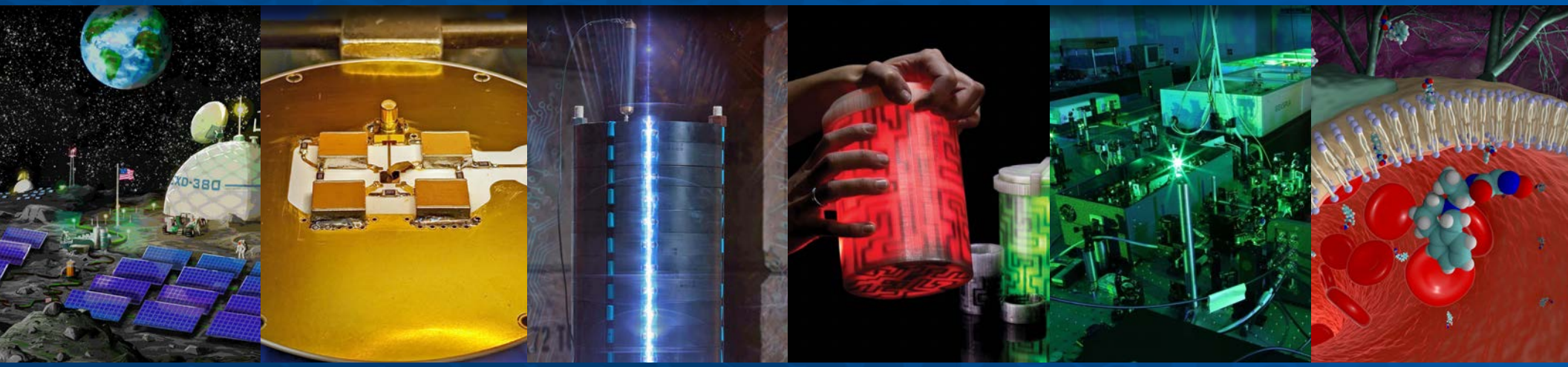
Technology Transfer at NNSA



2023

CALENDAR

National Nuclear Security Administration

NNSA Technology Transfer Program

Established by Congress in 2000, the **National Nuclear Security Administration (NNSA)** is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science. NNSA maintains and enhances the safety, security, and effectiveness of the U.S. nuclear weapons stockpile; works to reduce the global danger from weapons of mass destruction; provides the U.S. Navy with safe and militarily effective nuclear propulsion; and responds to nuclear and radiological emergencies in the United States and abroad[1]. NNSA is run from headquarters buildings spread over three sites (Forrestal, Germantown, and Albuquerque Complex) and conducts its critical missions at field offices and national security laboratories, plants, and sites (LPS) nationwide. As shown in the map in Figure 1, NNSA conducts research, development, and technology transfer programs at Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), and Sandia National Laboratories (SNL), as well as the Nevada National Security Site (NNSS), Pantex Plant (Pantex), Kansas City National Security Campus (KCNSC), and Y-12 National Security Complex (Y-12). Under the National Nuclear Security Administration Act, the NNSA Administrator "has authority over, and is responsible for, all programs and activities of the Administration [...] including the management and operations of the nuclear weapons production facilities and the national security laboratories."[2]

"The Office of Strategic Partnership Programs plays a crucial role in ensuring the NNSA operates in accordance with federal laws, statutes, and orders pertaining to technology transfer, nationally and internationally. Moreover, the office works hand-in-glove with the labs, plants, and sites to support partnership and policy priorities in the technology transfer, development, utilization, and commercialization space at the S-1 (Secretary of Energy) and NA-1 (NNSA Administrator) level. Since taking on the role of Acting Assistant Deputy Administrator for the Office of Strategic Partnership Programs in October 2021, my focus has been on building a robust organization that can operate at a level commensurate with the Call to Action issued by the Administrator to "Innovate. Collaborate. Deliver." In the past 14 months, our office has undertaken efforts to better leverage key partnerships, strengthen program interfaces, build and deploy teams to deliver on key commitments, work from a consistent, comprehensive, and measurable program framework, and consolidate information from reporting, data, and statistics collected from sites and institutions to communicate the significant contributions of NNSA-sponsored tech transfer. In the upcoming year, I hope to continue the aforementioned efforts and explore new tools to capture, both qualitatively and quantitatively, the massive global impact of tech transfer."

