TECHNOLOGY Partnerships

ANNUAL REPORT FY24

Sandia National Laboratories

At OTC, we are committed to transforming cutting-edge research into real-world impact. Our collaboration with Sandia exemplifies this mission. Whether through the Technology Commercialization Fund, Energy I-Corps, or direct engagement with industry, we are helping to accelerate American innovation, strengthen America's manufacturing and industrial base, and expand economic opportunities for businesses and communities across the nation.

– ANTHONY PUGLIESE

Chief Commercialization Officer & Director
Office of Technology Commercialization
U.S. Department of Energy

Sandia's technology commercialization programs and partnerships with the state of New Mexico move research discoveries into practical applications that create economic development. Technology transfer attracts companies to the state; including those that become suppliers for Sandia's nuclear weapons stockpile stewardship and other national security programs.

– DAN SANCHEZ

Assistant Manager for Programs
National Nuclear Security Administration
Sandia Field Office

Technology transfer is central to Sandia's mission. When our innovations move from the Laboratories into the hands of industry, they strengthen national security, advance critical capabilities, and deliver public value. We are proud to partner with companies, universities, and government agencies to turn ideas into real-world impact. These collaborations ensure the nation benefits fully from the science and engineering we develop in service to its security.

– LAURA McGILL

Laboratories Director
Sandia National Laboratories

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With the pace of technology development accelerating in areas including AI, quantum computing, and fusion energy, Sandia is committed to remaining deeply engaged with U.S. industry to meet our national security mission needs on an accelerated time scale. Public-private partnerships are an essential vehicle for delivering on Sandia's mission on behalf of DOE as well as commercializing technology via mutually beneficial industry collaborations.

– DOUG KOTHE

Associate Laboratories Director
& Chief Research Officer
Advanced Science and Technology
Sandia National Laboratories

Having a wide variety of technology transfer tools available lets us expand the opportunities for partnerships with businesses large and small. We can develop collaborative relationships tailored for each partner, designed to advance Sandia's technology transfer mission, grow companies, and expand the regional and national economies.

– MARY MONSON

Senior Manager
Technology Partnerships
& Business Development
Sandia National Laboratories

LDRD PROGRAM ESSENTIAL TO MISSION CAPABILITIES

Research conducted within the Laboratory Directed Research and Development program is essential to maintaining the vitality of Sandia's mission-critical science, technology, and engineering capabilities. The LDRD program has benefited Sandia's work in all of its national security mission areas, including nuclear security, homeland security, energy security, and global security.

The Labs and its strategic partners gain from collaborative research results. Many technological breakthroughs originating from or improved through the LDRD program are later transferred to industry, commercialized under licensing agreements, and brought to market for the U.S. public good.

Look for the LDRD logo in this report to discover which technologies grew out of the LDRD program.

To learn more about LDRD, visit www.sandia.gov/research/ldrd

Partnership Programs Foster Small Businesses for U.S. Economic Growth

Patent licensing and Cooperative Research and Development Agreements are two tools Sandia National Laboratories uses to move its technologies to the marketplace so they can benefit the U.S. economy. It's not only large corporations that benefit from these mechanisms—many smaller companies also take part. Sandia has streamlined processes, lowering the barriers to enter into an agreement with the Labs.

In addition to license agreements and CRADAs, small businesses and startups can also take part in multiple technology transfer programs, including those sponsored by the Department of Energy, National Nuclear Security Administration, state of New Mexico, and Sandia. You'll read about some of these programs in this report.

The report's partnership stories demonstrate the success of technology transfer tools. They show how even small businesses can have a big impact on national security, energy security, and economic security.

The following are a few examples where partnerships with Sandia are helping small businesses to:

- Develop microneedle technology and study interstitial fluid to support future wearable health monitoring solutions for military and public use
- Enhance waste heat recovery from industrial processes for electric energy production
- Advance algae-based water treatment technology for use in municipal water treatment and industry applications
- Create software to simulate and optimize complex engineering designs and component geometries for government and industry
- Commercialize and improve a Sandia-developed security system to be used at all NNSA locations that require Protection Level 1 security

Learn more about the power of partnerships between Sandia, businesses large and small, other government agencies, laboratories, and universities by reading the Sandia Partnerships Annual Report. We hope you find it enlightening.

Above: Sandia Researcher Brittany Humphrey prepares microneedles in a fume hood.

Right: Sandia researchers have found a way to increase the amount of interstitial fluid extracted with microneedles while saving time.

Microneedles Advance toward Wearable Health Monitoring Solutions

For years, researchers have been trying to develop a wearable diagnostic device that can measure biomarkers indicative of a person's health status in real time. Microneedles that sample interstitial fluid from just under the skin are a minimally invasive way to accomplish that goal. Unlike larger needles used to draw blood samples, microneedles are only two to three times the diameter of a hair and about a millimeter long. This makes the sampling much more comfortable.

Interstitial fluid shares many similarities with blood so can be used to monitor health, but it hasn't been studied as much. Sandia National Laboratories is at the forefront of microneedle research and technology, with research begun in 2011 by Ronen Polsky and his team leading to a patent in 2023. This interdisciplinary research, which has combined chemistry, engineering, and biology, is tied to Sandia's national security mission and has the potential to be used to monitor military service members' health. Companies are also working to develop health monitoring products for the general public that use microneedles and interstitial fluid.

Studying interstitial fluid has been very challenging because extracting samples in the quantities needed to run analytical assays was time consuming and difficult. But then a new method was developed through a Sandia partnership with SRI, an independent nonprofit research institute. This reduced the one- to two-hour collection process down to about 10 minutes. The new technique allowed Sandia to provide industry partner Adaptyx Biosciences with interstitial fluid samples quickly collected from volunteers.

Adaptyx Biosciences has expertise in developing advanced wearable biosensing technology and collaborated with Sandia to accelerate early-stage studies by accessing interstitial fluid samples through Sandia's microneedle-based collection methods. The collaboration enabled Adaptyx to work with leading scientists in the ISF field while supporting Sandia's broader translational goals.

By teaming with Sandia, Adaptyx Biosciences obtained samples of interstitial fluid for foundational physiological studies that are helping the company's scientists better understand the fluid's components and inform the development of a real-time, multi-analyte biosensor platform.

Sandia continues to collaborate with industry and university partners to further this research. This moves the work out of the Labs and expands its use to the broader science community with the potential to benefit people worldwide.

Understanding the composition of interstitial fluid is essential for developing next-generation, real-time biosensors. Sandia's microneedle-based sampling technology provided high-quality interstitial fluid samples that accelerated our early-stage research and platform development.

– **ALEX YOSHIKAWA**
Co-founder & CSO
Adaptyx Biosciences Inc.

Partnership Type: Cooperative Research and Development Agreement

Goal: To further develop microneedle technology and the study of interstitial fluid to support future wearable health monitoring solutions

LDRD

Above: Argyle Earth Co-founder and CTO Christopher McMillan taking measurements with an early prototype of Argyle's heat engine system.

Right: A bench prototype of Argyle's Multi-frequency Void Fraction Sensor.

New Process Converts More Industrial Waste Heat to Electricity

Argyle Earth is trying to solve one of the biggest challenges that industry faces—thermal losses.

It is estimated that between 20% and 50% of industry energy input is lost as waste heat. Recovering some of this waste heat can improve energy efficiency and lower the cost of production for companies.

Argyle has patented a new thermodynamic process technology called the McMillan cycle system that is capable of increasing the efficiency of heat to electricity conversion at lower temperatures. The company is collaborating with Sandia National Laboratories to increase the technology readiness level and assess different applications for a system using the thermodynamic process. Argyle chose to collaborate with Sandia due to the Labs' experimental capabilities and its scientists' expertise in thermal dynamics and thermal storage.

Sandia Researchers Kenny Armijo, Javier Martell, and Evan Sproul created a thermodynamic model for Argyle's technology and ran simulations. After completing a techno-economic analysis, which included assessing different use cases, Sandia scientists identified the large food and beverage and paper industries as good initial markets to enter. Both industries use low-temperature heat in their processes and could benefit from Argyle's new system to decrease waste.

The compact Argyle system combines the company's thermodynamic process with thermal energy storage to absorb as much waste heat as possible and produce electricity. This way the recovered energy can be deployed at the factory as needed or sold to a utility company and sent to the grid.

Compared to other technologies which might convert 13% of waste heat to electricity, the Argyle system converts about 35%. This level of efficiency can help more companies take advantage of converting their waste heat to a resource they can use or sell, ultimately lowering costs for consumers. The results of this partnership are linked to Sandia's national energy security and economic security missions.

The next step will be to develop a prototype system to be deployed as a pilot in an industrial setting. The Argyle system can then be scaled to support more companies in the paper and food and beverage sectors, with other industries to follow.

Working with the team at Sandia has been a game changer for Argyle. The team's knowledge is unparalleled and they consistently proved to be capable and dependable partners. We look forward to future collaborations!

– **KRISTINA MCMILLAN**
Co-founder & CEO
Argyle Earth Inc.

Partnership Type: Cooperative Research and Development Agreement

Goal: To create a new packaged system for enhanced waste heat recovery for energy production from low temperature industrial or commercial processes

Above: Sandia Technologist Jenna Schambach and Clean Aqua Solutions Founder David Aponte in front of the Attached Algal Flow-way pilot installation at the City of Santa Fe's Paseo Real Wastewater Treatment Plant.

Right: Installation of the terminal channel on the AAFW, with bracings for the four preceding channels in the background.

Low-Cost Method Scrubs Water to Prevent Algal Blooms and Fish-Kills

Water treatment infrastructure is aging and costs for updating systems are beyond what many small communities can afford. In addition, untreated agricultural and industrial runoff containing excess nutrients such as nitrogen and phosphorus released into natural waterbodies can cause costly, harmful algal blooms and fish-kills. Low-cost wastewater treatment solutions are being explored to help mitigate these problems.

Sandia National Laboratories developed an algae-based water treatment system, the Attached Algae Flow-way, as part of its national security mission. The low-cost aluminum flow-way is designed so that water slowly passes over "good" algae which scrub out pollutants before the water is returned to main water channels. In this method, the algae thrive on the excess nutrients in the wastewater, and the biomass can then be harvested and used for bio-fuel or fertilizer production. With excess nutrients scrubbed out of the water, it can be released into the environment without causing downstream issues.

After moving to New Mexico, Navy Veteran Dave Aponte took part in the first Boost Startup Studio in 2023, a Department of Energy Technology Commercialization Fund program linking entrepreneurs to national laboratory intellectual property. That's how he learned about Sandia's Attached Algae Flow-way treatment technology. He saw its potential for many industries including dairy, agriculture, and oil and gas, and decided to start a company, Clean Aqua Solutions, to further develop and commercialize it.

Now Clean Aqua Solutions is modifying Sandia's design for tertiary treatment of municipal wastewater. As part of the TRGR Technology Readiness Initiative, Aponte is working with Sandia Researcher Ryan Davis and Technologist Jenna Schambach to run a pilot of his company's system at the Paseo Real Wastewater Treatment Plant in Santa Fe.

