited improved production yield and superior performance compared to the externally produced product. (7000)

### Innovative website serves nuclear deterrence community

A Sandia team collaborated to design, build and launch a WordPress website to serve as a hub for nuclear deterrence information across Division 8000. The team of professionals from Communications, Strategy and Recruiting integrated strategy, accomplishments, job opportunities, recognition and culture, building relevant content for each section and reinforcing a cohesive "one team" nuclear deterrence community message. The project team sought feedback to guide the project and ensure effectiveness of future iterations. (8000)

## NUCLEAR DETERRENCE

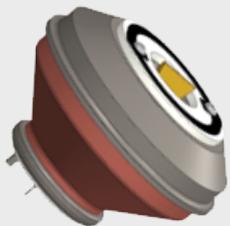
## W80-4 completes full-scale thermal and mechanical tests

In October 2021, the first W80-4 full-scale thermal and mechanical tests under normal conditions successfully demonstrated the warhead's survival of these conditions throughout its lifetime. In addition to helping qualify warhead design, these test results provided data to validate modeling and simulation tools, supporting component-level development of environmental specifications and performance requirements. (2000)



## W80-4 program completes functional testing milestones

The W80-4 Life Extension Program completed major milestones in functional testing by maximizing collaboration and agility between cross-site component and system test, qualification and design teams. The functional electrical test teams completed temperature testing of the joint test assembly configuration, demonstrating successful firedown and data acquisition for the flight test unit. The Sandia Programs Engineering and Assembly Research laboratory in California completed subsystem integration testing with war reserve prototypes. The combination of these efforts enables the release of component design engineering holds to ensure a successful final design. (2000, 8000)



## Scrapping of neutron tube eliminated

Sandia's Source End Diode Conversion team eliminated scrapping of neutron tubes, saving \$3 million annually for the neutron generator enterprise. In collaboration with tube design and production, Neutron Generator Science and Technology department identified a production improvement opportunity that translated into a change in the tube testing process, resulting in increased yield. The tested tube configuration also increased confidence that delivered tubes will perform to specifications. (7000)

*Rendering of a neutron tube.*

## Stockpile surveillance testers

Multiple system testers were qualified by staff at Sandia and the Weapons Evaluation Test Laboratory for stockpile surveillance and evaluation. Qualifications were issued for the B61-12 bench command disable and stronglink safety testers, as well as for a W80-1 small centrifuge conversion. Previously qualified B61-12 and W88 ALT 370 system test equipment successfully tested first production capability units and E-test units. Active testing, continuous improvement feedback and modernization of tester subsystems are driving operational efficiencies in stockpile testing. (2000, 7000)

*The B61-12 system test equipment at the Weapons Evaluation Test Laboratory in Amarillo, Texas.*



## Tonopah Test Range mission excellence

Fourteen flight tests supporting B61-12 qualification, full-weapon system demonstrations and stockpile systems surveillance requirements were conducted at the Tonopah Test Range. The range team expertly recovered 20 dropped assets, ensuring hardware was safely preserved for forensic analysis. They also responded quickly to a 120-gallon diesel fuel spill, ensuring spill containment, reporting to stakeholders and remediation from the Nevada Department of Environmental Protection. (2000, 7000)

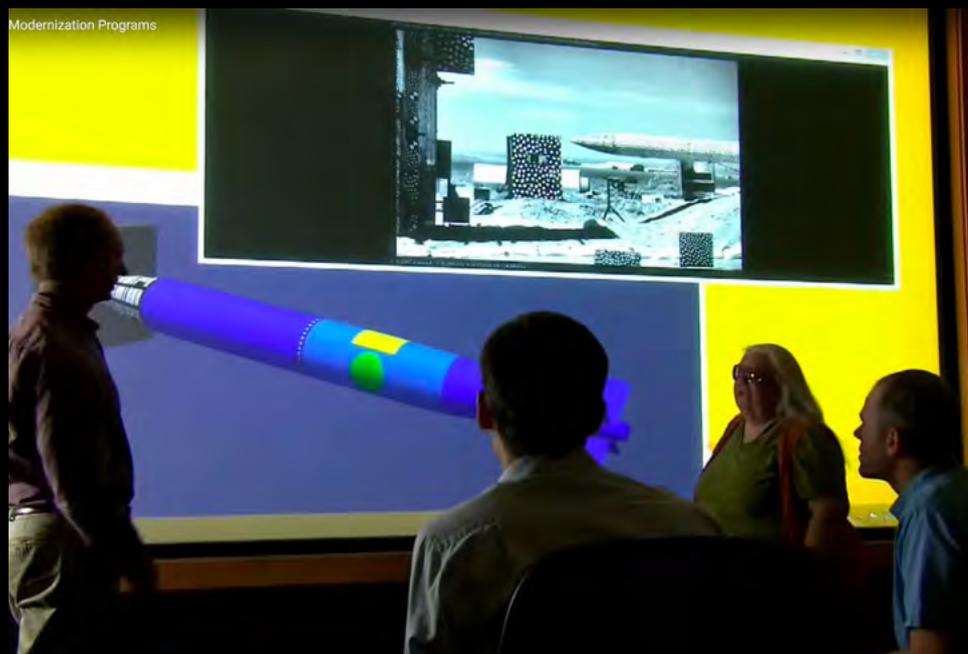
*An inert B61-12 test unit approaches its impact site during a qualification test drop at Tonopah Test Range.*



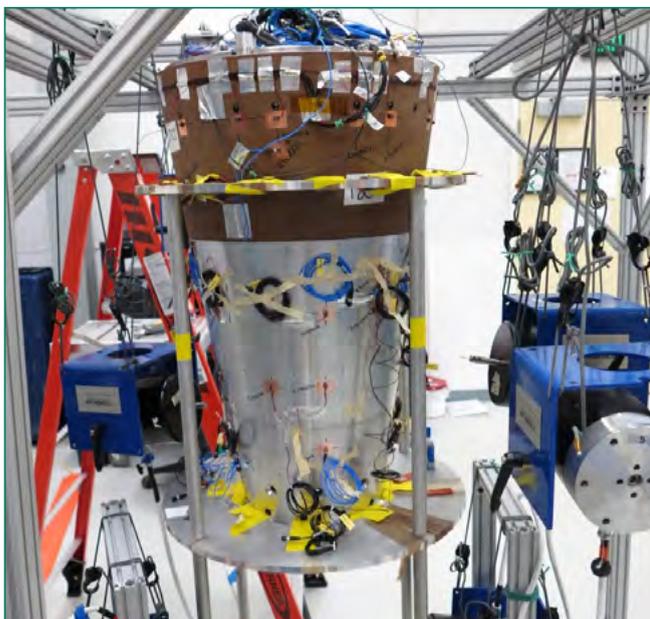
## NUCLEAR DETERRENCE

### Abnormal mechanical support for B61-12 design review

A team of system and component analysts provided abnormal mechanical technical basis data for the B61-12 Final Design Review and Acceptance Group meeting. The team used Sierra/SM, the massively parallel non-linear solid mechanics finite element software package, on high-performance computing platforms to explore the mechanical nuclear safety response of a weapon for a series of abnormal mechanical environments. Acceleration histories from these analyses were used directly in the examination of the nuclear safety component-level mechanical response. For each case, derived requirements were assessed to determine the mechanical nuclear safety state of the weapon. The data provided insight into mechanical nuclear safety strength of the weapon and how different nuclear safety features interact with each other. The approach also aided exploration of the weapon's mechanical nuclear safety response in the vast stockpile-to-target-sequence accident space. This information, along with data from full-system tests, contributed to the abnormal mechanical technical basis that supported the successful qualification of the design. (1000)



The team reviews modeling and simulation to prepare for the B61-12 final design review.



Subsystem test setup used in hybrid system prediction approach to enable block-upgradable modular testing.

#### Advances in block-modular testing

Sandia has matured testing and analysis capabilities for qualifying block upgradeable weapon systems. In partnership with the Joint Technology Demonstrator, Delivery Environments and Verification and Validation programs, Sandia demonstrated a hybrid system-model approach on a reentry body system to assess impact on dynamic performance when modules are swapped in and out of the system. Sandia now can rapidly characterize an upgraded system, evaluate performance impact and reduce the need for repeating select qualification activities. (1000, 2000)

### W80-1 Alt 369 last production unit



Rendering of the W80-1 warhead.