- Dr. Njema Frazier
Assistant Deputy Administrator for Strategic Partnership Programs, NNSA

Within the NNSA, one of the key mechanisms by which knowledge, intellectual property, and capabilities developed at NNSA laboratories, plants, and sites are transferred to other entities, such as outside Federal agencies, private industry, academia, and state/local governments, is **Technology Transfer**. Since the passing of the Stevenson-Wydler Technology Innovation Act of 1980, Federal laboratories, plants, and sites have been able to participate in, and budget for, technology transfer activities. Over the years, LPS activities have yielded tens of billions of dollars in return on investment leveraging NNSA-sponsored technology, capabilities, and expertise and led to a multitude of patents, agreements, companies, and awards. At NNSA Headquarters, the intersectionality of the Tech Transfer mission – involving science and technology development, intellectual property law, and business practices – has brought together a myriad of organizations across DOE/ NNSA to ensure that the US and the international community fully realize the benefits of technology transfer and commercialization.

[1]Department of Energy National Nuclear Security Administration "About NNSA" (www.energy.gov/nnsa/about-nnsa)

[2]Title XXXII, National Defense Authorization Act for Fiscal year 2000, Pub. Law 106-65, as Amended (energy.gov)

As a point of reference, the NNSA laboratories – LANL, LLNL, and SNL – account for the largest accumulation of patents issued to the Federal Government. The associated technologies have revolutionized the lives of the American people and provided great impact to the global community. Several of the groundbreaking technologies developed within the Nuclear Security Enterprise are highlighted within the pages of this calendar.

On the Office of Strategic Partnership Programs (SPP): NNSA's primary office of responsibility for Federal oversight of technology transfer activities is the Office of Strategic Partnership Programs (SPP). SPP ensures that the labs, plants, and sites are able to deliver the benefits of taxpayer-funded work in cutting-edge science and technology research and development (R&D) back to the American people. Management, oversight, and reporting requirements for the office derive from multiple US Government laws, Federal statutes, and DOE Orders. Internally, Tech Transfer program priorities are guided by a Strategic Framework consisting of six goals: (1) technology development, commercialization, and maturation; (2) workforce development, recruitment, and retention; (3) policy, evaluation, and economic development; (4) outreach and visibility; (5) collaboration; and (6) protection of American technologies.