Clean Aqua Solutions is leveraging a new serpentine AAFW design with five, 1 foot by 100 foot channels, connected by turns and falls to minimize the system footprint. After construction is complete, the channels will be lined with a substrate that promotes attachment and growth of a native consortium of microbes with filamentous algae doing the bulk of the excess nutrient scrubbing. Data collected will provide a proof of concept that the company can share with potential customers, including rural and tribal communities.

Collaborating with Sandia has helped us to increase the technology readiness level of this water treatment system. Our company was founded to overcome customers' water challenges, because as our tagline says: Water is life.

– **DAVE APONTE**
Founder
Clean Aqua Solutions LLC

Partnership Type: License

Goal: To advance algae-based water treatment technology so it can be used for municipal water treatment and to treat water in the agriculture, dairy, and oil and gas industries

Above: Morphorm CEO Miguel Aguilo in front of a screen displaying a structural component design generated by Morphorm's proprietary software. The design illustrates an optimized material layout aimed at enhancing both mechanical and thermal performance.

Right: Close-up view of the von Mises stress field in a generatively designed 3D antenna support bracket.

Software Accelerates the Engineering Process for Complex Designs

Additive, or 3D manufacturing enables the use of advanced geometries and materials, but design technologies have not kept pace. Sandia National Laboratories developed Plato software to accelerate the engineering development process. The software empowers engineers to quickly change component geometry to meet design specifications. It simulates and optimizes multiple engineering facets such as thermal and mechanical before a physical prototype is developed. This reduces development time and cost.

Miguel Aguilo was a Sandia computer scientist who helped develop Plato and worked on mission-related national defense projects using the software. He took part in the Defense Advanced Research Project Agency's Transformative Design, or TRADES, program, which aimed to advance the foundational mathematics and computational tools required to generate and better manage the enormous complexity of design. As he met and worked with partners in the TRADES program, he recognized the significant demand for software like Plato across government and industry.

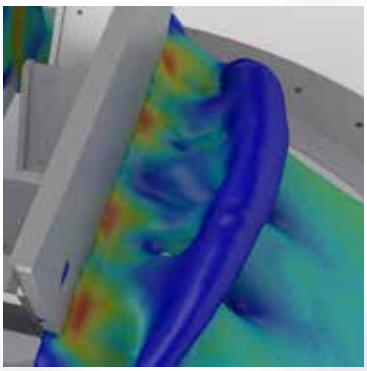
Despite the risks, Aguilo was motivated to start his company, Morphorm, because he was passionate about seeing Plato used to solve problems in industry, whether at a defense contractor or other commercial manufacturer. Although the Sandia-developed Plato software is open source, so freely available, its complexity presents a significant learning curve. Aguilo understood that few companies or agencies had an expert like himself or Plato Co-developer and Sandia Researcher Josh Robbins on staff. He felt he could be the bridge between the Labs and industry for this technology.

Morphorm, an engineering simulation and optimization software company, is currently creating software based on Plato. It is first focusing on semiconductor applications, which include solar panels and computer chips. As the Department of Energy seeks to extend the lifespan of solar panels from 30 to 50 years, engineers must improve degradation rates by optimizing critical design parameters such as cell material, size, and metallization layout. This means solar manufacturers need simulation software that can optimize all these factors, such as what Morphorm is creating. Computer chips, which, like solar cells, use semiconductor materials, have similar design simulation software requirements and are continually being updated with the latest technology.

Aguilo and his company partnered with Sandia and Robbins through the TRGR Technology Readiness Initiative. Morphorm expects to release a trial version of its software by the end of 2026, ahead of its original estimate.

Partnership with Sandia lets us collaborate with world-class experts, accelerating the growth of our company while helping us bring the fruits of the Labs' R&D investment to the commercial world.

– **MIGUEL AGUILO**
Founder & CEO
Morphorm LLC



Partnership Type: Cooperative Research and Development Agreement

Goal: To share the benefits of Sandia's Plato engineering development software with government and industry

Above: Testing personnel located at Eglin Air Force Base Test Area C-3 perform a test maintenance activity on the PIDS equipment using provided documentation.

Right: PIDS equipment stored in the shipping configuration, ready to be deployed when needed.

Portable Intrusion Detection System Protects National Security Assets

A rapidly deployable physical security system was needed to protect critical national security assets that require the highest level of security. The system had to be capable of meeting Protection Level 1 requirements for high-level assets like nuclear weapons. There are other physical protection systems in use that met these requirements, but none are portable, where modular components could be installed, moved, or reconfigured easily.

To meet these requirements, the scientists at the Sandia National Laboratories' Physical Security Center of Excellence developed the Portable Intrusion Detection System. PIDS combines command and control, sensors, and cameras in a unified, mobile platform. After developing a workable system, there was a need to further refine the electronic and computer interface for alarm station operators who monitor the system from a command and control center, as well as finalize the design for manufacturability.

Sandia looked for an industry partner for PIDS to increase its technology readiness level so it could advance to manufacturing. They teamed with Prometheus Security Group Global, a leader in physical security solutions for the federal and critical infrastructure sectors. With a long history in physical protection, the company had the capability to work with Sandia to further develop PIDS so it could become a commercial-off-the-shelf system and get the required certifications from the National Nuclear Security Administration and the U.S. Air Force.

PIDS is planned to be used at all NNSA locations that require Protection Level 1 security. Sandia is collaborating with Prometheus to prove cyber compliance for PIDS in order for NNSA to achieve the required Enterprise Authority to Operate. The USAF is also interested in using PIDS.

PIDS is flexible, and can be scaled to protect any area, large or small. It ships prebuilt and preconfigured, and is more cost-efficient and quicker to deploy than traditional, permanent systems which have to be designed by engineers and constructed at each unique location. When finished, the PIDS can be packed up into its storage configuration, allowing it to be moved to another site if desired.

This partnership, which is tied to Sandia's national security mission, has been very successful. The licensing agreement is an essential component to allow for continued availability of PIDS. Sandia and Prometheus are continuing to work together under a CRADA to continue to improve and add more capabilities to the system which is now available for both government and commercial customers.

We are proud to have partnered with Sandia on the PIDS project—the latest in a long line of critical technical collaboration projects with Sandia's world-class security professionals. Our shared passion for delivering mission- and policy-informed innovation to safeguard the nation makes this a rare and powerful partnership.

– **RICK GROSS**
President & CEO
Prometheus Security Group Global

Partnership Type: License and Cooperative Research and Development Agreement

Goal: To improve and produce the Portable Intrusion Detection System for NNSA, USAF, or commercial customers that have assets that require Protection Level 1 or below

Above: Sandia Researchers Adrian Chavez, Logan Blakely, and Shamina Hossain-McKenzie, and Project Manager Don Maez at the PNM Prosperity Site where the PIDMS field test took place.

Right: Adrian Chavez integrating the PIDMS into the PNM Prosperity Site control cabinet for field testing.

Protecting Interconnected Utility Grids from Cybersecurity Threats

The electric grid is transforming rapidly with the installation of more distributed energy resources. DERs include a variety of technologies including solar systems, wind systems, and battery energy storage. However, an increasing reliance on interconnectivity and communications for grid-edge DER systems broadens security vulnerability. Cybersecurity is a concern because compromises of the electric grid can result in interruption or loss of essential services that can cause significant, detrimental impact to society.

Researchers at Sandia National Laboratories developed the Proactive Intrusion Detection and Mitigation System as part of the Labs' energy security mission. The PIDMS is a bump-in-the-wire technology that captures real-time DER network traffic and performance data to automatically detect and respond to cybersecurity threats. As a cyber-physical system, the PIDMS can monitor operations like power flow and voltage along with communications data to assess system health and detect early indications of a cyberattack.

After its initial development, led by Sandia Researcher Shamina Hossain-McKenzie, the PIDMS technology was patented and won an R&D 100 Award. As part of its continued move toward the marketplace, PIDMS was then selected for a Department of Homeland Security Science and Technology Directorate Commercialization Accelerator Program project where Hossain-McKenzie and team members Adrian Chavez and Logan Blakely worked to advance the technology's maturation.

Longtime Sandia partner, utility company PNM, made its Prosperity Renewable Energy Storage Site available for field testing as part of the DHS CAP project. The Prosperity site was designed to test the initial integration of solar and battery storage, and after opening in 2010, it continues to be used for research projects. PNM, like other utilities, is very concerned about cyber-threats and although the company has robust systems in place to detect them, it knows that with DERs becoming a larger part of the energy mix, the security landscape is ever changing. PNM partners with Sandia to improve its own systems as well as to contribute to updated industry-wide codes and standards.

The successful field test of the CAP project was focused on integrating the PIDMS into a real energy system and testing it against cyberattack scenarios. With that completed, research is continuing with funding from the Department of Energy's Technology Commercialization Fund and a focus on machine learning robustness. There has been industry interest in licensing the technology, and a solar-focused version of PIDMS, called SolarSnitch, has been developed.

We value Sandia's expertise and partnership as we work collectively to safely and securely transform our electric grid and attain New Mexico's sustainable energy goals.

– **PAT VINCENT-COLLAWN**
Executive Chair
PNM

Partnership Type: Cooperative research funded by the Department of Homeland Security's Commercialization Accelerator Program

Goal: Advancing proactive intrusion detection and mitigation system technology toward commercialization so it can protect the utility grid

Above: Sandia Battery Safety Lead Loraine Torres-Castro and Electrochemist Nathan Brenner Johnson in front of the glovebox used for current generation and next generation materials-scale battery safety experimental assembly.

Right: Assembling a battery microcell using a combination of DSC microcells, gas analysis, and materials characterization.

Making New EV Batteries Safe by Design

Although the use of electric vehicles is increasing in the U.S., many consumers still have concerns that keep them from buying one. Will there be enough range? Can they rapidly recharge the batteries? Will a used EV remain reliable? And if they live in an area with cold winters, will an EV work well for them?

The Department of Energy's Advanced Research Projects Agency-Energy Electric Vehicles for American Low-Carbon Living program is working to increase adoption of EVs by enabling safe, inexpensive, long-lasting, fast-charging batteries that have improved performance in freezing temperatures and better overall range retention. The program is also looking at solutions to minimize the use of critical battery materials, supporting U.S. energy independence and tying to Sandia National Laboratories' energy security mission.

Sandia researchers are working on a battery safety project, developing a framework that will enable U.S. battery companies to more rapidly develop new battery systems. They want to ensure that the next generation of batteries will be safe by design. Manufacturers often have to wait until a new battery design is fully developed to know if it is safe, but with this new framework, they can evaluate the safety of materials and combinations of materials far earlier in the development process, saving time and money.