W80-1 Alt 369 successfully completed its last production unit at the Pantex Plant on May 12, 2021. The alteration extends the life of the W80-1 warhead until replacement, addressing identified aging issues and refurbishing the system in a managed and affordable fashion. The program was a major collaborative effort between Sandia, Pantex, NNSA Headquarters, the NNSA Production Office, Lawrence Livermore National Laboratory, Kansas City National Security Campus and the Savannah River Site. (8000, Pantex, NNSA, LLNL, KCNSC)

#### Advancing computational simulations on next-generation platforms

The Advanced Simulation and Computing Structural Dynamics and Thermal Fluid computational simulation teams have delivered to nuclear deterrence analysts the ability to run mechanical and normal thermal simulation under normal conditions on the next-generation computing platform at Lawrence Livermore National Laboratory, called ATS-2. The structural dynamics and thermal applications are now production ready applications on ATS-2 that make efficient use of the graphics processing units. Using ATS-2, the most powerful computer in the NNSA complex, W80-4 system model analyses that previously took days can be completed in hours, greatly increasing the value of these analyses for component and experiment design cycles. Equally important advances were enabled in model setup, meshing at scale and developing credible workflows to improve efficiency. Next year, W80-4 analysts will leverage the increased throughput enhancement, using the new machines for system uncertainty quantification via ensemble analyses. (1000)

## Assessing US and Mexico border security

Sandia partnered with the Department of State's Bureau of International Narcotics and Law Enforcement Affairs and Mexico's Servicio de Administración Tributaria to evaluate security in five border sectors, each with multiple points of entry. Used to develop a baseline analysis of existing security operations, these assessments will inform recommendations for future U.S. and Mexican strategic investments that disrupt illicit cross-border activities and potentially guide other international cross-border security activities. (5000, 6000)

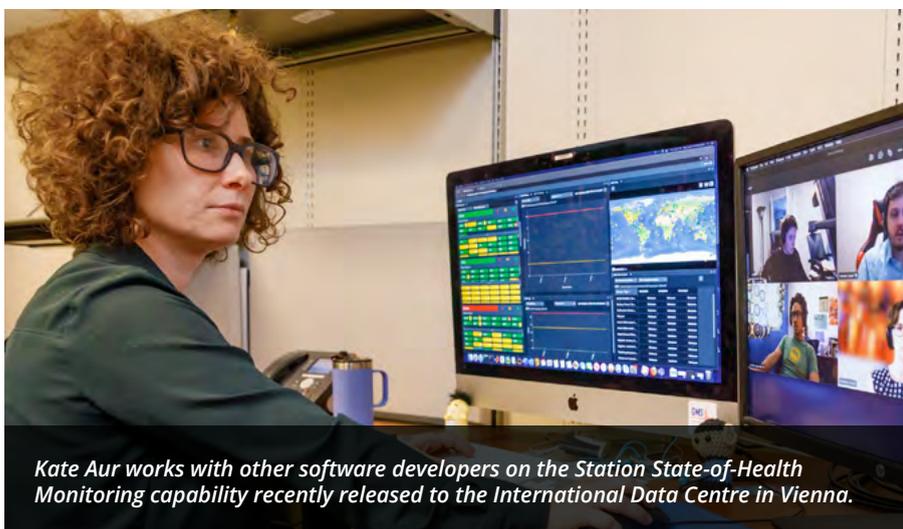


### Security System of the Future roadmap

Fundamental architectures for physical security systems that protect the nation's most critical assets have not changed much since Sandia created the key principles for these systems five decades ago. They are heavily reliant on costly infrastructure that limits adaptability and adoption of rapidly improving capabilities. Sandia's Security System of the Future Program is a phased approach for developing the next generation of physical security systems, aiming at simultaneously decreasing installation costs, improving target detection and increasing system resiliency. Several U.S. agencies have invested in the development of an integrated Security System of the Future roadmap using many capabilities from across Sandia. (6000)

### Unmanned Aircraft Systems Research and Engineering Center established

Recognizing the rapidly evolving risk to national security driven by extensive development of unmanned aircraft systems, the DOE and NNSA requested Sandia establish and lead the UAS Research and Engineering Center. Leveraging expertise from partners across the national security enterprise, the center addresses the challenging problems resulting from the adversarial use of these technologies. Chartered in January 2021, the center's early efforts have included advising the White House Office of Science and Technology Policy on the use of foreign-sourced unmanned aircraft systems for critical national security missions. (6000)



*Kate Aur works with other software developers on the Station State-of-Health Monitoring capability recently released to the International Data Centre in Vienna.*

### Monitoring global nuclear weapons testing activity

Sandia provided software updates that will improve the Comprehensive Nuclear-Test-Ban Treaty Organization's ability to filter the information processed daily to monitor for global nuclear detonations. Data is gathered at more than 300 monitoring stations and sent to the organization's International Data Centre, where signals in the data stream from natural and human-caused activities, including earthquakes, volcanic eruptions, mining and drilling, nuclear reactor operations and medical isotope production, create noise that complicates identifying nuclear detonation events. Sandia's updates sustain the highly sensitive monitoring system that is essential for nuclear weapon treaty verification efforts. (6000)

### Novel electric field sensor advances noninvasive diagnostics of electronics

Sandia modeled and developed a novel laser-based method to improve electric-field detection signal-to-noise ratio by at least an order of magnitude. This technology allows for the sensitive detection of the charge state of electronic devices, such as capacitors, and could enable end users to examine sealed objects to determine potential hazards. The work advanced research initially funded by Laboratory Directed Research and Development from technology readiness levels one and two to level four. (6000, LDRD)

### Global Burst Detection test assets mitigate program risks

The Global Burst Detection team continued to execute in accordance with an accelerated test asset delivery schedule to support the U.S. Space Force's risk-mitigation approach for the GPS III F program, exceeding original NNSA delivery expectations. On-schedule test-asset shipments include Global Burst Detection Simulators 1 and 2 in May 2021 and the Interface Emulator in July 2021. These test assets will be used by the Space Force and supporting contractors for Global Burst Detection-to-GPS space vehicle compatibility testing. (6000)

### Increasing biological security in Uganda

Sandia's Global Chemical and Biological Security team partnered with the Uganda Wildlife Authority to complete a final operational readiness assessment before it could assume control of the Wildlife Veterinary Diagnostic Laboratory, a state-of-the-art zoonotic diagnostic facility funded by the Defense Threat Reduction Agency. Building on past Sandia biorisk management training, the authority was well prepared for the exercise and demonstrated rigorous measures to ensure laboratory biosecurity. The facility will continue to support the authority's disease detection, prevention and research mission. (6000)



*Sandia researchers partnered with the Uganda Wildlife Authority to ensure that its lab met biosecurity criteria.*

## GLOBAL SECURITY



The GPS III Space Vehicle 05 launch.

### Global Burst Detector III Payload launched

On June 17, 2021 the U.S. Space Force launched the fifth Block III GPS satellite onboard a SpaceX Falcon 9 rocket. The satellite is equipped with a Global Burst Detector III payload built by Sandia's Monitoring Systems Center in partnership with Los Alamos National Laboratory. The detector enhances the nation's capability to effectively monitor for nuclear detonations and compliance with treaties. (6000, LANL)

[Watch video of the launch](#)

### Rebuild of Djibouti radiological detection system

After floods destroyed key parts of a radiation detection system in Djibouti, Sandia border security experts worked quickly to preconfigure, build, test and ship an entire multitechnology radiation detection system to replace damaged infrastructure. The team also developed new procedures to provide virtual oversight for installation and final acceptance of the system, which plays a key role in combating radiological and nuclear material smuggling in Africa and the Middle East. (6000)

### Cooperative scientific engagement for global security

Sandia's Cooperative Monitoring Center reinvigorated its mission to increase global security through science-based collaboration by hosting dialogues with key stakeholders in government, academia and industry on issues at the intersection of technology and policy. Activities included the Global Climate Security Symposium, the Nuclear Energy Experts Group roundtable on civil nuclear energy, a four-panel series on cooperative security in South Asia and 20 expert-driven regional seminars. The center also hosted seven visiting research scholars from five countries to conduct and publish new research on regional security issues. (6000)

### Nuclear safeguards technology transfer wins awards

Sandia's Global Nuclear Security and Non-Proliferation team was presented two prestigious International Safeguards Engagement Program Joule Awards for outstanding efforts in the transfer of nuclear safeguards technologies. The team was recognized for facilitating the transfer of identiFINDER, a handheld sodium iodide detector tool that enables users to identify and characterize nuclear materials, from the NNSA to the Mongolian Nuclear Regulatory Authority. The team also was recognized for deploying Sandia-developed software designed to increase surveillance system efficiency to the International Atomic Energy Agency Department of Safeguards. (6000)

### RAPTR N95 delivers a reusable, affordable respirator

Recognizing a need for affordable, effective N95 masks during the COVID-19 pandemic, a team of Sandians developed an affordable, rapidly producible, effective N95 respirator mask design. The team prototyped the mask and verified its effectiveness in comfort, ease of breathing, filtering ability and ease of sterilization. The project was selected as an R&D 100 winner for 2021 in two categories: Analytical/Test and Special Recognition Corporate Responsibility, Silver Medal. (1000, 2000, 3000, 5000, 6000)

### First hypertextural sensor focal plane array

The Global Burst Detector team successfully completed design, fabrication and realization of the first hypertextural sensor focal plane array. A key component for optical remote sensing missions, the focal plane is a multichip assembly that relies on several industry partners and advanced microfabrication and assembly processes to achieve a functional integrated product. The focal plane is capable of recording events of interest at multiple kilohertz rates to measure key event characteristics. (6000)



### Access-delay hardware transferred to industry

NNSA's Office of Radiological Security funded Sandia's successful collaboration with Gamma Service Medical to develop access-delay and tamper-detection hardware for about 125 blood irradiators containing cesium-137 distributed worldwide. Delay times were reduced by 75% to meet security requirements to prevent illicit removal of radioactive materials from these devices. Test results were published in internal Sandia reports, and the designs were transferred to industry for use on existing and newly manufactured machines. (6000)

The team responsible for transferring to industry access-delay hardware for about 125 blood irradiators containing cesium-137.