National Security Laboratories, Plants, and Sites

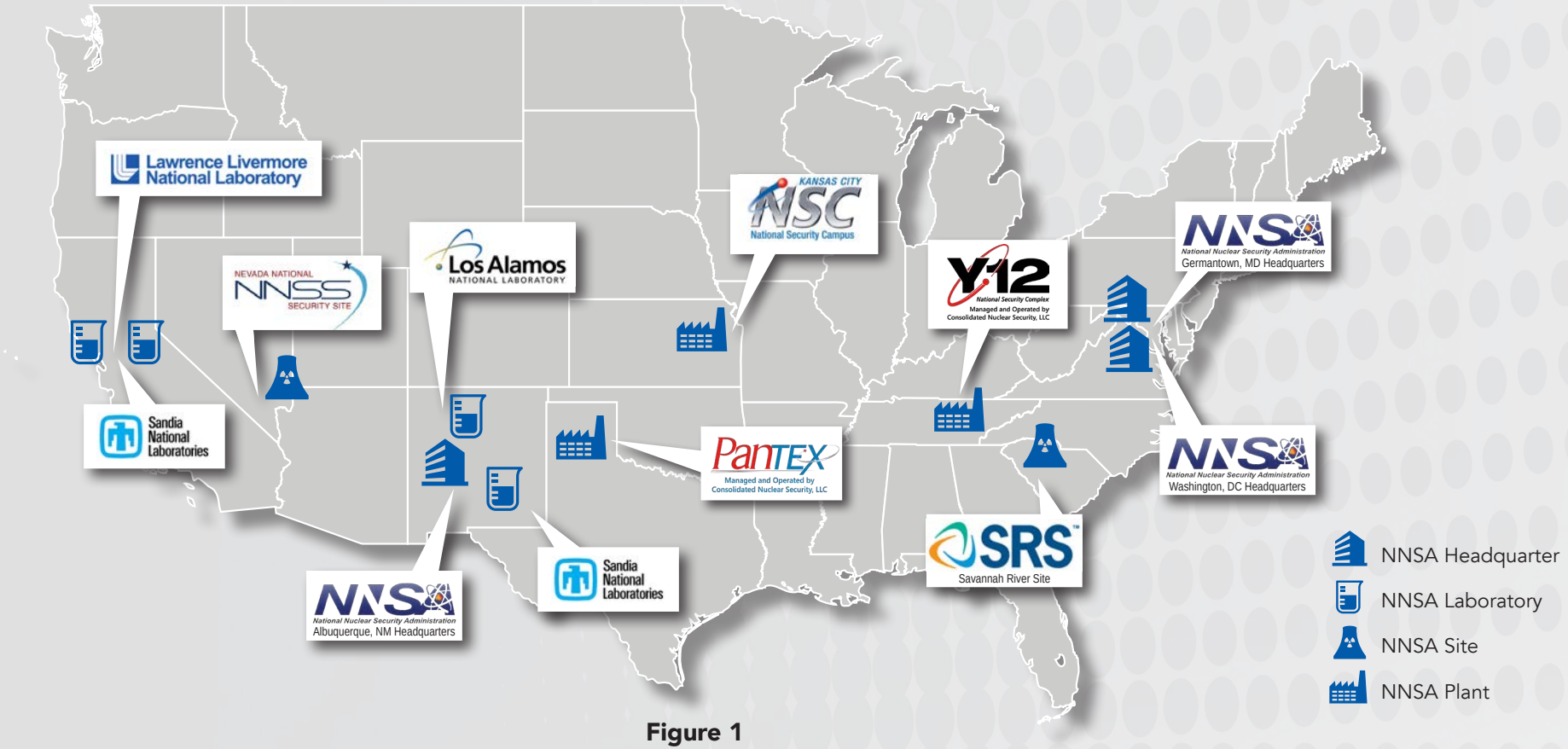


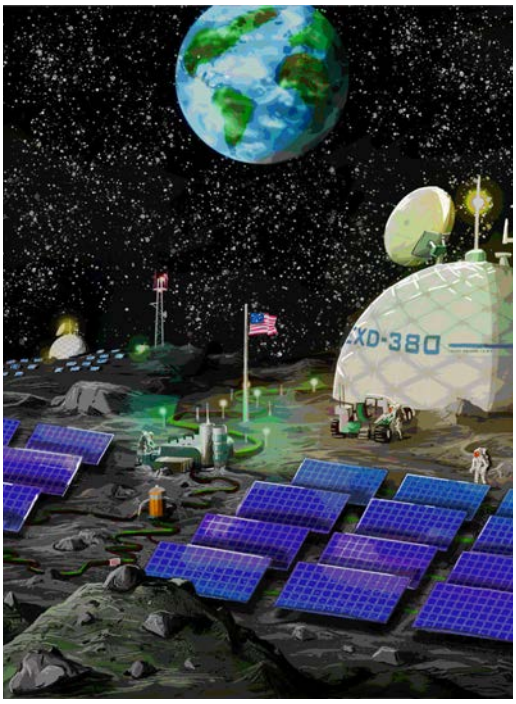
Figure 1

Success Story

Powering the Moon

Sandia National Laboratories is well-known for designing reliable and resilient microgrids for military bases and vital city services. Now, Sandia researchers are working with NASA to design one for the moon.

This is not the first time Sandia has partnered with NASA to power equipment on the moon. In fact, Sandia provided the technical direction for the radioisotope thermoelectric generators that powered the lunar experiments placed by many of the Apollo missions.



An artistic rendering of what a resilient microgrid for a lunar base camp might look like. Sandia National Laboratories engineers are working with NASA to design the system controller for the microgrid. (Illustration by Eric Lundin)

NASA's plan for its concept Artemis lunar base is that it will serve as a technology proving ground for the eventual human exploration of Mars, said Jack Flicker, a Sandia electrical engineer. The base camp concept consists of a habitation unit — complete with room for up to four astronauts — as well as the potential for separate mining and fuel processing, called in-situ resource utilization, facilities. Early Artemis missions will include short stays at the base camp with the goal to build up to stays of two months at a time.