New batteries are being designed that have novel liquid, gas, and solid components and that don't look at all like today's batteries. Sandia is collaborating with six industrial battery manufacturers, Electrochemical Safety Research Institute of ULRI, Purdue University, and the University of Maryland on research on the safety of these new materials. Manufacturers know they can trust the Labs with their proprietary battery chemistries and appreciate access to Sandia's expertise on battery safety. Researchers are using techniques like differential scanning calorimetry to understand the reactions between different proposed battery materials.

At the direction of the program, the National Renewable Energy Laboratory is now collaborating with Sandia, with the two laboratories combining their ideas from separate projects on battery safety to jointly create a manual that battery developers can use at the material-scale stage, the small cell stage, or later stages of the development process for new EV batteries.

This manual, combining knowledge and research from NREL and Sandia, will provide guidance that will help de-risk and accelerate the development of next-generation batteries by U.S. companies.

NREL has collaborated with Sandia to provide a comprehensive description of battery safety for next-generation batteries to facilitate the success of electric vehicles. The partnership has involved fruitful collaborative meetings where diverse ideas and innovative research directions are shared.

– DONAL FINEGAN
Senior Scientist
National Renewable Energy Laboratory

Partnership Type: Cooperative Research funded by the DOE Advanced Research Projects Agency-Energy

Goal: To accelerate the process of developing new types of EV batteries that are safe, affordable, reliable, and efficient

Above: Sandia Physicist Nils Otterstrom works to align an integrated photonics chip at the quantum photonics lab as part of work with ASU.

Right: Instead of using typical large optical tables, Sandia is developing acousto-optic device technologies, such as this eight-inch wafer that can selectively reflect different colors of light.

Scaling up Quantum Computing by Miniaturizing Photonic Systems

Quantum computing is the future. Advancing quantum systems will enhance U.S. leadership in this fast-growing field that seeks to answer the nation's and the world's most serious problems, ensuring economic and national security.

But in order to do useful quantum computations, quantum computers need to be scaled up to sizes far beyond anything that has been demonstrated so far. In principle this can be realized by connecting smaller computers with light, but current tabletop optical systems are bulky and expensive.

Sandia National Laboratories is working with Arizona State University to further quantum technology. ASU leads the nationwide Quantum Collaborative where partners, including national laboratories, are working together to accelerate the quantum field. Professor Joe Lukens is a leading expert on using the frequency of light for quantum computing and networking systems. In this approach, quantum information can be carried by a single photon that occupies two different wavelengths, or colors, simultaneously.

Sandia Physicist Nils Otterstrom, a researcher at Sandia's National Security Photonics Center, specializes in integrated photonics and is at the forefront of miniaturizing large optical systems to chips. He is using Sandia's Microsystems Engineering, Sciences and Applications complex, or MESA, to fabricate small integrated circuits that can process frequency-encoded light, such as splitting a single-color photon into two colors.

Miniaturizing photonic systems is a first step to creating large, useful quantum computers and networks. When operations are done with microsystems, they're easier to control, and the overall system has a smaller footprint, is less expensive, and more stable.

The partnership with Sandia and its MESA facility, where chips can be designed, fabricated, and tested, is making this research possible. University researchers have access to Sandia's specialized expertise and facilities, while Sandia benefits from the new ideas and applications brought by its university partners.

As a result of the original CRADA with the Quantum Collaborative, ASU developed a quantum testbed based around Sandia-built photonic integrated circuits. Sandia then awarded $17 million in Laboratory Directed Research and Development funds to take this work to the next level.

Although Lukens recently moved from ASU to Purdue University, he continues to work closely on these topics with Otterstrom at Sandia. With better photonic circuits and new approaches to processing quantum light, a future of scalable and networked quantum computers could be in reach—solving problems that couldn't be solved otherwise and perhaps even replacing the computers we all use at work and at home.

Sandia is the perfect partner for my research. They have one of the top foundries in the world for photonic integration, which they combine with an unmatched enthusiasm for leading-edge basic research. They aren't afraid to try risky ideas, opening new areas of research for both ASU and Sandia.

– JOSEPH LUKENS

Senior Director of Quantum Networking and Research Professor
Arizona State University

Partnership Type: Collaborative research supported by a Cooperative Research and Development Agreement and a Sandia LDRD Grand Challenge program, Error-Corrected Photonic Integrated Qubits

Goal: Advancing quantum computing and networking by miniaturizing light-based processors on chip

Sandia concentrates on three primary areas of research with UNM. There is a robust partnership in quantum with the joint UNM/Sandia Quantum New Mexico Institute. Second, there is an active partnership that has commenced in AI through the New Mexico AI Consortium. Finally, Sandia partners with UNM in research related to advanced manufacturing.

Above: UNM Graduate Student Graham Monroe and Sandia Engineer Sal Rodriguez display the dimpled rocket nose they built as part of a collaboration between Sandia and UNM.

Right: Dye moving across plastic beads shows how dimples accelerate flow and heat transfer.

It's Not a Drag—Dimpling Improves Aerodynamics and Fuel Combustion

Sandia National Laboratories Engineer Sal Rodriguez was teaching a class in computational fluid dynamics at the University of New Mexico. The large number of turbulence equations was confusing for students, so he decided to compile a concise set that could solve problems quickly and accurately.

Those equations became the basis of new software, later copyrighted by Sandia. Rodriguez first tested the software on golf balls. He plugged in parameters to see if the dimpling pattern the software came up with to improve aerodynamics would be close to that of manufactured balls. It was an almost perfect match.

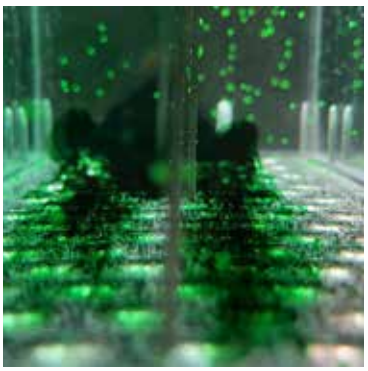
UNM Graduate Student Graham Monroe was fascinated with the idea of using dimples to reduce aerodynamic drag. It works on golf balls by creating a thinner wake and more streamlined trajectory; perhaps the same would be true for other objects. He and Rodriguez decided to try dimpling the nose cone of a rocket. UNM has a rocket team and Monroe had taken part previously. This time his rocket project would become the basis of his master's thesis, with Professor Peter Vorobieff as his academic advisor.

Using the software, Rodriguez created the dimple pattern for the rocket nose cone. Monroe applied and adapted this 2D blueprint to a printable 3D model geometry. By comparing a rocket flown with a smooth nose cone to one with a dimpled nose cone, Monroe was able to analyze acceleration and frictional aerodynamic drag. The experiment was a success. The dimpled nose cone provided a peak reduction in drag of about 40%.

Use of the software with 3D printing facilitates rapid prototyping and continuous improvement of engineering designs. The software quickly produces practical surface-dimpling designs to enable rapid manufacturing and assembly. A project such as this Sandia-UNM Mach 0.64 high-performance rocket nose cone can move from theory to completion within five days.

UNM is an alliance partner in Sandia's University Partnerships Network. The SUPN promotes collaborative research and helps attract top talent to Sandia as employees to work on problems of national and international significance. As a graduate student, Monroe was thrilled to take part in real-world research.

The use of dimpling technology is poised to make a difference not only for rockets, but also for commercial jets, where less drag can increase fuel efficiency. An industry collaboration has tested dimpling of pistons in diesel engines, resulting in a 54% reduction in nitrous oxide emissions. Sandia is also working on patenting a dimpled wind turbine blade and exploring enhanced heat transfer applications.



Joint research with Sandia gives our students challenging research opportunities. The dimpling technology collaboration has led to two joint research papers on theory and applications. We look forward to further collaboration using UNM's new wind tunnel.

– PETER VOROBIEFF

Professor and Associate Chair, Department of Mechanical Engineering
University of New Mexico

Partnership Type: Sandia University Partnerships Network

Goal: Moving dimpling technology forward to improve aerodynamics and efficiency for rockets, various transportation modes, and energy production.

Responding to Pathogens with Medical Countermeasures

The COVID-19 pandemic as well as outbreaks of Ebola and mpox have revealed the necessity of continued emerging infectious disease research and countermeasure development to help mitigate future outbreaks. To treat current pathogens of national security interest and be prepared for emerging threats, the Department of Energy national laboratories are leveraging the boom in advanced machine learning in combination with high-throughput experimentation.

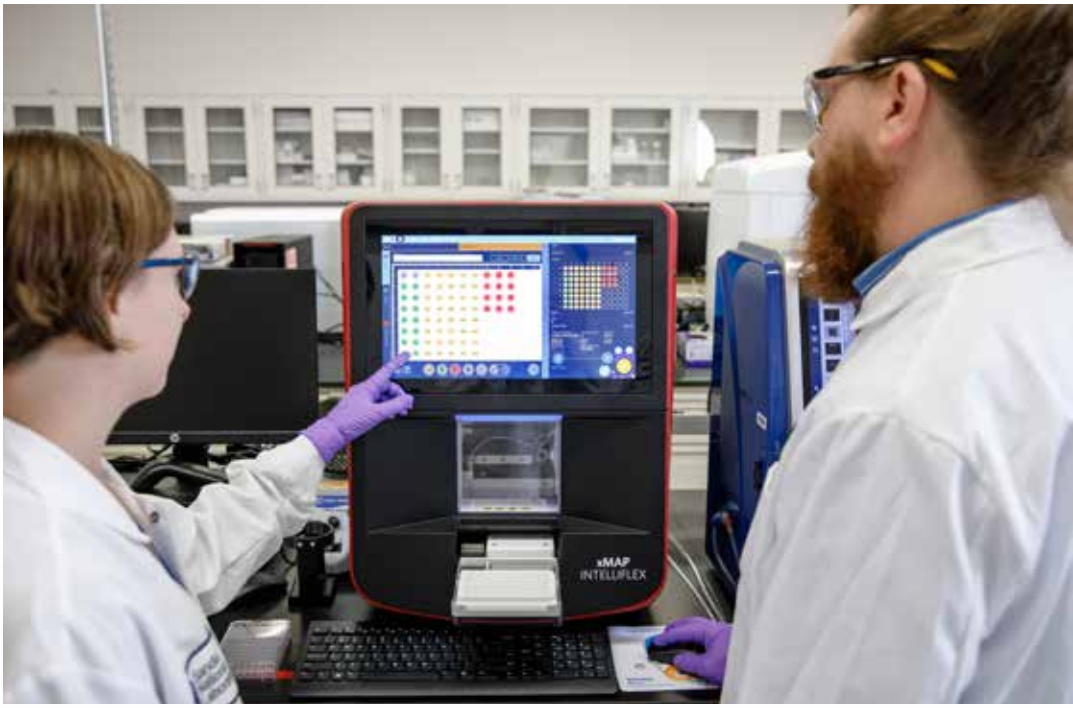
Revolutionary approaches are needed to prepare broad spectrum and effective countermeasures in anticipation of the next emerging infectious disease. Sandia National Laboratories has recently updated its laboratories to include automated high-throughput synthetic biology capabilities and has used these capabilities in 2024 for several collaborative projects.