### Radiological Assistance Program real-world responses

Sandia's Radiological Assistance Program team members supported and responded to several real-world events. A responder was part of the 29-person cross-complex team that performed nuclear and radiological vehicle scanning for the presidential inauguration. The program also supported the Environmental Protection Agency's search of a facility in Davis, Oklahoma, the FBI investigation of an individual suspected of collecting radiological material and mobile search operations at the Tulsa Race Massacre Centennial commemoration and presidential visit. (6000)

Sandia's Radiological Assistance Program team readying equipment in Tulsa, Oklahoma, in support of the EPA.



## ADVANCED SCIENCE &amp; TECHNOLOGY



## Enabling power management on Astra

*Team members stand with Astra, the first petascale Arm-based supercomputer.*

Collaborating with industry partners, Sandia codeveloped power measurement and control capabilities for the Astra supercomputer. This enables the team to explore trade-offs among application performance, system power usage and temperature. Experimental results demonstrate the ability to improve performance by up to 10% while staying within the system's thermal constraints. This work will guide the design of advanced power management in future high-performance computing systems, which is vital considering the steadily increasing power usage of such platforms. (1000, 9000)



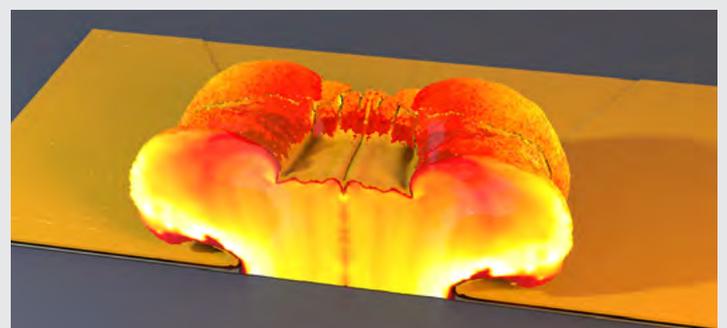
## Material structure on the fly

The arrangement of atoms in a material — layers stacked like apples at a farmers market or lined up as squares — influence many physical properties of materials. The Labs developed time-resolved X-ray diffraction on both the Z Pulsed Power Facility and the pulsed power driver THOR to measure this structure under dynamic loading, then tested its capabilities at the Advanced Photon Source at Argonne National Laboratory. The team successfully measured structural phase transitions during impulsive extreme pressure events. (1000, LDRD, ANL)

*Researchers Tom Ao, left, and Sakun Duwal tested X-ray diffraction to interrogate materials at the Advanced Photon Source at Argonne National Laboratory.*

## New detonator design capability

Using the newly released multiphysics code LGR, or Lagrangian Grid Reconnection, hundreds of thousands of simulations were performed on the Sierra computer at Lawrence Livermore National Laboratory to obtain an extraordinarily detailed map of design parameter space to train a reduced-order machine-learning model. The previous simulation capability required several hours to run, and an LGR simulation can run in approximately 10 minutes, but the reduced-order model runs in less than a second. This enables nuclear weapons component designers to use LGR simulations directly in the design workflow. (1000, 2000, 7000, 8000, LLNL)



*LGR simulation of electrical current passing through a metallic bridge. The current rapidly bursts into a high-temperature plasma and launches an overlying flyer coating toward an energetic material.*

## ADVANCED SCIENCE & TECHNOLOGY



Microscope image of Microsystems Engineering, Science and Applications fabricated more than 6,000 volts gallium nitride EMP arrester diode prototype.

### Record-breaking grid protection switches

A wide bandgap materials and devices team demonstrated a compact device that can shunt excess electricity within nanoseconds while operating at a record-breaking 6,400 volts — a significant step toward electromagnetic pulse grid protection. EMP surges are 100 times faster than those caused by lightning, so existing devices designed to protect the grid against lightning strikes have questionable effectiveness against an EMP. This advance is a key step toward creating devices that can operate at around 20,000 volts, beyond most grid distribution voltages. (1000, ARPA-E)

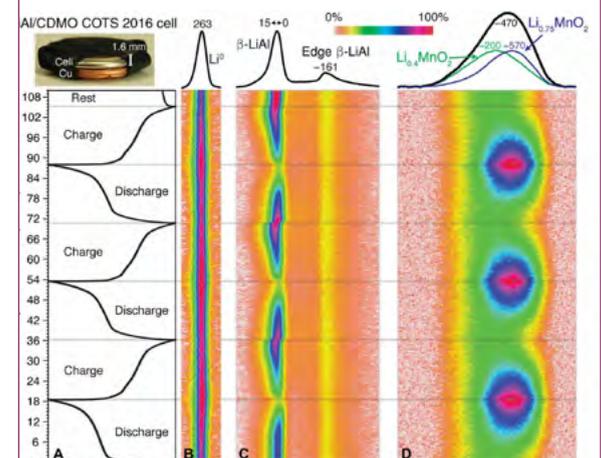
### DIVERSE-W: Encouraging women to pursue inventorship

To address the gender gap in inventorship, Diversity and Inclusion in InVentorship and EntrepReneurship Strategies and Engagement-Women engaged women researchers in a cohort program to increase participation in innovation and technology transfer. Participants networked across the Labs while learning to navigate the Sandia innovation ecosystem. DIVERSE-W also hosted a DOE-wide speaker series to inspire researchers, featuring accomplished women from 3M; High Water Mark, a New Mexico woman- and native-owned small business; NASA; and a panel of four women innovators from FermiLab and Oak Ridge, Idaho and Sandia national laboratories. (1000, ORNL, INL)



The DIVERSE-W speaker event featured women innovators from national laboratories, NASA and successful companies.

### Energy storage R&D advanced characterization



Operando nuclear magnetic resonance results, published in *Science Advances* and described in a patent application, with a coin cell photograph, upper left, electrochemical data, left, and NMR signals, right.

Two complementary techniques were first demonstrated for advancing the development of next-generation batteries. Nuclear magnetic resonance analysis was previously considered incompatible with coin-cell battery metal casings. Sandia demonstrated operando NMR in coin cells by developing an NMR probe. The team also demonstrated a cryogenic laser milling technique for cross-section scanning electron microscopy analysis of entire coin cell batteries to reveal battery failure mechanisms. (1000, 2000, LDRD)



The IDAES team visited Lawrence Berkeley National Laboratory in February 2020.

### The Institute for the Design of Advanced Energy Systems

IDAES, a collaboration between Sandia, National Energy Technology Laboratory, Lawrence Berkeley National Laboratory, Carnegie Mellon University, West Virginia University, University of Notre Dame and Georgia Institute of Technology, received an R&D 100 award for the release of the IDAES Integrated Platform. Built in a Sandia-developed Pyomo modeling environment, IDAES enables optimal design and implementation of complex, interacting energy systems from individual plant components to the entire electrical grid, ensuring environmentally sustainable, reliable and cost-effective national energy infrastructure. (1000, 8000, NETL, LBNL)

### Enhanced nuclear reactor fuel inspections

Advances in fuel inspections at the Annular Core Research Reactor resulted in the most comprehensive understanding of fuel health since reactor start-up in 1978. Developing a comprehensive fuel-health program and designing and implementing diagnostic equipment that uses nondestructive evaluation techniques — including ultrasonic, mass measurement, visual and dimensional measurements — made the achievement possible. Inspections were completed in the summer after a high rigor readiness review to ensure safe operations with new equipment and updated processes. Fuel-health program execution will enable reactor operations that support Sandia's mission. (1000)

### Power delivery for Z successor

A next-generation pulsed power machine will require delivery of more than 50 million amperes to centimeter-scale targets to produce the world's brightest X-ray and thermonuclear fusion environments for stockpile stewardship. New experiments on the Z Pulsed Power Facility using scaled transmission lines demonstrated the ability to deliver the equivalent current density under the same electric and magnetic fields as a next-generation pulsed power facility with essentially no loss. These innovative tests provide additional confidence in design studies for a future machine. (1000)

### Faculty Loan Program for Joint Appointments

Academic Programs has launched the Faculty Loan Program for Joint Appointments to enable Sandia staff members and faculty members at partner universities to hold joint appointments at both institutions. So far, New Mexico State University and the University of Arizona are in the program, with plans to add more schools in 2022. The program is intended to deepen Sandia's strategic relationships with university partners and increase the diversity of Sandians partnering with universities. Partnerships across Sandia were critical to establishing the program. (1000, 3000, 4000, 10000, 11000)