The mining and processing facilities could produce rocket fuel, water, oxygen and other materials needed for extended exploration of the lunar surface while decreasing supply needs from Earth. This facility will be located far away from the base camp — so other science and technology activities conducted there won't be disrupted — but the electrical grid for the two units will be connected during emergencies for resiliency and robustness, Flicker added.

One part of the Sandia team, that includes Lee Rashkin and Dave Wilson, is designing an electrical system controller for the mining and processing center's microgrid. The controller needs to be able to maintain an even voltage level on several different timescales, from less than a thousandth of a second to seasons. "Our goal is to come up with a lunar energy power management system that can efficiently maintain a level system on all those timescales," Wilson said.

Sandia researchers design microgrid for future lunar base

Reliable, resilient microgrid to sustain astronauts, mining and fuel processing

Sandia National Laboratories

The second major focus of the Sandia researchers is developing the system that will connect the mining facility and habitation unit microgrids for resiliency and robustness. Flicker's part of the team is also exploring how the connection between the two microgrids could operate. They're studying the impact the distance between the mining facility and habitation unit has on transfer efficiency and stability, whether they're five miles apart, or 20.

To answer these questions and explore various contingency scenarios, Flicker and electrical engineers Rachid Darbali-Zamora and Andrew Dow are using two research facilities. Sandia's Distributed Energy Technologies Laboratory is used to study the integration of renewable energy resources such as wind turbines and solar panels into larger energy systems. One of the strengths of this lab is hardware-in-the-loop experiments. The team will also use the Emera DC microgrid on Kirtland Air Force Base to see how a power-electronic-heavy system can operate and port power as needed in low-energy contingency scenarios.

"Even though this work is for a microgrid on the moon, the research is also relevant to creating resiliency for communities on Earth," Darbali-Zamora said. "I'm originally from a small town in Puerto Rico. I hope that some of the lessons that come out of this project in terms of resilience, are lessons I can implement back home."

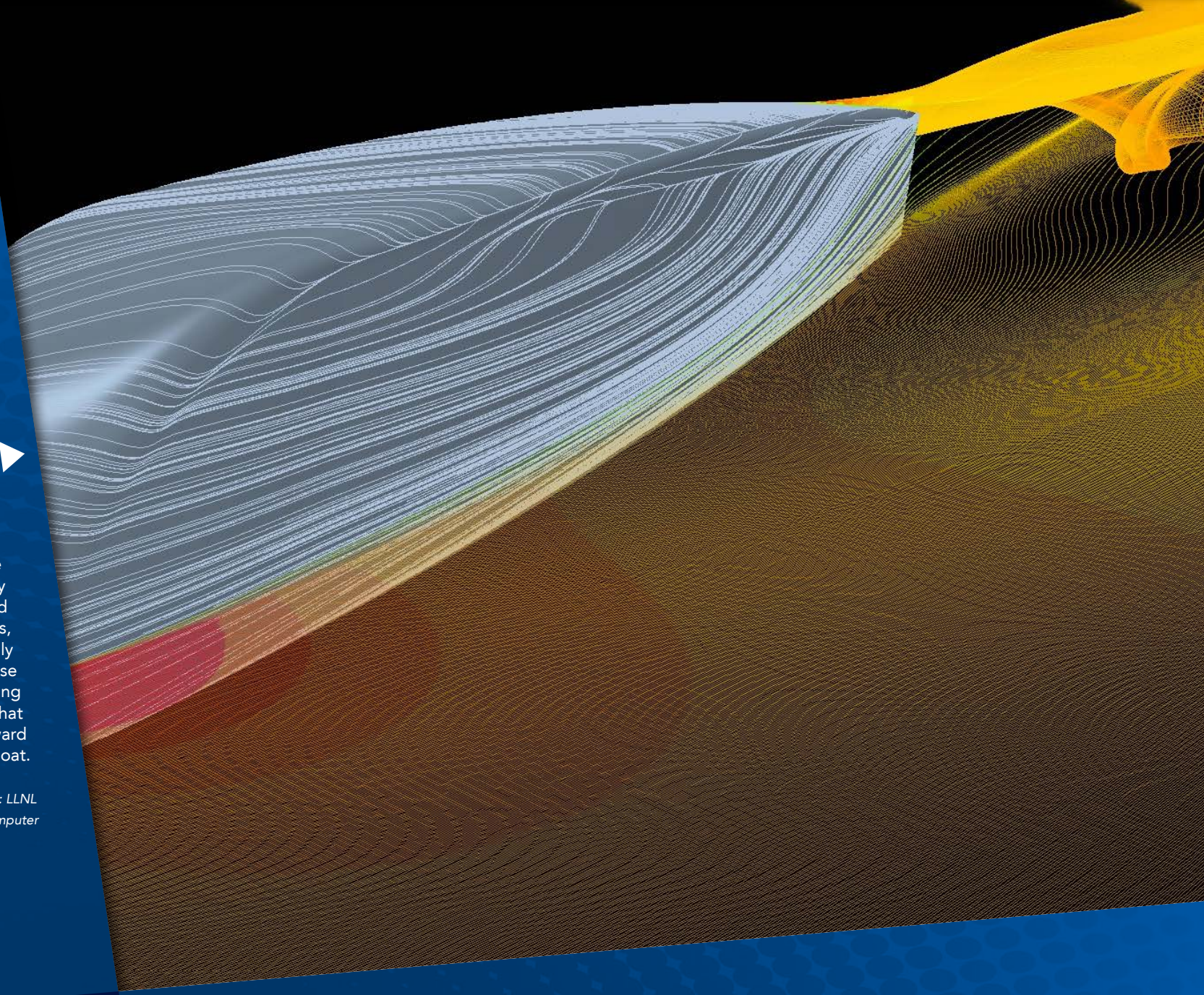
Sandia National Laboratories electrical engineers Rachid Darbali-Zamora, front, and Lee Raskin test out an algorithm on a hardware-in-the-loop set-up at the Distributed Energy Technologies Laboratory. (Photo by Rebecca Gustaf)