Computational Approaches for Predicting Shared Interactions of Infectious Diseases, or CAPSIID, is one of those projects, aimed at speeding up the development of effective medical countermeasures which typically take years if not decades to develop.

CAPSIID partners Los Alamos National Laboratory, Lawrence Livermore National Laboratory, University of California, Davis, and University of New Mexico are working together, leveraging high-throughput capabilities. Facilities at Sandia National Laboratories, LANL, and LLNL have both distinct and redundant capabilities so that the DOE labs can rapidly respond in the instance of a new pandemic or other emergency.

CAPSIID is developing host-directed medical countermeasures as a broad spectrum anti-viral approach. While traditional MCMs neutralize the activity of pathogen proteins directly, host-directed MCMs neutralize the viral-host protein interaction. Host-directed MCMs can be preemptively developed and are inherently broad spectrum.

Collaboration leverages each lab's strengths for greater impact. Sandia's facilities in California, as well as at the New Mexico site, are a critical component for CAPSIID and for work on other projects related to Sandia's national security mission.



Above: Sandia Technologist Salvador Martinez uses an Integra Viaflow 386 to prepare microtiter plates for high-throughput assays.

Right: Sandia Researchers Iris Jones and Dylan Johnson leverage the xMAP Intelliflex System to perform high-throughput analysis of protein and gene expression assays for CAPSIID.

PSEL Helps Improve PV Module Performance and Reliability

The Photovoltaic Systems Evaluation Laboratory at Sandia National Laboratories in Albuquerque is designed to study commercial and emerging PV module technologies. The seven-acre site was developed in 1976 to study space systems with NASA. Today, researchers at PSEL collaborate with nearly 50 industry and university partners from around the country and internationally.

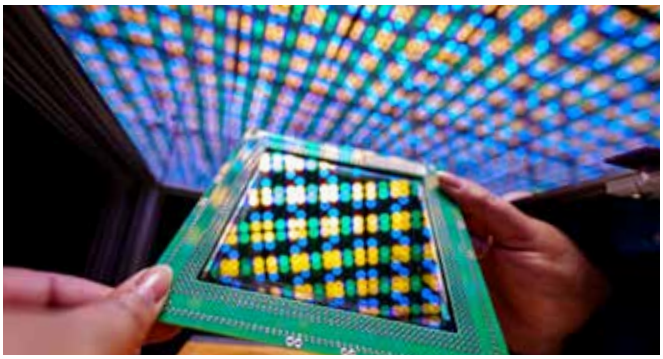
On any given day, PSEL is testing hundreds of solar PV modules, arrays and balance-of-system components such as connectors and trackers. Experimental techniques are used to measure characteristics like current, voltage, and power as a function of irradiance, temperature, wind speed, and precipitation. Combining data with models allows Sandia to better understand and predict each technology's performance and reliability. Research at PSEL is conducted on behalf of the Department of Energy, Department of Defense, and other customers as part of Sandia's national energy security mission.

One project utilizing PSEL is the Photovoltaic Accelerator for Commercializing Technologies funded by the DOE Solar Energy Technologies Office. PACT is led by Sandia in partnership with the National Renewable Energy Laboratory. PACT supports commercialization of new PV module technologies by providing free outdoor and indoor module testing services for companies and research institutes. Its mission is to advance the commercialization of novel solar cell materials, especially metal-halide perovskites.

MHP and tandem MHP/cadmium telluride thin film solar cells and modules, for instance, hold promise as low-cost and high-performance alternatives to conventional crystalline silicon PV. While MHP efficiency has increased over the last decade, technical challenges remain. Module performance, stability, testability, and scalability still require more work. Since its inception in 2021, PACT has tested over 700 MHP modules from ten companies, seven research labs, and universities from around the world, helping to speed R&D.

Left: Perovskite minimodule being prepared for testing under an LED solar simulator.

Below: Sandia Researcher Joshua Stein inspecting a photovoltaic array at the PSEL.



To learn more about the PSEL, visit energy.sandia.gov/facilities/photovoltaic-systems-evaluation-laboratory-psel

For information about PACT, visit pvpact.sandia.gov

Entrepreneurial Separation to Transfer Technology

Left: TerraPower Lead Safeguards Engineer Eva Uribe.

Above: Integrated Effects Test at TerraPower's laboratory in Everett, Washington.

Sandian Becomes Safeguards Engineer for Nuclear Reactor Company

Eva Uribe has been interested in nuclear science since she was a child. A nuclear radiochemist whose postdoctoral fellowship focused on safeguards and non-proliferation, she joined Sandia National Laboratories in 2017. In the California Systems Analysis group, Uribe worked on a variety of complex national security problems, including international safeguards, integrated deterrence, and experimental gaming.

After almost seven years at Sandia, Uribe was faced with a tough decision—whether to leave the Labs for a job at TerraPower, a company leading development of molten salt-fueled nuclear reactors. She decided to join the company, seeing a chance to make a huge impact in the field.

Her transition was made easier by Sandia's Entrepreneurial Separation to Transfer Technology program. ESTT supports Sandia's technology transfer mission and allows employees to leave the Labs to start up or expand technology companies, with guaranteed reinstatement for up to two years.

As new liquid-fueled molten salt reactors like TerraPower's Molten Chloride Fast Reactor are being deployed, there is a need for a paradigm shift in safeguards systems from those designed for solid fuel to systems that can monitor fluid fuels. In her new role as Lead Safeguards and Nonproliferation Engineer, Uribe and her team will develop safeguards and non-proliferation strategies for MCFR technology, making sure materials are only being used for peaceful purposes.

Today's advanced reactors have many applications, from land-based and offshore power to marine propulsion and production of medical isotopes. Uribe's work at Sandia and her academic training make her uniquely qualified to transfer expertise and to further advance national and global security and nonproliferation missions in the international and national interest. This will further strengthen Sandia's global security mission by helping ensure civilian nuclear energy technologies meet international standards.

Ranchers Increase Revenue and Conserve Water with New System

Lacking livestock water distribution systems, Navajo Nation ranchers have relied on costly, inefficient windmills and water hauling. Windmills are expensive to maintain and inherently waste millions of gallons of water by continuously pumping without a mechanism to stop flow.

Recognizing the urgent need for improved water distribution, Remote Well Solutions embarked on a groundbreaking collaboration with Environmental Engineer Brian Dwyer from Sandia National Laboratories through the New Mexico Small Business Assistance Program, which partners local businesses with the expertise and capabilities of the state's national laboratories. NMSBA supports Sandia's technology transfer mission.

Remote Well Solutions was awarded patents for a new, fully automated water distribution management system using solar panels to power high-efficiency pumps that draw water from existing wells. The microprocessor controlled system uses a network of pipes, valves and pressure sensors to regulate distribution of water to strategically positioned storage tanks and livestock watering stations. System installations dramatically expand land use, increasing livestock carrying capacity per ranch.

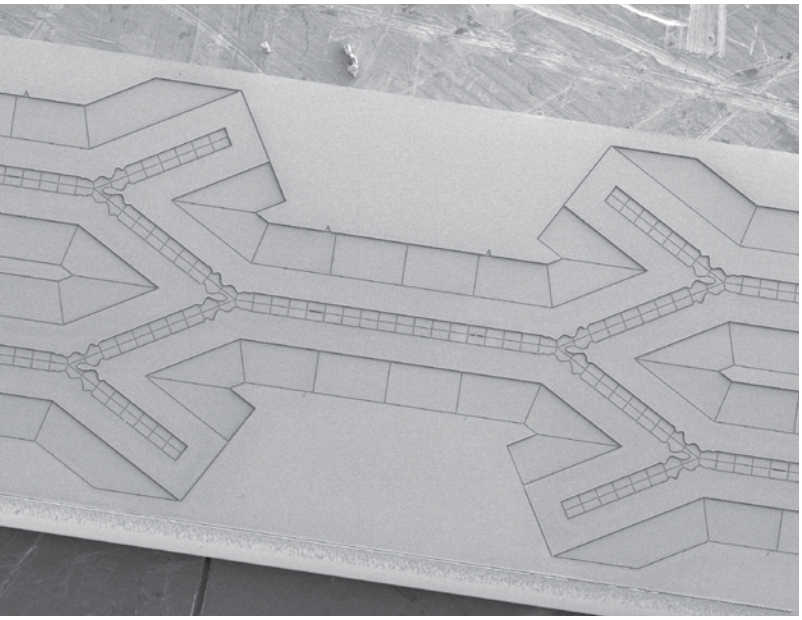
Collaboration with Sandia involved consulting on system design, evaluating water quality, and exploring point-of-use water treatment options. The system's sturdy construction and weatherproofing ensure reliability in harsh environments. The project report detailed system design specifications, water quality assessment results, and treatment recommendations.

In 2023, a $502,000 pilot project installed these water systems on four Navajo tribal ranches. Several million dollars has been allocated for more installations in 2024, and the Navajo Nation has been awarded a $25 million U.S. Department of Agriculture Regional Conservation Partnership Program grant to increase utilization of these systems on its lands. Remote Well Solutions expects to hire 25 to 40 new employees. Based on these results, the project received NMSBA's Honorable Speaker Ben Luján Award for Small Business Excellence for demonstrating the most economic impact.

Left: Brian Mego, Dylan Mego, Anna Francis, and Ryan Mego of the Francis Ranch with Mike Lisk of Remote Well Solutions standing by a fully automated, solar-powered RWS Water Distribution Pumping Plant.

Above: Livestock water trough being filled from a remote storage tank that is part of an RWS water system.

To learn more about NMSBA, visit www.NMSBAprogram.org



Left: The Enchilada Trap is an ion trap that enables scientists to build more powerful machines to advance quantum computing.

Above: The 2024 Quantum Systems Accelerator all-hands meeting at UNM.

New Mexico Helps Lead Quantum Technology Revolution

Co-led by Sandia National Laboratories and Lawrence Berkeley National Laboratory, the Quantum Systems Accelerator is a leader in quantum information science and workforce development.

At the 2024 Quantum New Mexico Symposium at the University of New Mexico, which QSA helped plan and execute, Governor Michelle Lujan Grisham was the keynote speaker. She said she was confident that the state can lead a "technology revolution" in quantum, supporting businesses that locate and expand here with incentives that are among the best in the country.

The governor also recognized that QSA, along with other labs, academic research institutions, and commercial organizations in the mountain west region, collaborated with the Elevate Quantum consortium to secure a phase 2 TechHub award through the U.S. Economic Development Administration. The $120 million received as part of the CHIPS and Science Act will further build the local quantum ecosystem.

Building on that momentum, QSA and partners across the region are collaborating on the New Mexico Quantum Moonshot Initiative, a finalist in the National Science Foundations' Regional Innovation Engines program, seeking to secure an additional $160 million to help accelerate quantum innovation. As one of only four quantum-focused ecosystems invited to this stage, this recognition highlights New Mexico's potential to become a powerhouse in quantum technology, leveraging the state's unique combination of national security, academic, and industry assets to create economic growth and ensure national security.