## NATIONAL SECURITY



## Pressure-sensitive paint diagnostic test

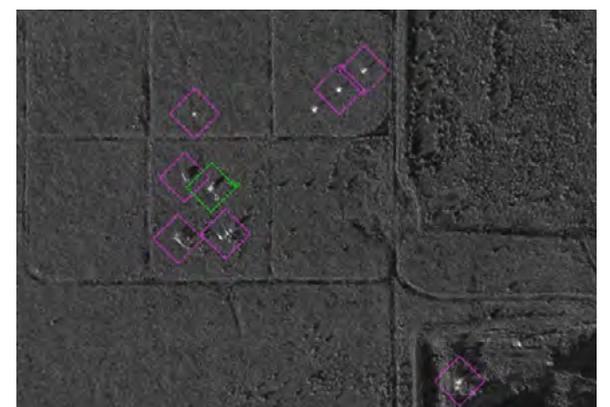
*A novel diagnostic demonstrates the capability to measure full field shock loading on systems.*

Sandia's Validation and Qualification group and Aerosciences department successfully partnered on a Delivery Environments project to field a pressure-sensitive paint diagnostic in the blast tube for the second time in March 2021. Schedule and funding constraints, as well as the COVID-19 pandemic, made pretest logistics challenging. However, the test successfully demonstrated that the paint can be used to capture loading on systems in higher pressure blast environments, which is one step closer to a mature diagnostic that can be applied to system-level testing. (1000)

## Demonstration of the Perseus Radar

The Radar Intelligence, Surveillance and Reconnaissance team demonstrated the Perseus Radar on Sandia's Twin Otter Testbed for several U.S. Army organizations. Perseus' high-performance synthetic aperture radar and real-time automatic-target recognition were demonstrated through multiple SAR modes. Perseus successfully executed automatic target recognitions that met and exceeded the Army's range requirements, demonstrating with targets on Kirtland Air Force Base and White Sands Missile Range for scenes with multiple objects to confuse the radar. The small size, weight and power of the Perseus radar will allow its integration into a variety of future manned and unmanned platforms. (5000)

*A portion of the Sandia user interface displays Perseus' automatic target recognition detections.*



*A team member puts the WeaselBoard through its paces on a test apparatus.*

## WeaselBoard team completes production milestones on multiple devices

The WeaselBoard team successfully completed production readiness review for multiple hardware security device variants. Through a collaborative effort across Sandia, the Kansas City National Security Campus and the DOD, the team was able to transition an innovative Laboratory Directed Research and Development concept, despite travel and other logistical challenges due to the COVID-19 pandemic.

Installation of WeaselBoard devices has begun, and eventually hundreds to thousands of the devices will be installed on a range of critical industrial control systems. These devices will deliver cyber and physical security to DOD systems by providing the ability to monitor for anomalies and protect critical subsystems. By transitioning the design, testing documentation and technology to the KCNSC production partners, the WeaselBoard team will have successfully taken an LDRD-funded concept from idea to production. By collaborating with the KCNSC and using its secure manufacturing capability, the team will enable enhanced trust of cyber and physical security for devices installed in the field. (5000, 6000, 7000, KCNSC)

## NATIONAL SECURITY

### Radar Analysis, Modeling, Simulation and Emulation Suite

Radar Analysis, Modeling, Simulation and Emulation Suite is a Sandia-developed software suite that provides synthetic aperture radar and moving target indication system design and performance analyses. Using RAMSES as a national asset has lessened risk, timeline and cost for numerous DOE and DOD programs.

RAMSES is a culmination of software capabilities where each project develops unique radio frequency modeling and simulation tools that benefit novel and ongoing projects. RAMSES provides swift responses to the national program deliverables for airborne, strike, nuclear deterrence and space applications. (5000, 6000)

### BlueJay: A GPS-denied navigation solution



*BlueJay developed a 10-plus sensor payload that can be flown on an unmanned aerial vehicle for more than four hours and brings a new capability to Sandia and its partners.*

Sandia's BlueJay team provided a unique GPS-denied navigation solution for a challenging national security need. The BlueJay team responded by developing a navigational sensor payload containing over 10 sensor technologies for small unmanned aerial vehicles. The payload contains three cameras, four inertial measurement units and a magnetometer that met all challenging performance requirements. The team achieved a four-hour UAV flight demonstration in a three-month period. The BlueJay program marks one of the Labs' first Strategic Partnership Project deliverables

of GPS-denied technologies to an external national partner. (5000)

### Direct-write printed radio frequency antennas

Aerosol-jet, direct-write printers demonstrated printed radio frequency antennas. Using conductive and dielectric inks, radio frequency structures and interconnects were printed between monolithic-microwave integrated circuits on printed circuit boards. Direct-write printing is an enabling technology for heterogeneous integration of sensors and integrated circuits into low-loss, conformal packaging of radio frequency modules for radar and electronic-warfare systems. (5000)

### Modern computer-assisted design ecosystem

During the Defense Advanced Research Projects Agency Transformative Designs program, Sandia's team created Plato, a graphics-processing, unit-accelerated, computer-assisted design platform. Plato became the main testbed in the program and fostered new partnerships with industry and defense laboratories to address engineering design challenges. Plato also enabled other programs to investigate design workflows and served as a common modern design testbed that was leveraged, augmented and quickly experimented with during the DARPA program, catapulting it to overall program success. (1000)

### State-of-the-art complementary metal oxide semiconductor digital logic

In a Sandia first, teams designed and taped out an integrated circuit for fabrication at seven nanometers, the smallest metal-oxide semiconductor digital-logic process node in production. The Advanced Research for Integrated Circuits in Hostile Radiation program, a collaboration with Intel Federal, was the exemplar program for the Strategic Radiation Hardened Electronics Counsel Export Control Workshop. In response to the workshop, the Department of Commerce published an FAQ about providing state-of-the-art facilities with access to government programs. These accomplishments pave the way for Sandia to access innovative integrated circuits that will broadly impact Sandia's mission. (5000, 10000)



*Visual representation of the software-designed radio signal burst detection.*

## Next-generation Communication Solutions

The Advanced Engagement Systems team within the Next-gen Communication Solutions group matured technology for the Sidetrack program and delivered production units to the customer.

Sidetrack provides an advanced engagement capability through a platform-agnostic hardware set capable of targeting unmanned aerial system threats in a single payload. Sidetrack's scope includes design and integration of the system into an existing platform, establishing a communications infrastructure and the deployment of a central server. (5000)



### Automated target recognition supporting warfighters

Building on a 35-year history of developing and deploying trusted automated target recognition systems into high-consequence operational environments and leveraging the latest advances in artificial intelligence, machine learning and automation, Sandia dramatically expanded its ability to support tactical users across the strike and intelligence, surveillance and reconnaissance communities. The new capabilities enabled coverage of more targets and missions, significantly outperformed similar technologies developed by other national security organizations and allowed research and development staff to focus on solving the next set of challenges. (1000, 5000, 6000, 9000)

*An example of Sandia's flagship automated target recognition system in operation, where specific targets were identified in a synthetic aperture radar image and transmitted to a user.*

## ENERGY &amp; HOMELAND SECURITY



## A song of ice and fiber

*Looking west over a frozen Arctic Ocean. Unseen optical telecommunication fiber stretches to the west and north.*

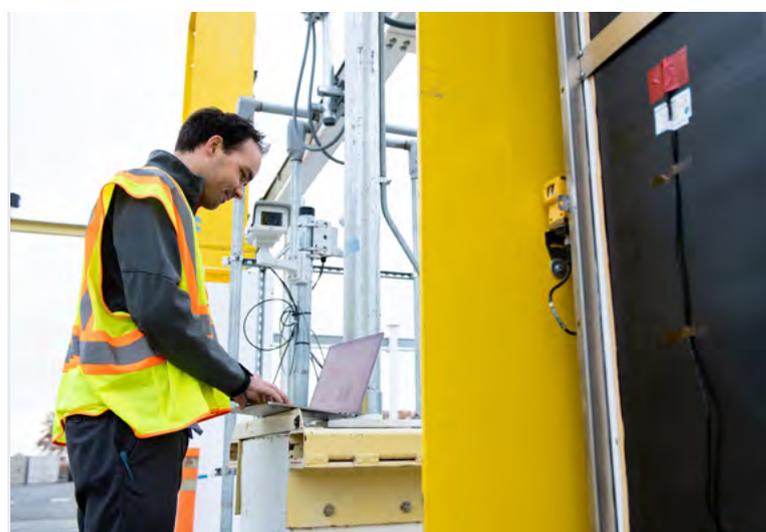
Sandia researchers have collected a first-of-its-kind seismic data set under the Arctic Ocean at Oliktok Point, Alaska, to record signals from sea ice formation and breakup, ocean wave height, sea ice thickness, whale vocalizations and seismic activity. The team partnered with telecom company Quintillion to attach a sensor system to a 38-kilometer-long "dark" optical fiber off the Beaufort Sea coast. This data set will allow researchers to better understand variations in the sensitive Arctic climate due to man-made and natural causes. (8000, LDRD)