Aerodynamic Truck Design

Reshaping the exterior of semitrucks, so that they are aerodynamically integrated along their entire length could reduce drag, increase fuel efficiency, and cut carbon emissions. Using wind tunnel measurements and computational fluid dynamics simulations, Lawrence Livermore National Laboratory engineers have created aerodynamically integrated vehicle shapes for heavy vehicles, such as semitrucks to reduce drag and improve fuel efficiency. The velocity streamlines of the model, developed using LLNL's supercomputers, demonstrated that aerodynamically integrated vehicle shapes decrease body-axis drag in a crosswind, creating large negative front pressures that effectively "pull" the vehicle forward against the wind, much like a sailboat.

Image Credit: LLNL

The image was created by a supercomputer



Lawrence Livermore National Laboratory

January 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 New Year's Day	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16 Martin Luther King Jr. Holiday	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

December 2022

				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	30

February 2023

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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

Smart Enclosure

Engineers at the Kansas City National Security Campus recently designed a "smart enclosure" that protects precision instrumentation, provides additional layers of safety and security, and can be further designed for remote visual monitoring, mobility, and ergonomic access. The patented enclosures were initially manufactured and ultimately licensed by a local Kansas City design firm.

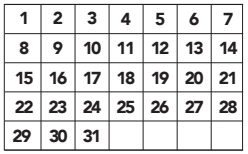
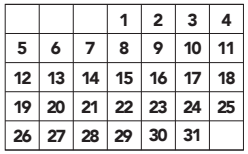
During a 2022 visit to the KCNSC, NNSA Administrator Jill Hruby toured our advanced manufacturing facility and saw these enclosures in operation.

Image Credit: Kansas City National Security Campus, Communications

KANSAS CITY NSC National Security Campus

February 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14 	15	16	17	18
19	20 Presidents' Day	21	22	23	24	25
26	27	28			January 2023 	March 2023 

Analytical Technologies:

NMSBA/solar-powered charging stations being used by Navajo Nation

Through the New Mexico Small Business Assistance (NMSBA) Program, Sandia partnered with Analytical Technologies, Inc., a small business that repairs circuit boards for the oil and gas industry and that recently expanded its services—offering solar adaptation as well as solar generators and solar-maintained streetlights. The company developed a standalone charging station for portable personal electronic devices; These solar-powered charging stations are ideal in rural and out-of-the-way locations, which often do not have easy access to electrical power.