Looking ahead, programs piloted by QSA in previous years are ramping up. Central New Mexico Community College received $862,000 in federal funding for the development of a Quantum Learning Lab and training, with curriculum created in partnership with QSA and Sandia. The immersive 10-week (40 hours per week) Quantum Technician Bootcamp will prepare students for high-tech manufacturing positions in the semiconductor, solar manufacturing, and opto-electronics industries.

To learn more about QSA, visit www.quantumsystemsaccelerator.org

Park Creates Economic Growth through Collaboration

The Sandia Science & Technology Park is a valuable resource for Sandia National Laboratories and the state, bringing high-quality jobs to New Mexico. It fosters collaboration among Park companies, Sandia, the Air Force Research Laboratory, and U.S. Space Force.

The Biennial Economic Impact Assessment done in 2024 by the Mid-Region Council of Governments reported that since its inception in 1998, companies and organizations within the SS&TP have paid $7.7 billion in wages and salaries, created over 6,500 jobs, and contributed $4.4 billion in taxable consumer spending.

The SS&TP was established through a partnership between the nonprofit Sandia Science & Technology Park Development Corporation and Sandia. "The Park serves as a valuable technology hub for New Mexico and a driving force for national security development," said Sherman McCorkle, chairman of the SSTPDC.

The work performed at the Park also helps spur local job growth. The report shows that 4,375 jobs were linked to the SS&TP in 2022 and 4,528 in 2023. Those jobs were in industries including construction, manufacturing, retail trade, professional and technical services, healthcare and social assistance, and accommodation and food services. About half of those were direct employment at the Park and the other half were indirect.

"Since its inception, the SS&TP has surpassed the expectations of achieving economic competitiveness and prosperity for our local, regional and national economies," said Dan Sanchez, assistant manager for programs at the National Nuclear Security Administration's Sandia site office.

"The impact on Sandia is big," said Mary Monson, senior manager for technology partnerships and business development at Sandia "Our suppliers and partners are in the Park. We are able to access them easily and they are able to access Sandia. It's key to our mission success."

Below: A Company Leadership Luncheon at the SS&TP.

Right: Aerial view of the SS&TP.

To learn more about the SS&TP, visit www.sstp.org

Water Treatment Solution Tackles 'Forever Chemicals'

Sigma Advanced Technologies is a commercial provider for large water treatment systems. The company is keen on developing next-generation water treatment solutions for emerging contaminants.

Sigma is now using its proven treatment methods and remediation know-how in combination with licensed Sandia National Laboratories technology to remediate PFAS, or Polyfluorinated-Alkyl-Substances, commonly referred to as "forever chemicals." PFAS are very toxic to humans and animals, and are contaminating water supplies in all 50 states and globally.

According to the Food and Drug Administration, PFAS were first used in the 1940s and are now in hundreds of common household products including stain- and water-resistant fabrics and carpeting, cleaning products, paints, and fire-fighting foams. They are also used in food packaging, including microwave popcorn bags, pizza boxes and candy wrappers, which places them in contact with food products.

This TRGR Project, focused on advancing an efficient and low-cost solution to permanently remove these forever chemicals from drinking water sources in-situ. They tested Sandia-licensed intellectual property along with a proprietary Sigma process to accomplish this goal.

This assistance was available to Sigma through the TRGR Technology Readiness Initiative, a program focused on technology maturation for New Mexico companies that have licensed technology from either Sandia or Los Alamos National Laboratory, or are engaged in a Cooperative Research and Development Agreement with one of the labs. TRGR supports Sandia's technology transfer mission.

As a result of the TRGR Project, the technology moved from a proof of concept with a TRL of 2-3 to a TRL of 4, with an operational benchtop apparatus that can be used to demonstrate the process. Sigma Advanced Technologies has applied to the New Mexico Small Business Assistance Program in order to continue improving the process and move it further toward commercialization.

Below: Gas control board in the Sigma lab.

Right: Sigma Advanced Technologies CEO Robert Sachs, CTO Roger Remy, and Project Manager Greg Remy at the Sigma lab.

To learn more about TRGR, visit www.NMTRGR.org

Authenticating Parts for Systems Where Failure is Not an Option

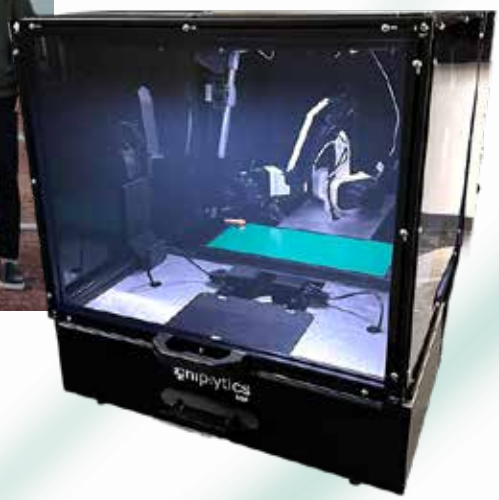
The National Nuclear Security Administration and Department of Energy Office of Technology Commercialization, in partnership with FedTech, run the DOE Emerging Tech Startup Studio. In this program, entrepreneurs and lab researchers learn how to launch a technology-focused venture by leveraging intellectual property from DOE's national laboratories. During the 2024 program, successful Startup Studio alumni companies went through an accelerator which provided additional assistance on their commercialization path.

Chiplytics was formed to commercialize Power Spectrum Analysis, a novel nondestructive testing technique designed by Sandia National Laboratories Scientist Pai Tangyunyong to authenticate microelectronic devices. The company founders were matched with Sandia PSA technology and researchers during the 2020 DOE Startup Studio.

Typically testing microelectronics is slow, destructive, and requires an expert, so testing an entire batch of components is out of the question. PSA speeds up the process. Other methods also cannot detect the subtle differences that PSA can. For applications where failure is not an option, such as aerospace, defense, critical infrastructure, and medical devices, testing parts before they are installed in a system is essential. Counterfeit or used components that find their way into the supply chain can be spotted, greatly improving system reliability and security.

Chiplytics founders recognized the potential of PSA technology, but also realized that for commercial success they would need to advance PSA from a benchtop system to a smaller, easy-to-use product that could still achieve reproducible results. Sandia researchers collaborated with Chiplytics, validating the company's prototype with funding from the Sandia COVID-19 Technical Assistance Program in 2021 and further collaborated during the recent alumni Startup Studio.

The Chiplytics PSA System is now in use at government and commercial facilities and the company is working with partners to introduce PSA into microelectronics industry standards to help secure the supply chain.

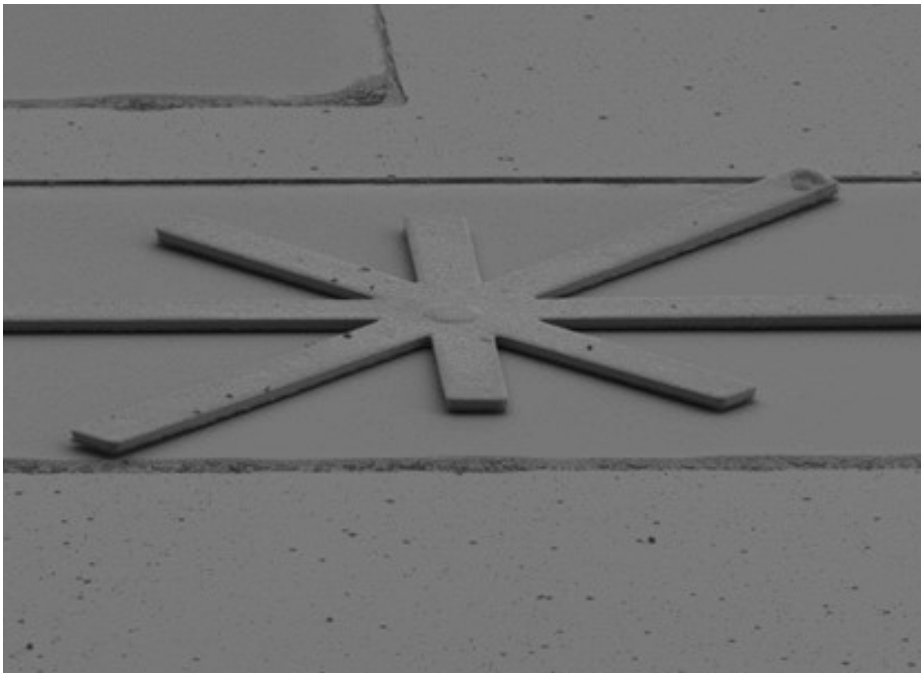


Left: Chiplytics Sandia visit.

Below: The Chiplytics MIP, which runs PSA as well as other electrical tests.

To learn more about the DOE Emerging Tech Startup Studio, visit www.fedtech.io/startup-studios/doe-emerging-tech-studio-dets

Above: Sandia Researchers Christian Arrington and Jamin Pillars, U.S. Senator Ben Ray Lujan, and VastVision CEO Kyle Guin in Washington D.C. after the MagTag team completed the Energy I-Corps program.



Right: A scanning electron micrograph showing a tiny microfabricated MagTag resonator the size of a grain of rice.

MagTags Track and Monitor Sensitive Assets When RF Tags Can't

Energy I-Corps brings lab ideas to the market where they can benefit the nation and world. The Department of Energy Office of Technology Commercialization program, which aligns with Sandia National Laboratories' technology transfer mission, has teams of researchers and industry mentors define technology value propositions, conduct customer discovery interviews, and identify market pathways.

Sandia's MagTag team, sponsored by the DOE's National Nuclear Security Administration, was in Energy I-Corps Cohort 17. The MagTag technology is a chip-scale, magnetic smart tagging and sensing platform for the accurate tracking, sensing, and monitoring of assets. Principal Investigator Jamin Pillars, as well as Christian Arrington and other Sandians, developed MagTag to solve the problem of tracking nuclear materials. Since spent nuclear fuel is often stored in heavy metal containers that are highly conductive, RF, or radio frequency tags, can't be used, Pillars came up with the idea of using a magnetic signal.

MagTags need no batteries or maintenance. Even if buried underground with a container, their magnetic-based resonator arrays can be pinged with an AC magnetic frequency, even years later, by using a handheld reader that can measure and analyze the response.

Before taking part in Energy I-Corps, Pillars had not considered other applications for this technology. But in the process of looking at market share, end users, commercialization, and advancing technology readiness level, the program has changed the way he thinks about the use of lab-developed technology.

The MagTag industry mentor during the Energy I-Corps session was Kyle Guin, CEO and co-founder of VastVision Technologies, a company with an inventory management and asset tracking platform that works with GPS and RFID tracking. After completing the program, the patented MagTag technology was licensed by VastVision. The team continued to develop the technology through a TRGR Technology Readiness Initiative Project. Pillars and Arrington have now joined VastVision full time to pursue commercialization.