### Cybersecurity capabilities transitioned to CISA

Sandia transitioned Deception Orchestration Leveraging Open Source Intel capabilities to the Department of Homeland Security's Cybersecurity and Infrastructure Security Agency's Threat Hunting Emulation effort for use in their exercises. In addition, the tool's automated dynamic-user-behavior-generation component will help analysts understand how to hunt and identify threats within realistic host logs derived from user interactions and resulting network traffic. The transition to a DHS agency illustrates the successful transfer of research and development work for the real world. (8000, 9000)

### Power electronics for electric drivetrains

Sandia has developed a process for fabricating vertical gallium nitride-based trench metal-oxide-semiconductor field-effect transistors for use in electric drivetrains. Their vertical topology promotes more efficient scaling toward high-power applications, where both high voltage and high current are necessary. Vertical gallium nitride devices are gaining traction for high power applications as they promise increased performance and power density compared to conventional silicon or even silicon carbide-based systems. For electric vehicle drivetrains, the advantages of vertical gallium nitride devices translate to more miles driven per charge and more compact charging solutions. (8000)

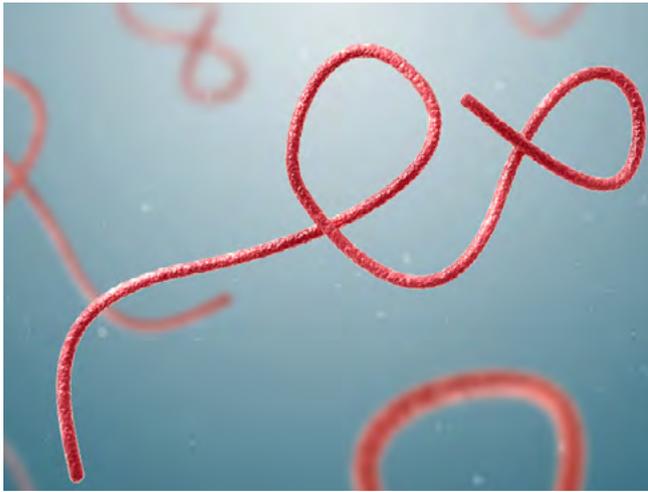


### Redesigning ports-of-entry radiation monitors

Sandia has designed an interface specification for modular radiation portal monitors for ports of entry into the U.S. and supported the Department of Homeland Security in an Industry Day event and request for information to industry. The modular design is expected to allow improved detection sensitivities and reduce false-positive alarms while providing flexibility for operations and easier upgrades. Sandia has also developed a best-in-class alarm algorithm for portal monitors and is actively developing further machine learning capabilities to support the mission. (6000, 8000)

*Physicist Will Johnson demonstrates the proof-of-concept modular portal that was installed and tested at the Pacific Northwest National Laboratory radiation portal monitor test track.*

## ENERGY & HOMELAND SECURITY



### Combating Ebola using CRISPR technology

To rapidly develop antiviral therapeutics, Sandia used CRISPR gene-editing technology throughout the Ebola countermeasure development pipeline, from target discovery and validation to using the CRISPR tools as next-generation therapeutics. Recently, the team reported 100% survival against Ebola infection in mice when pretreated with lipid nanoparticles containing CRISPR reagents targeting a critical host factor gene. This method severely hindered the virus's ability to replicate. Ebola studies were performed in collaboration with the University of Texas Medical Branch in biosafety level-four containment. (8000)

*3D illustration of the Ebola virus.*

### Successful counter-unmanned aerial systems tests

A Sandia team conducted about 40 tests against unmanned aerial systems during a three-day test event in Washington, D.C., in support of the Department of Homeland Security Science and Technology Directorate, Federal Protective Service and U.S. Coast Guard. The team verified key operational aspects against DHS requirements despite facing significant weather, airspace and equipment challenges. This effort, and future testing, enables DHS to assess how well candidate technologies can sense, track, identify, and mitigate unmanned aircraft system threats at key facilities, and advise DHS on the realities of performance. (6000)

### Hydrogen breakthrough through machine learning

A team of materials and computer scientists used machine learning to identify new alloys with the potential to release hydrogen at much lower temperatures compared to existing technology. They then created a dozen new alloys from a set of 600, earning the cover of the Chemistry of Materials for a paper detailing their methods. Additionally, these high-entropy alloy hydrides could enable a natural cascade compression of hydrogen as it moves through the different materials, potentially revolutionizing domestic hydrogen infrastructure. (8000)



*Solar panels at a wastewater treatment facility in Vieques, Puerto Rico, enhance energy resilience by providing enough power to run the facility, enabling this critical service to continue even if grid power is unavailable.*

### Puerto Rico energy resilience

Following Hurricane Maria in Puerto Rico, Sandia provided tools to ensure that billions of dollars of recovery funds were spent to enable energy resilience and provide critical services to the country. Sandia partnered with two Puerto Rican universities, where professors and students further developed and implemented Sandia tools to address local issues and maximize local impact. Communities were directly engaged, such as through the recent microgrid design workshops Sandia led in Culebra and Vieques, where community leaders were active participants. (8000)

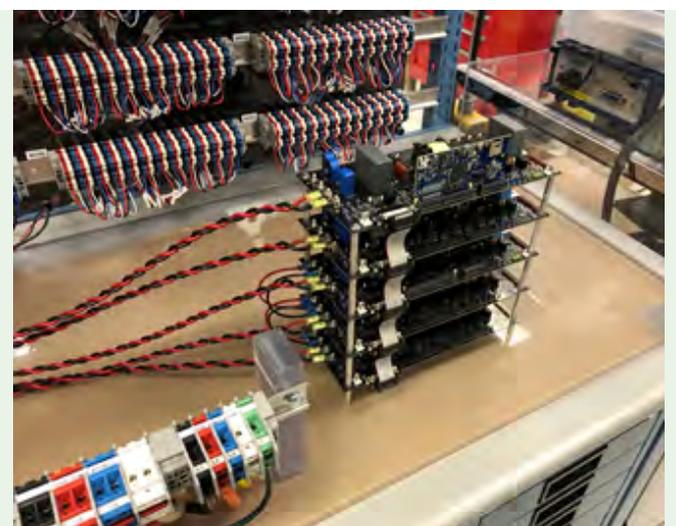
### Gen3 particle pilot plant

Sandia developed and advanced the use of particles as a heat-transfer media to achieve temperatures higher than 700 degrees Celsius and receiver designs of greater than 80% efficiency. Further investigations confirmed the safety of the receiver by measuring low-particle emissions and the promise of advanced particle conveyance systems and thermal storage design for particles. As a result, Sandia was awarded a \$25-million project to construct and test the first 1 megawatt of thermal heat, particle-based concentrating solar power tower with a 5-MW receiver, and 6 MW per hour of thermal storage. These enhancements reduce the risk of technology failure and lower the cost for commercial system use. (8000)

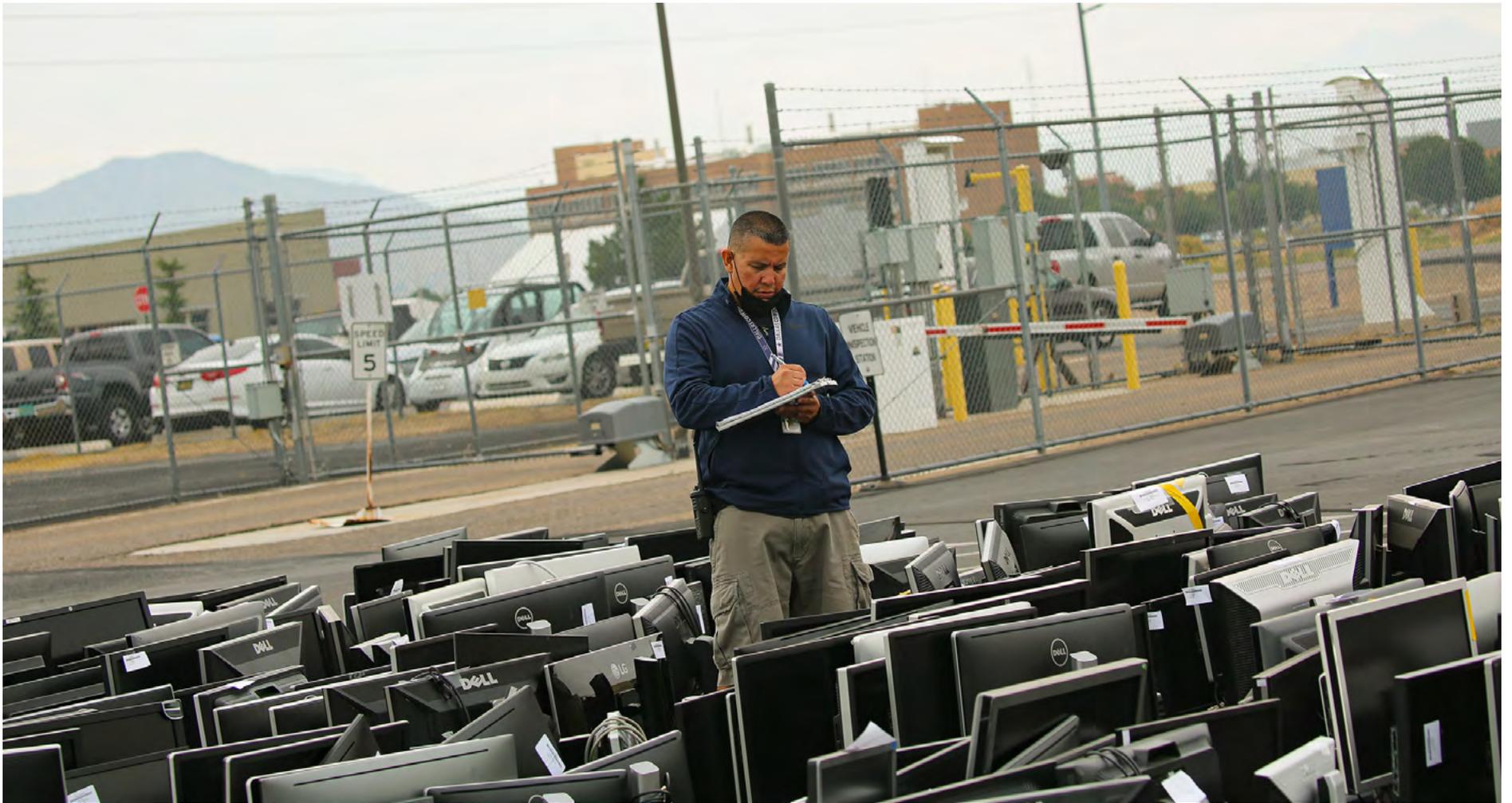
### Scalable power conversion for energy storage