To learn more about Energy I-Corps, visit energyicorps.energy.gov

Programs in NM and CA Accelerate Commercialization of Sandia Tech

Sandia National Laboratories has royalty-funded Technology Maturation Programs at its New Mexico and California sites designed to accelerate the commercialization of Sandia-developed technologies so they can be deployed for the U.S. public good. These programs are part of the Labs' technology transfer mission. Activities may include benchtop demonstrations, initial steps to scale-up, data generation for further decision-making, or other activities. The programs also support engagement with prospective commercial licensees.

New Mexico

The Sandia Technology Maturation Program selects up to three promising technologies with near-term potential for commercial impact each year. For 2024, one of the selected technologies was Functionalized Mesoporous Carbon for PFAS Sequestration. Removing PFAS from water sources is an urgent challenge for long-term water security. Sandia's functionalized mesoporous carbon PFAS-selective adsorbents can be used as a filter or sorbent material to arrest PFAS transport in water.

This project furthered materials synthesis and evaluation to maximize PFAS adsorption and improve the technology's capability. The technology has now been licensed to Sigma Advanced Technologies and the company is working to combine the licensed technology with its own proprietary process.

Below: Produced water, right vs. clear treated water, left, from Sigma's benchtop treatment system.

Above: Sandia Researchers Isaac Avina and Patrick Doty holding freestanding films of conjugated polymers with evaporated gold contacts, mounted for testing in a high energy proton beam.

California

Using a competitive process, the Division 8000 Innovation & Commercialization Call selects up to three projects to fund each year in order to advance technical breakthroughs toward commercial viability. Electronic Polymer Dosimeter for Radiotherapy was one of the projects selected for 2024.

EPDR is a patch that can better prevent damage of healthy tissue in proton radiation cancer treatment. The main component of this patch is a Sandia-patented neutron/proton radiation sensor. Follow-on funding has been received from the Defense Threat Reduction Agency and is expected from other sources. Sandia executed a License Option Agreement with WearableDose and additional intellectual property has already been generated to advance the technology through a Cooperative Research and Development Agreement.

S2-EDGE Helps Move Semiconductor Technologies to Market

In the winter of 2021, when the S2-EDGE project was conceived, the microelectronics sector in the U.S. faced significant challenges due to the offshoring of the industry. S2-EDGE was developed to leverage industry input to move innovations in semiconductor technologies and next-generation microelectronics from the lab to the marketplace, in alignment with anticipated national policy initiatives such as the CHIPS Act.

Semiconductor Sector research development demonstration and deployment—Expedite and Develop Game-changing Exemplar, or S2-EDGE, was made possible by support from the Department of Energy's Office of Technology Commercialization's Technology Commercialization Fund. S2-EDGE complemented Sandia National Laboratories' national security and technology transfer missions.

Led by Sandia in partnership with four other DOE laboratories—Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Pacific Northwest National Laboratory, and SLAC National Accelerator Laboratory, S2-EDGE was a two-year project with long-term effects.

Four events facilitated dialogue and information sharing among members of the semiconductor ecosystem taking part: five laboratories, five academic institutions, seven industry leaders, and eight small businesses. By creating an overview of the domestic microelectronics landscape, key areas for targeted investment and R&D emerged. S2-EDGE also laid the groundwork for a more unified approach to partnering with the national labs. Terms for an ACCESS Cooperative Research and Development Agreement and Umbrella User Facility agreement were drafted for all four S2-EDGE partner labs.

S2-EDGE also included a Technology Transfer Internship program which provided students hands-on experience with tech transfer. The interns conducted over 130 customer discovery interviews and developed commercialization strategies for DOE technology. Many of the interns transitioned to year-round positions.

The insights gained by the S2-EDGE project have been leveraged by the DOE to shape future research directions that support the domestic microelectronics industry, ensuring that new technologies meet both commercial and national security needs.

Left: S2-EDGE Interns Meadow Crise, Isaac Lopez, and Janine Hagar-Montoya take a tour of the National Solar Thermal Test Facility.

Below: Participants listen to one of the eight small business presenters at the S2-EDGE Small Business Showcase hosted at SLAC National Accelerator Laboratory.

To learn more about TCF, visit
www.energy.gov/technologytransitions/technology-commercialization-fund

Innovation and Intellectual Property Celebrations

Sandia National Laboratories Integrated Partnerships Organizations hosted Innovation and Intellectual Property Celebrations in New Mexico at the National Hispanic Cultural Center in Albuquerque and in California at McGrail Vineyards in Livermore. The annual events recognize staff whose work furthers Sandia's technical innovation and engineering excellence.

Along with granted patent inventors and commercial copyright authors, the events recognize Mission Innovators for their contributions to the Labs' national security mission. Director-nominated Up & Coming Innovators are also recognized for their impactful solutions to complex challenges in addition to entrepreneurial talent.

In New Mexico, awards were presented to 214 patent inventors, 36 copyright authors, 7 Mission Innovators, and 17 Up & Coming Innovators. In California, 26 patent inventors, three copyright authors, 18 Innovation Recognition Award recipients, one Federal Laboratory Consortium Far West Excellence in Technology Transfer award winner, and one Society of Women Engineers award winner were honored.

Above: California Innovation Celebration

Above: New Mexico Innovation Celebration

Above: The Remote Well Solutions team was recognized at the NMSBA Innovation Celebration.

NMSBA Innovation Celebration

The New Mexico Small Business Assistance Program held a celebration at Santa Fe Brewing Company in Santa Fe to recognize teams comprising New Mexico small businesses and Sandia and Los Alamos national laboratories principal investigators that achieved outstanding innovations through NMSBA.

Six Sandia projects featured in the 2023 NMSBA Perspectives Annual Report were showcased: Dash2 Labs, Emerging Technologies Ventures, National Water Services, Ophthalmic System Leveraged Project, SensorComm Technologies, and Remote Well Solutions.

The Honorable Speaker Ben Luján Award for Small Business Excellence for demonstrating the greatest economic impact was awarded to Remote Well Solutions. In 2023, a $502,000 pilot project installed the company's water systems on four Navajo tribal ranches. Several million dollars was allocated for more installations in 2024, and the Navajo Nation has been awarded a $25 million U.S. Department of Agriculture Regional Conservation Partnership Program grant to increase utilization of these systems on its lands. The company expects to hire 25 to 40 new employees.

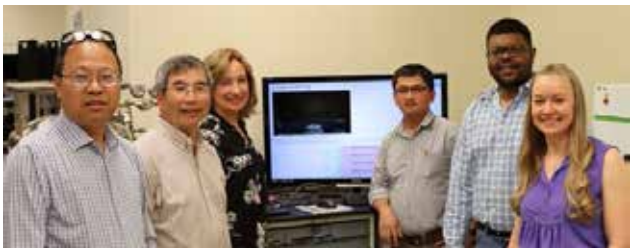
R&D 100 Awards

The R&D 100 Awards celebrate the year's 100 most innovative technologies. Sandia National Laboratories competes with universities, corporations, and other government laboratories for these prestigious awards.

JOINT AWARDS

Low-cost Direct Air Capture of CO_2 with Clay Nanointerlayers

Sandia researchers won this award partnering with Purdue University.



LDAC^3 uses specialized clays to capture carbon dioxide directly from the atmosphere making this vital climate change mitigation strategy more accessible. Nanoscale expansive clay interlayers and the associated confined water selectively concentrate and remove CO_2 from the air with reduced energy input, material cost, and environmental footprint. This technology exhibits significant competitive advantages over other existing alternatives using inexpensive and widely available natural materials with no chemicals.

Machinable, Larger-Scale, Self-Healing Refractory High-Entropy Alloys for Energy and Aerospace Applications

Sandia researchers won this award partnering with Westwind, CalNano, Plasma Technology Inc., Pennsylvania State, Applied Surface Engineering, Dynetics, and the University of New Mexico.

RHEAs represent a significant development in material performance. These alloys can withstand extreme temperatures and radiation, making them well suited for applications in aerospace, nuclear reactors, fusion, electronics, and other demanding settings. The team developed an additive manufacturing, rapid prototyping, continuous improvement process and software for manufacturing larger-scale, self-healing, high-quality, machinable RHEAs for high-temperature, radiative, and corrosive environments.

FLC Awards

The Federal Laboratory Consortium Awards Program annually recognizes federal laboratories and their industry partners for outstanding technology transfer efforts.

NATIONAL AWARDS

Outstanding Technology Transfer Professional Award

Samantha Updegraff

Chief Intellectual Property/Patent Counsel Samantha Updegraff was recognized for her ability to devise creative ways to successfully accomplish Sandia's tech transfer mission.

State and Local Economic Development Award

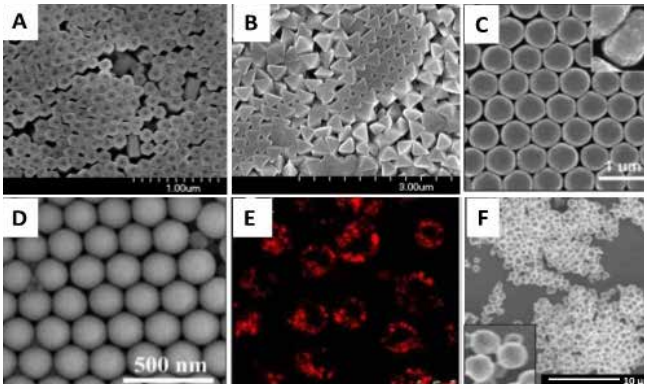
TRGR Technology Readiness Initiative

The TRGR Program was recognized for its partnership with the state of New Mexico in developing and implementing a program that helps move technology developed at the national labs to market and creates considerable economic impact.

REGIONAL AWARD

Regional Technology Transfer Award for the Mid-Continent Region

Long-lasting Disinfectant 2.0



Lunano licensed Sandia's Detergent-Assisted Fabrication technology to create Disinfectant 2.0, which is expected to enhance disinfectants for households, transportation, restaurants, hotels, and other public and personal spaces.

DOE TTWG Awards

The Technology Transfer Working Group awards celebrate the exceptional work done by the 17 Department of Energy national laboratories to support American competitiveness and security through a streamlined commercialization process.

Economic Development Award

Jennifer Valdez and Monica Martinez

Jennifer Valdez and Monica Martinez were recognized for their efforts in supporting the Navajo Nation's access to federal funding to build jobs and create an economy based on renewable energy initiatives.

Partnering Award

The Sandia Boost Program Team

The Sandia Boost team was recognized for their role in creating an innovative ecosystem for small communities to engage with national laboratories and entrepreneurs in exchanging ideas and learning how to usher technologies into the marketplace.