The multiconverter system developed in the Advanced Power Electronic Conversion Systems lab provides the power conversion and control functions necessary to integrate multiple energy storage systems into a single grid asset. The purpose of this multiconverter is to validate new circuit topologies and control methods that improve the performance, reliability and survivability of utility-scale storage installations. The system demonstrates the lab's end-to-end design, implementation and integration capabilities, which provide a streamlined pathway for the development and maturation of innovative power conversion solutions. (8000)

*A five-converter stack connected to the Advanced Power Electronic Conversion Systems lab's energy storage emulation testbed.*



## MISSION SERVICES



## K-12 computer donation program

*Reapplication team member Anthony Gonzales tracks inventory during the K-12 computer donation program event.*

Representatives from 17 New Mexico schools visited Sandia to pick up used desktop computers, laptops, tablets, keyboards and other equipment as part of Sandia Reapplication's K-12 Computer Donation Program. More than 1,700 items were donated to schools and nonprofits, bringing the total number of computers donated since 2012 to 10,377, valued at more than \$24 million. (10000)

### Sandia leads financial improvements for DOE

Sandia's Chief Financial Officer organization led the enterprise by using a site-specific financial risk register as a pilot for the DOE-required internal controls testing. In addition, the CFO organization participated in the DOE Payment Integrity Improvement Initiative Working Group by developing key templates, which DOE adopted for enterprisewide use. The CFO organization also created DOE procedures to identify and correct uncollectible receivables and developed a single General Terms and Conditions Invoicing Milestone Implementation Plan for NNSA's management and budget office. (10000)

### Innovative management of nontrackable property

Information Technology and Property Management developed an innovative and elegant solution to manage nontrackable property. The new Administratively Controlled Property application is designed to manage nontrackable property, such as monitors, scanners, printers, lab equipment and furniture, ensuring all government property used by telecommuters and virtual workers is effectively and efficiently managed. The Property Management team has demonstrated the tool with property management organizations across the enterprise, paving the way for all other contractors. (10000)

### Largest subcontract in Sandia history awarded to small business

Sandia awarded its largest subcontract to date — potentially up to \$700 million over a possible seven years — for information technology services to local small business Encantado Technical Solutions LLC. The transition to the new service provider was completed with the release of 27 task orders for a value of \$72.5 million, which contributed more than 4% to NTESS small-business goals. (10000)

### International Organization for Standardization 9001 recertification

Sandia successfully completed the external International Organization for Standardization 9001 recertification audit at the New Mexico and California sites. The audit ensures that Sandia uses quality processes and procedures. Auditors identified 14 noteworthy practices. (10000)

## MISSION SERVICES

### Project-management maturation

Sandia committed to long-term project management by creating a Project Management Center with associated systems, processes and tools. Strides in project management were achieved through the organizational redesign effort across centers that aligned project-management capabilities and competencies under the Project and Product Management Center and business-management capabilities and competencies under Integrated Business Management. Both centers continue to strengthen their identities and add value by refining services, enhancing training and ensuring career development paths for staff. (10000)

### Financial and procurement spend

Sandia closed the fiscal year with total operating costs of \$3.8 billion, which is \$157 million more than the previous fiscal year. Total operating funding amounted to \$4.24 billion, an increase of \$442 million over fiscal 2020. Sandia spent a total of \$1.65 billion, \$169 million more than in fiscal 2020, an 11% increase. (10000)

### Sandia develops supply chain part-risk assessments

Integrated Supply Chain Management collaborated with Nuclear Deterrence and the Kansas City National Security Campus to develop risk assessments for commercial electronics parts. These assessments combine product-risk information, such as obsolescence and availability, with manufacturer business-risk data to create a comprehensive picture of supply chain risk. Nuclear Deterrence will use these assessments much earlier in the product realization life cycle, informing design decisions and reducing risk for their programs. (10000)

### Successful completion of strategic objective for service delivery

The Labs Strategic Objective 4.4 team successfully completed development of an Integrated Service Delivery model and executed targeted pilots. The model started in Division 8000 as an effort to formalize cross-functional teaming and integrating activities on behalf of line organizations. The Labs strategic objective in FY21 aimed to test wider adoption of the model. Seven pilots were conducted in divisions 1000, 2000, 5000, 6000 and 10000 with feedback indicating that efforts should continue in fiscal 2022 to further deploy the model. (8000, 10000)

### Strategic cost savings result from subcontracting solutions

Sandia's contribution to DOE's strategic cost savings goal — measuring an organization's use of strategic subcontracting solutions — was \$117.6 million, representing about 9.1% of Sandia's total spending (the highest percentage in the enterprise), and accounted for 36.5% of the enterprise's total strategic cost savings. This helped NNSA exceed its goal. (10000)

### Successful virtual financial wellness month

Sandia conducted its most successful financial wellness month with 29 virtual events, an increase of 61% over last year; 4,872 attendees, an increase of 29%; and 94% positive feedback. Financial wellness month in July is an annual program aimed at helping members of the workforce assess their financial health. (3000, 10000)

### Maturity of core labs assurance system elements

Sandia enhanced the way it manages issues and enterprise-level risks to ensure that corrective actions are monitored and risks are appropriately mitigated. Both risk- and issues-management processes, and corresponding Sage tool modules, were recently updated based on customer feedback. Sandia implemented the BlueDragon Hyper-Integrated Causal Analysis methodology to conduct effective causal analyses. To date, 83% of Sandia's current causal analysts have been trained and are successfully using it for significant and systemic issues. Sandia also engaged in several collaborative enterprise projects to share assurance-related best practices. (10000)

### Contractor purchasing system approved

Sandia successfully demonstrated an efficient and effective purchasing system compliant with government policy, and the Sandia Field Office awarded a three-year purchasing system approval with a consent threshold of \$20 million on April 27, 2021. The contractor purchasing system gives Sandia authority to make purchases on behalf of the DOE. Awarding a three-year approval demonstrates DOE and the field office's confidence that Sandia's supply chain process is sound. (10000)



## Small-business engagement and development

For the fifth consecutive year, Sandia exceeded the small-business contracting goal of 58% and goals in all five socioeconomic subcategory. Through the Mentor-Protégé Program, established in fiscal year 2020 to pair qualified small businesses with Sandia experts to help them be more competitive for federal and industry opportunities, Sandia conducted 15 workshops, 26 one-on-one mentoring sessions, three presentations and three meetings led by 63 mentors from across the Labs to support protégé development. (10000)

*Small-business program manager Paul Sedillo presented to small-business representatives and owners during a forum at the University of New Mexico Lobo Rainforest.*

## INFRASTRUCTURE OPERATIONS



## Facilities Service Contracts delivers big

*From left to right, Chris Knight, Ray Chavez and Ryan Gomez from the Service Contracts team.*

Facilities Service Contracts team executed more than \$10 million in Facilities support tasks through nearly 3,700 work orders. The team accomplished the work with zero reportable safety incidents. In addition, the team successfully partnered with Procurement to negotiate more than \$23 million in new contracts for landscaping, paving maintenance, roofing maintenance, security escort services, pest control, and heating, ventilation and air conditioning. The contracts were awarded to a mix of small and large business. (4000, 10000)

### California data-center modernization

With the successful completion of the California data center, a multidisciplinary team began work on operationalizing the facility. Experts from Information Technology, Facilities, Safeguards and Security, Logistics, ES&H, Procurement and other programs came together to execute the move. During a complex migration with limited downtime, more than 1,000 servers were moved into the building and hundreds of miles of cable were run to support connectivity needs. (8000)



*Modernized California data center.*



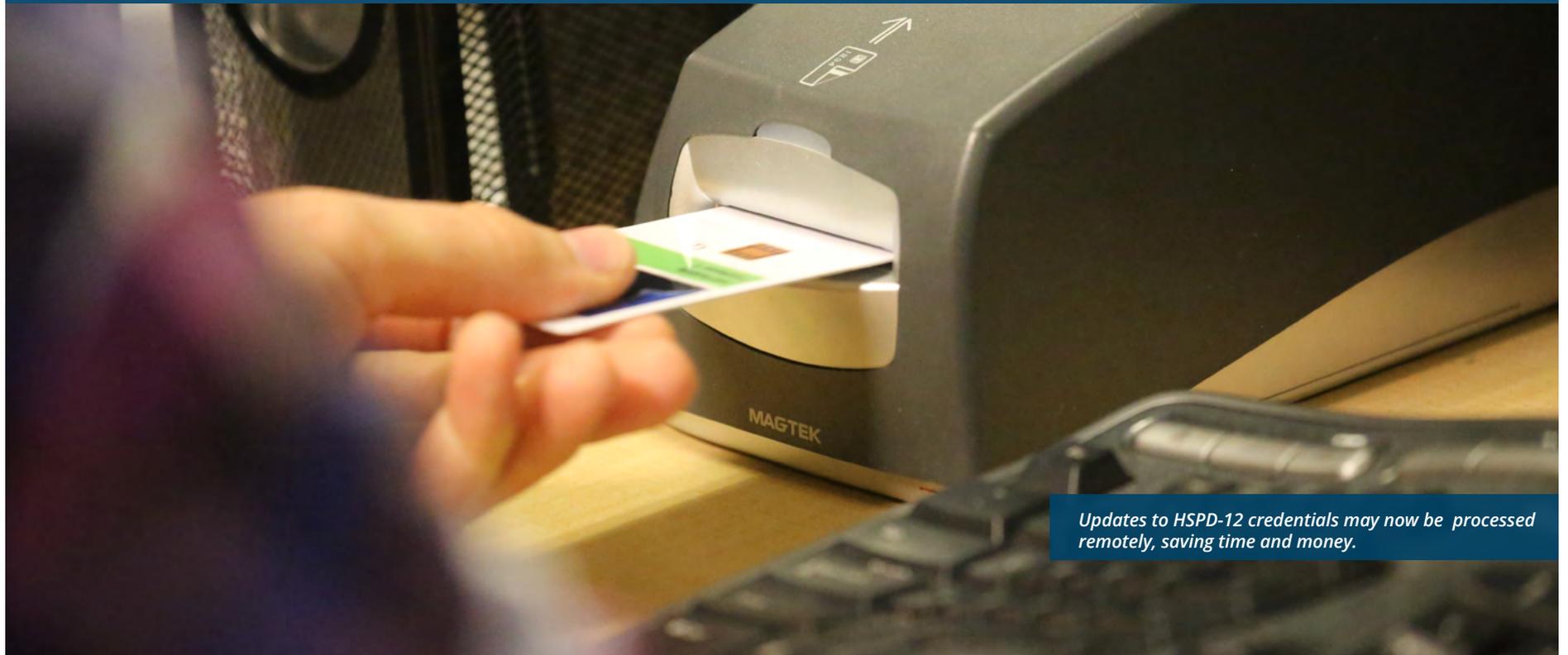
### Protecting threatened species at California site

With reduced staff on-site due to COVID-19, the California site reported an increase in wildlife sightings. In April 2021, a Swainson's hawk was discovered nesting near an active construction project. Due to the state-threatened species status of the hawk, precautions had to be developed to ensure the work did not negatively affect the hawk during nesting season. Working with the Sandia Field Office, Facilities, ES&H and wildlife biologists, steps were taken to protect the Swainson's hawk while construction activities continued. Monitoring of the hawk nest ended in July 2021 when the chick left the nest. Local birdwatching groups indicated it was the first Swainson's hawk nest recorded in Alameda County. (8000)

*A Swainson's hawk keeps an eye on everyone below from the top of a tree on the Livermore campus. (Photo courtesy of Condor Country Consulting)*

## ■ INFRASTRUCTURE OPERATIONS

### Personnel Security develops remote HSPD-12 certificate update



*Updates to HSPD-12 credentials may now be processed remotely, saving time and money.*

Sandia's Personnel Security team collaborated with Information Technology partners to develop a new capability to update the required certificates on HSPD-12 credentials remotely, eliminating the need for individuals to travel to a badge office or credentialing center. The innovation has already saved Sandia more than \$1 million while helping to maintain active virtual and physical access for clearance holders through scheduled updates. This new capability has been shared with other sites as a potential enterprisewide solution. (4000, 9000)

#### Improvements to the fire-protection program

The Building and Fire Safety department partnered with Radiation and Electrical Science, Facilities, ES&H and Nuclear Facilities and Applied Technologies to implement more rigor and formality in fire protection processes, including the fire protection impairment process and procedure, and inspection, testing and maintenance systems. Other key results included improved communications and documented expectations for all fire-protection programs. (600, 1000, 4000)

#### Sandia Infrastructure Investment Planning process

Sandia developed and implemented an integrated facilities and infrastructure investment process that reduced the number of internal calls and databases, matched investments to funding streams and ultimately established Labs-level investment priorities. This process aligned facilities and infrastructure needs to Future Years Nuclear Security Program planning, feeding external funding activities and internal indirect sizing efforts. The process was a recipient of Sandia's fiscal year 2021 Continuous Improvement Award and a fiscal 2021 Employee Recognition Award. NNSA Safety, Infrastructure and Operations also recognizes the process as a best practice across the complex. (4000)

#### New and improved building-contact signage

To better support and communicate with the workforce, signage was installed at the main entrances of more than 250 buildings with photos and contact information for building managers. The facilities organizations established a process to easily update and maintain the signage over time. This effort received Labswide recognition from Sandia's #LightenTheLoad initiative. (4000)

#### Sandia transitions to a hybrid work model

The pandemic and the Labs' space shortage provided an opportunity to transition to a hybrid work model. A cross-organizational team with members from all divisions in New Mexico and California has worked diligently to cement hybrid work as a permanent fixture. The transition to the new model required aligning individuals and work, policy revisions, ergonomics, safety, security and information technology enhancements. A project subteam completed the setup of more than 300 touchdown spaces in multiple locations across the New Mexico and California sites. (All Divisions)

#### Classification office enhances tools on the Sandia Classified Network

Multiple initiatives resulted in more agile and secure experiences for all users on the Sandia Classified Network. Jupiter Lite, a classified supplement to the flagship Jupiter application, improves efficiencies with real-time search capabilities to find a derivative classifier and immediately access relevant classification guides and awareness training — such as new specific subject matter briefings — without having to refer back to the Sandia Restricted Network. These enhanced resources improve Sandia's ability to identify and secure potentially classified information. (4000, 9000)

## HR, COMMUNICATIONS &amp; HEALTH SERVICES



## Sandia's flagship publication goes all digital

*The latest edition of Sandia Lab News is published online biweekly. Issues from the past 25 years are available online.*

After a 72-year run as a print publication, Sandia Lab News retired its paper format in December 2020 and became a completely digital publication, offering a cost savings to the Labs of more than \$75,000 annually. Since the end of the print format, the Lab News external email subscription list has grown to more than 5,600, exceeding the number of external recipients of the print edition at final production. Online, Lab News has had more than 500,000 average monthly views in 2021. (3000)

### New Manager Bootcamp program

Sandia designed and implemented its New Manager Bootcamp program based on the results of a needs assessment conducted with more than 100 new managers, senior managers and human resources business partners. The program focuses on developing critical skills that correspond to Sandia's new leadership competencies to enable a successful transition into leadership positions and uses the Harvard ManageMentor library of resources. The program is in high demand and received positive feedback from new managers. (3000)

### New medical plan and HSA choice for employees

In response to last year's Labswide employee benefits preference survey results, a team designed, implemented and communicated a new medical plan option that enables employees to save for future medical costs in a health savings account, including retiree medical expenses. About 34% of employees selected the new plan option during 2022 Open Enrollment. (3000)

### Sandia claimed top public relations award

The New Mexico Chapter of the Public Relations Society of America recognized the Sandia Labs' 70th Anniversary Campaign with top honors as Best of Show at the virtual Cumbre Awards on Nov. 19, 2020. The annual NMPSA Cumbre Awards celebrate New Mexico's communications professionals and their outstanding public relations campaigns and tactics. The anniversary campaign was recognized nationally with top honors from the Association of Marketing and Communication Professionals, PR Daily, Communications Concepts Inc. and the Academy of Interactive & Visual Arts. (3000)

## EXECUTIVE SUPPORT GROUP



### Strategic plan looks 10 years ahead

Sandia leadership unveiled a new strategic plan designed to strengthen the Labs' mission, operations and culture. The plan is anchored by a 10-year target objective to "unleash innovation and high-velocity engineering to counter global threats" and supported by five-year goals and 2022 milestones. Labs Director James Peery spearheaded development of the target objective, and Strategy and Executive Operations teams drove the complex process. The plan will help Sandia steward its work into the future with a thoughtful and effective strategy focused on breakthrough ideas. (ESG)