NMTC Women in Technology Awards

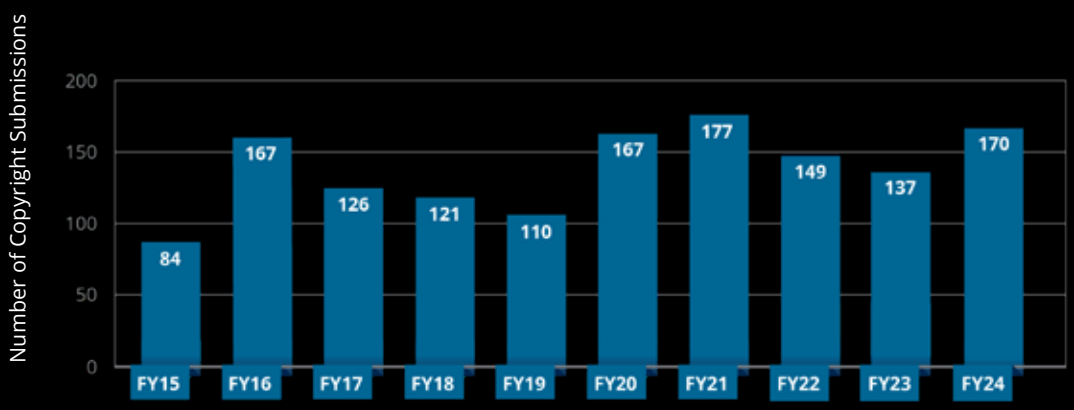
Women in Tech Honorees

Mary Monson and Mara Schindelholz

Mary Monson and Mara Schindelholz were recognized by the New Mexico Technology Council as women working to drive innovation and excellence in technology and for their efforts to inspire and empower others to pursue careers in the tech industry.

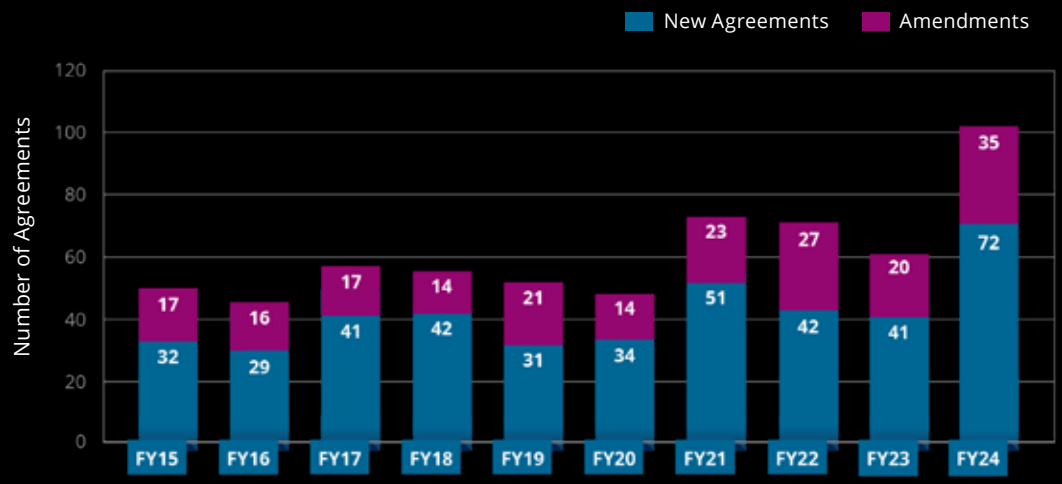
Copyrights

Copyright Submissions

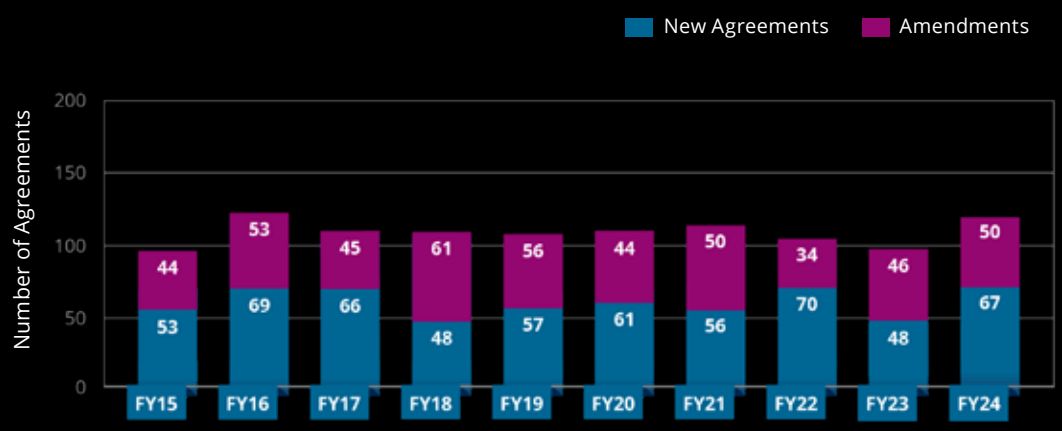


CRADAs and SPP/NFE Agreements

Cooperative Research and Development Agreements (CRADAs)

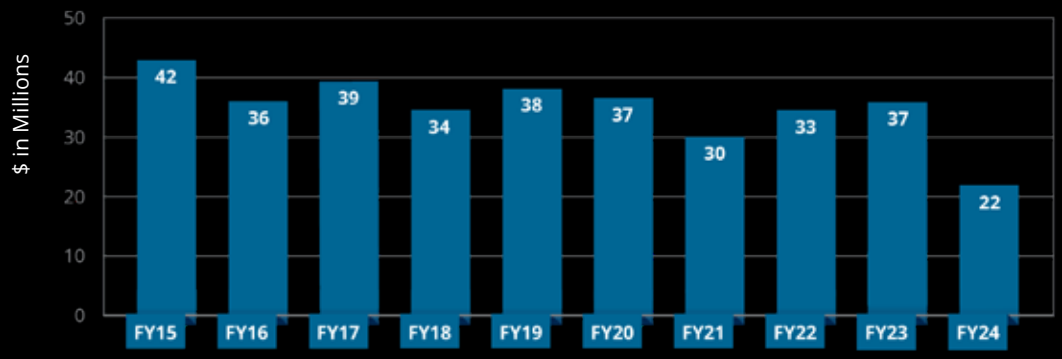


Strategic Partnership Project/Non-Federal Entity (SPP/NFE) Agreements



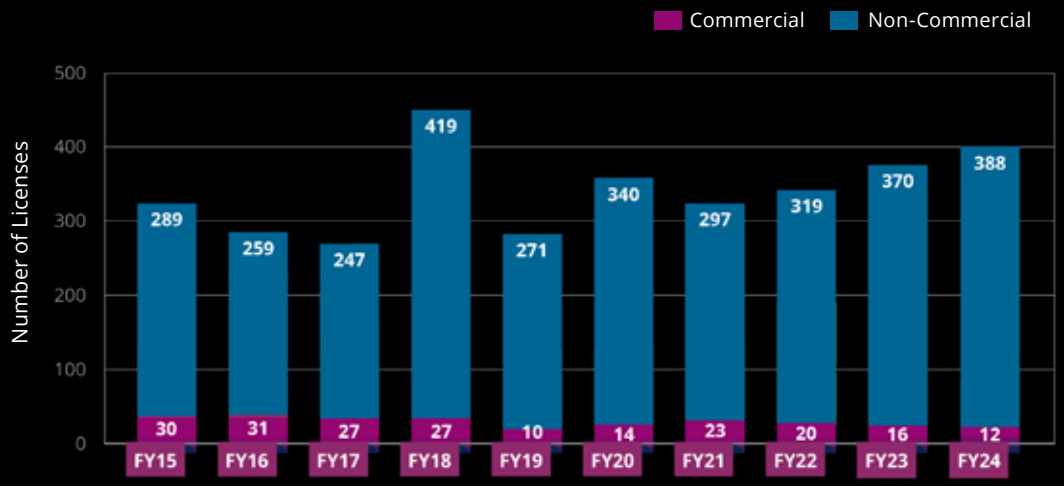
Industry Funds-In to Sandia ($M)

Industry Funds-In



Licenses

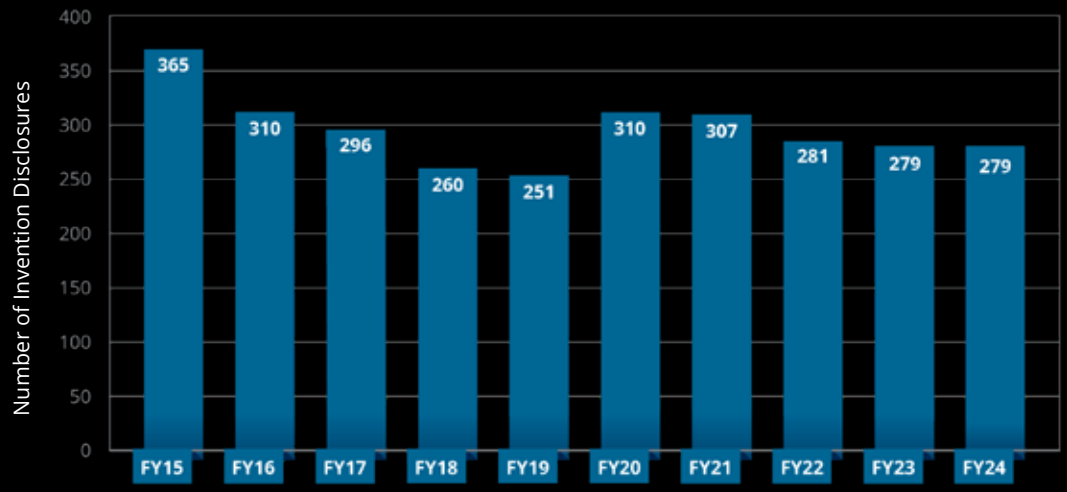
Licenses



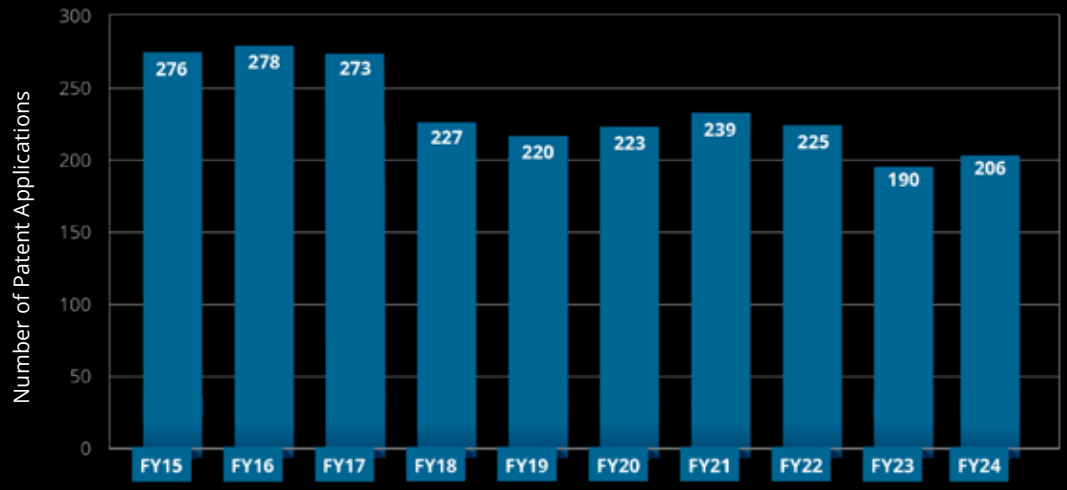
Licensing Income ($M)

Patent Activity

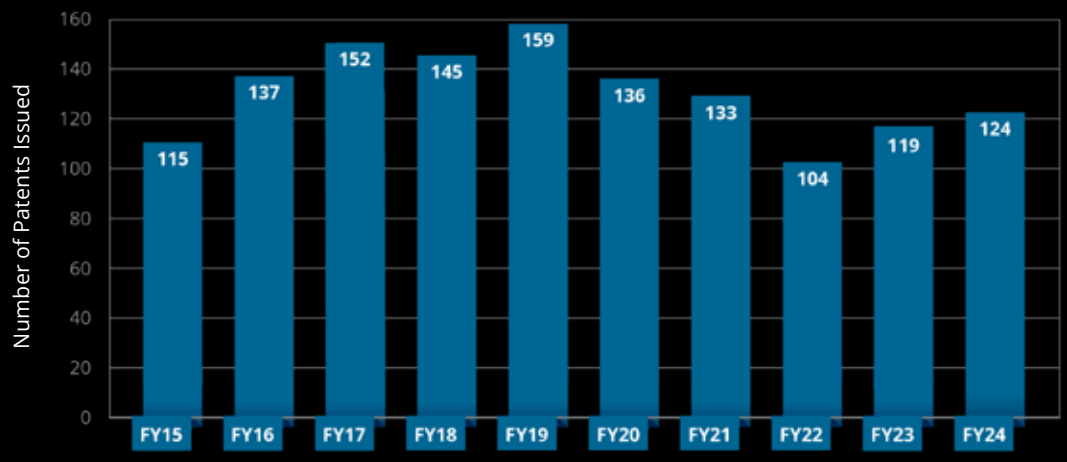
Invention Disclosures



Patent Applications



Patents Issued



University Partnerships

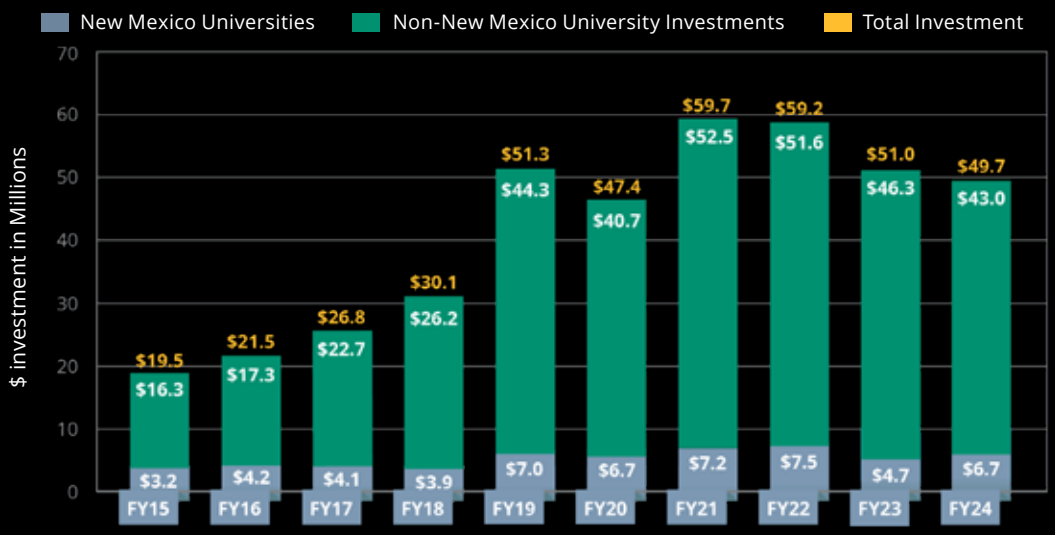
Since 1997, when the Campus Executive program was established, Sandia National Laboratories has formally cultivated university research to expand its science and technology base. Through the Campus Executive program, Sandia formalized agreements with about 20 schools that defined partnership goals, including research collaboration areas and talent pipeline objectives. In 2016, Sandia began more focused collaborations with a subset of the Campus Executive schools under its Sandia Academic Alliance Program. These schools had strong historical partnerships with Sandia, possessed synergistic research competencies and capabilities, and shared Sandia values and an affinity for national security work. In 2021, Securing Top Academic Research and Talent with Historically Black Colleges and Universities (START HBCU) was founded to foster workforce development.

Sandia also revisited its strategy for university engagement in 2021, and implemented the new Sandia University Partnerships Network in 2022. The SUPN is a graduated spectrum of relationships with universities across the United States. The objectives of this network are to partner broadly with universities based on merit to ensure a robust pipeline of top talent and innovative ideas, and to establish and cultivate enduring strategic and mutually beneficial relationships with a focused set of schools. The Academic Programs Office, under the auspices of the Chief Research Officer, serves as the point of contact for university research, and implements those processes that enable and enhance university partnerships.

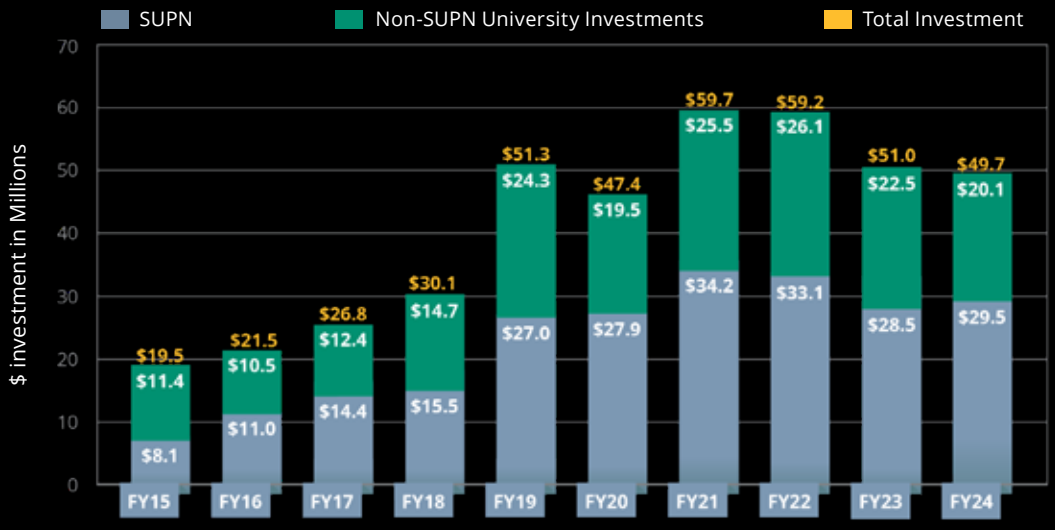
These programs pair Sandia executives with university officials at schools that share research interests and capabilities.

*Historic data has been updated to reflect current university structure and some investment numbers may have changed from previous reports.

Investments in Research at New Mexico Universities*



Investments in Research with Sandia University Partnerships Network*



Scorecard

Sandia Science & Technology Park

Companies and Organizations	43
Employees	2028
Buildings	27
Public Investment in the Park*	$99.7M
Private Investment in the Park*	$399.4M
Total Investment in the Park*	$499.1M
Increase in Tax Revenue*	$4.4B
Increase in Wages*	$7.7B
Average Salary of Full-time Jobs in Park	$92K
Average Salary of Full-time Jobs in Metro Albuquerque	$60K

**Since Park opened in 1998.*

2024

During the calendar year, 7 new companies moved into the SS&TP.

SANDIA SCIENCE & TECHNOLOGY PARK

New Mexico Small Business Assistance

Sandia: 2000-2024

New Mexico Small Businesses Assisted	2,567
Rural vs. Urban Businesses	
Rural (58%)	1,477
Urban (42%)	1,090
Combined	2,567
Dollar Amount of Assistance	$53.1M

Sandia and Los Alamos: 2000-2023*

Return on Investment (ROI)**	$1.79
(For every $1.00 of state tax credit invested)	
Economic Impact	
Small Business Jobs Created and Retained	12,723
Average Reported Salary (2023)	$70.2K
Increase in Revenue	$573M
Decrease in Operating Costs	$396M
Investment in NM Goods/Services	$206M
New Funding/Financing Received	$349M

**Surveys are performed six months to one year after project completion.*

***ROI is based on salaries of jobs created and retained.*

2024

During the calendar year, Sandia invested $2.4M helping 139 small businesses in 15 counties throughout New Mexico. There were 53 Sandia Principal Investigators across 42 departments that supported NMSBA.

New Mexico Small Business Assistance NMSBA

Entrepreneurial Separation to Transfer Technology*

Sandians Who Left on ESTT	184
To Start up a Company	83
To Expand a Company	101
Companies Affected by ESTT	134
Start-up Companies	67
Expansion Companies	67

**Since ESTT began in 1994.*

2024

During the fiscal year, 4 Sandians were approved to leave on ESTT.

ESTT
Entrepreneurial Separation to Transfer Technology

TRGR Technology Readiness Initiative*

Sandia and Los Alamos: 2020-2023

Companies Assisted	27
New Licenses	21
New CRADAs	8

**Since TRGR began in 2020.*

2024

During the fiscal year, Sandia invested $502K assisting 12 companies.

TRGR Technology Readiness Initiative

Thank you to everyone who contributed to this report.

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U.S. DEPARTMENT of ENERGY NNSA National Nuclear Security Administration

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Partnerships National Reach
Explore our interactive data map which illustrates the amazing breadth of work Sandia National Laboratories does with industry, university, government, and lab partners around the U.S.

www.sandia.gov/partnerships_reach

TECHNOLOGY Partnerships | Sandia National Laboratories

CENTER *for* COLLABORATION *and* COMMERCIALIZATION

To learn more about the Center for Collaboration and Commercialization, contact David Kistin at **dkistin@sandia.gov** or stop by our partnership space in downtown Albuquerque at 101 Broadway NE.

IPO Integrated Partnerships Organizations

To learn more about industry or university partnership opportunities with Sandia, visit **www.sandia.gov/partnerships** or contact us at **partnerships@sandia.gov**

To learn more about licensing and technology transfer at Sandia, visit **ip.sandia.gov** or contact us at **ip@sandia.gov**

Academic Programs

To learn more about academic partnerships at Sandia, visit **www.sandia.gov/working-with-sandia/academic-partnerships** or contact us at **acadalli@sandia.gov**

Small Business First

To learn more about how to do business with Sandia, visit **sbu.sandia.gov** or contact us at **supplier@sandia.gov**