*Labs Director James Peery led the effort to develop Sandia's 10-year target objective.*

### Improvements made to safety training

The ESH200 New Leader Training program advanced with input from performance data, benchmark activities and several pilots, providing a course more based on experience. The online part of the program features video messages from executive leaders on the importance of being an ES&H role model. The interactive course was recognized for "Innovation in Safety Training" by the EHS Daily Advisor, a professional group that features best practices from the environmental, health and safety profession. Last year, 228 new managers completed the course. (ESG)

### ES&H Governance Board matures

Established in June 2020, the ES&H Governance Board, led by then-Deputy Labs Director and Chief Operating Officer Dori Ellis, increased its focus on eight committees. Its cross-functional representatives approved an updated planning and control manual, which includes a new template for multiorganizational work agreements and training requirements for all managers who oversee activity-level work. The board also facilitates flow down of high-value learning events from across the DOE enterprise, an indicator of a strong safety culture. (ESG)

### Efforts improve ethics environment

Ethics/EEO Advisory and Investigations enhanced Sandia's ethical environment by leading a cross-organizational Investigative Working Group, promoting information-sharing and issues resolution, improving its collection and reporting of metrics, and updating the Code of Ethics and Standards of Conduct included in the Annual Ethics Awareness Training. (ESG)

### Emergency Management strategy implemented

Emergency Management was reorganized, based on a new five-year strategic plan that incorporates programmatic improvements and best practices. The group developed and implemented comprehensive drill and exercise plans to improve performance and standardization and conducted two annual exercises with internal and external stakeholders. Leadership broke ground on the new Emergency Operations Center. Emergency Management improved federal and Labs leadership confidence ratings on performance and program health in the DOE/NNSA Emergency Management Readiness Assurance Program Tool. (ESG)

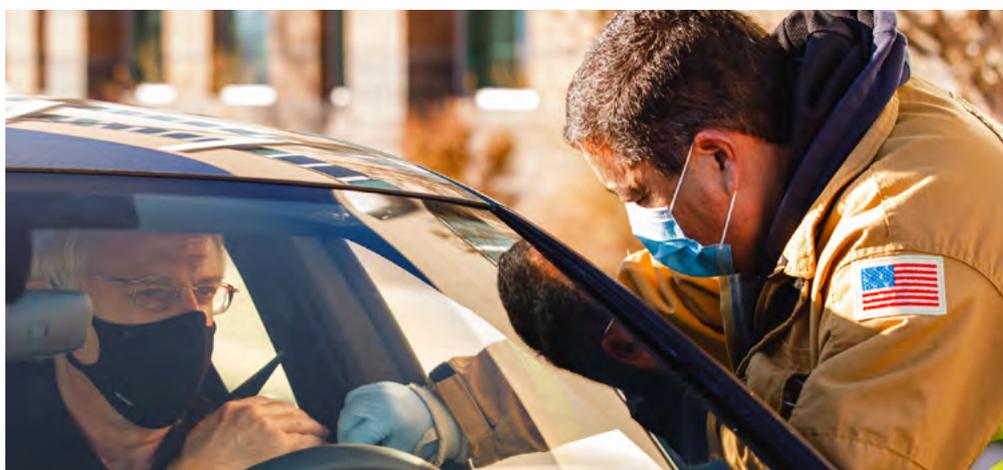
### Executive Protocol managed high-level visits

The Executive Protocol team, Sandia's experts on diplomatic and business etiquette, hosted 88 events, including assistant secretaries, the U.S. Air Force chief of staff and director of hypersonics, Kansas City Nuclear Security Campus president and several congressional visits. The team successfully organized and managed visits during the COVID-19 pandemic while following health and safety procedures. (ESG)

### Key audits completed

Audit Advisory Services completed 26 internal audits and audits on 120 contracts worth \$240 million. Internal audits informed improvements in several areas including the procurement card program. All subcontracts awarded under the Lockheed Martin Management and Operating Contract have been audited, meeting a commitment to the Sandia Field Office. (ESG)

## MISSION ASSURANCE



### COVID-19 testing, contact tracing and vaccination distribution

Employee Health Services leads the Labs' efforts to continue providing rapid on-site COVID-19 testing, support contact tracing, minimize employee exposure risks, and distribute vaccinations to the workforce. The DOE recognized the testing team's efforts with the Secretary of Energy Honor Award. (3000)

*Then Associate Labs Director Mike Burns received his COVID-19 shot after Sandia moved its vaccination clinic outdoors.*

### HPC visualization and analysis enhanced

A 24-member team from Sandia and Los Alamos National Laboratory completed the Integrated System and Application Continuous Performance Monitoring and Analysis Capability milestone by analyzing and visualizing high-performance computing application and system data. Because of their work, code teams and system administrators will better understand conditions and issues before, during and after high-performance computing runs. (1000, 9000)

### Collaboration improves product realization

The Product Realization Information Management and Exchange, Product Data Management Link and Electronic Data Management teams collaborated to streamline the engineering authorization process by adding new drawing and approval workflow integrations. Nearly three years of collaborative effort between the B61-12, W80-4, Product Realization Information Management and Exchange, Product Data Management Link and Electronic Data Management programs decreased turnaround time for some types of engineering authorizations from six days to about three days. (9000)

### Information Technology innovates high-performance computing

Sandia's newest high-performance computing cluster, Manzano, was ranked number 69 on the November 2020 [Top500](#) supercomputers list, a global ranking of the world's most powerful computers. The cumulation of five months of work by various Sandia Information Technology groups and Procurement, Manzano is achieving processing speeds up to 4.25 petaflops. Manzano establishes Sandia as a visionary of high-performance computing in the [NNSA enterprise](#), and creates the groundwork for perpetuating scientific and engineering advancements. Manzano is available for Labwide needs. (9000, 10000)

## Microsensors to detect SARS-CoV-2 virus

A joint development effort between Honeywell International Inc. and Sandia has produced a microsensor capable of detecting tiny amounts of airborne SARS-CoV-2, the virus that causes COVID-19, under realistic testing conditions. The microsensor combines Honeywell's optical detection technology with Sandia's expertise in biological sensing and microfluidics. Future deployments of this technology could detect the virus in hospital wards, building air-handling systems or airplanes to alert of a COVID-19 infection, which would allow proactive measures to limit virus transmission. (8000)

### New process cuts hazardous waste

Sandia made a positive environmental impact and saved money with a new process for addressing damaged mobile devices and batteries that treats only the batteries as hazardous waste. The devices powered by the batteries are either repaired and returned to the customer or sent to Sandia Reapplication. In addition to reducing Sandia's hazardous waste, the improved process retains accountability for each battery and reduces the time that Information Technology staff previously spent completing forms. The annual hazardous waste reduction is about 768 pounds with annual projected cost savings of about \$300,000. (600, 4000, 9000, 10000)

### Cyber community and educational outreach

Sandia cybersecurity teams presented programs on multiple topics to the New Mexico community, including cyber-risks, digital forensics and incident response. Presentations included an eight-day workshop at Central New Mexico Community College, whose primary focus was to involve local students in cybersecurity and other STEM fields. The program is part of a broader STEM-related curriculum supported by STEMCore, which prepares underrepresented and underprepared students to achieve foundational skills required for associate and bachelor's degrees and employment in STEM fields. (3000, 5000, 6000, 9000)

### Sandia enhances video conferencing capabilities

To enable Sandia's vision of hybrid work, Information Technology teams upgraded 261 Skype meeting rooms, in addition to Microsoft Teams meeting capabilities, and installed 30 new Skype- and Teams-enabled meeting rooms across five locations. They also integrated virtual teleconferencing and Skype infrastructure, allowing users to host and attend meetings from their desktops, thereby increasing the maximum capacity to 250 users and relieving the need to manually record attendees. (8000, 9000)

### Protecting Sandia against counterfeit items

Counterfeit items pose risk to worker safety and national security. To protect against these risks, Sandia personnel must inspect procured items for nonconformity. Developed by Supply Chain Systems, Supply Chain Risk Management and Supplier Diversity, and User Experience Solutions, the new Labwide solution reduces the time spent recording and reporting inspection results by an estimated 3,000 hours annually. It also demonstrates Sandia's compliance with federal regulations for reporting nonconforming items. (9000, 10000)



### Information Technology supports on-site COVID vaccinations

Responding to fast-developing requirements, Enterprise Information Systems collaborated with Employee Health Services to implement Sandia's COVID-19 vaccine clinics at the New Mexico campus. This effort included introduction of the COVID-19 Vaccination Scheduling eForm, which enabled employees to provide personal information and schedule two vaccination appointments, offering more convenient and efficient access to vaccinations for employees. The process included checking in with a badge and equipment logistics, such as vaccine storage temperature loggers, for reporting to New Mexico Department of Health. (3000, 9000)

*Employee Health Services and Enterprise Information Systems partnered to offer COVID-19 vaccines, free of charge, to employees.*