To help refine the charging station's design, Sandia worked with Analytical Technologies to miniaturize, as much as possible, the size of the solar panel, enhance battery life, and bolster the functionality of the inverter and ancillary electronics, such as the charge-management system and maintenance indicators. The Sandia team also selected optimal hardware to ensure system ruggedness in often-challenging environments. The Navajo Nation recently opened a river-walk pathway for the community which features Analytical Technologies' first charging station. The Navajo Nation requested three more charging units, as well as two solar streetlamps for this pathway.

Image Credit: Bret Latter

Sandia National Laboratories

March 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
February 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	April 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23/30 24 25 26 27 28 29		1	2	3	4
5 Non-Proliferation Treaty (1970)	6	7	8	9	10	11
12 Daylight Saving Time begins	13	14	15	16	17	18
19	20 Spring begins	21	22 Ramadan begins at sundown	23	24	25
26	27	28	29	30	31	

Additively Manufactured Tamper Evident Containers

Additive manufacturing creates a unique Tamper Evident Container with arbitrarily complex shaped monitoring electro/optical-mechanical sensors embedded within its walls and lid. The technology provides full coverage to store and transport valuables, sensitive assets, forensic evidence, or accountable items for government or the private sector. Flexible design and simple manufacturing offer customized sizing, capabilities, and mass production. Unlike traditional tamper evident seals, the entire container acts as a seal. Encrypted on-board electronics stored inside record the complete integrity history and environment of the protected items. The container can alert owners or take defensive actions should a disruptive or tamper event occur. Patents are pending. The technology received a 2022 R&D 100 Award.

Image Credit: David Woodfin, Sarah Tasseff, and Allen Hopkins, Los Alamos National Laboratory

2022 R&D 100 WINNER

Los Alamos NATIONAL LABORATORY EST. 1943

April 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
March 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	May 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31					1
2	3	4	5 Passover begins at sundown	6	7	8
9 Easter	10	11	12	13	14	15
16	17	18	19	20 Los Alamos NATIONAL LABORATORY EST. 1943 1943	21	22
23 30	24	25	26	27	28	29

Success Story

Tailored Glass

LLNL researchers have developed an additive manufacturing method that extrudes glass "inks" capable of forming a continuous concentration grading when deposited with the physical precision of 3D printing. Known as Tailored Glass by Direct Ink Writing (TGDIW), the result is a free-form glass production method capable of yielding monoliths and intricate lattices while enabling precision design and engineering of optical and material properties. TGDIW offers a high-level design freedom and resilient construction over a broad range of applications. Designs successfully produced so far include gradient refractive index optics, specially shaped liquid-tight containers, and microfluidic channels.

Direct ink writing (DIW) works by robotically depositing viscous "inks" through a micronozzle over a computer-defined path in order to build an object from the ground up. In TGDIW, the inks form glass. Glass is a unique and difficult material in the context of 3D printing, since it is conventionally produced via a process of melting and fusing silica powders.

LLNL physicist Du Nguyen inspects a tiny flower vase printed using Tailored Glass by Direct Ink Writing technology, where the flow rate of two different glass-forming inks is adjusted to control the material composition emerging from the nozzle during the build. Photo credit: Jason Laurea

Creating "Tailored Glass" using 3D printing

Lawrence Livermore National Laboratory

LLNL's TGDIW process prints silica-based optics and glass components with customizable forms and spatially varying material properties. Flow of multiple glass-forming inks is finely controlled to achieve the desired structure and optical properties. Unlike traditional processes used for developing new silica-based products that are costly and require specialized equipment to withstand very high temperatures, TGDIW eliminates the need for excessive industrial equipment.

There are other significant cost benefits when manufacturing low-volume glass items. Each new structure or new design can be produced using the same equipment rather than requiring expensive custom molds for each new design. Costs for power consumption and specialized work safety requirements could be reduced by working at lower temperatures rather than those used for melting glass. For some applications, it would also eliminate waste material resulting from precision subtractive manufacturing methods.

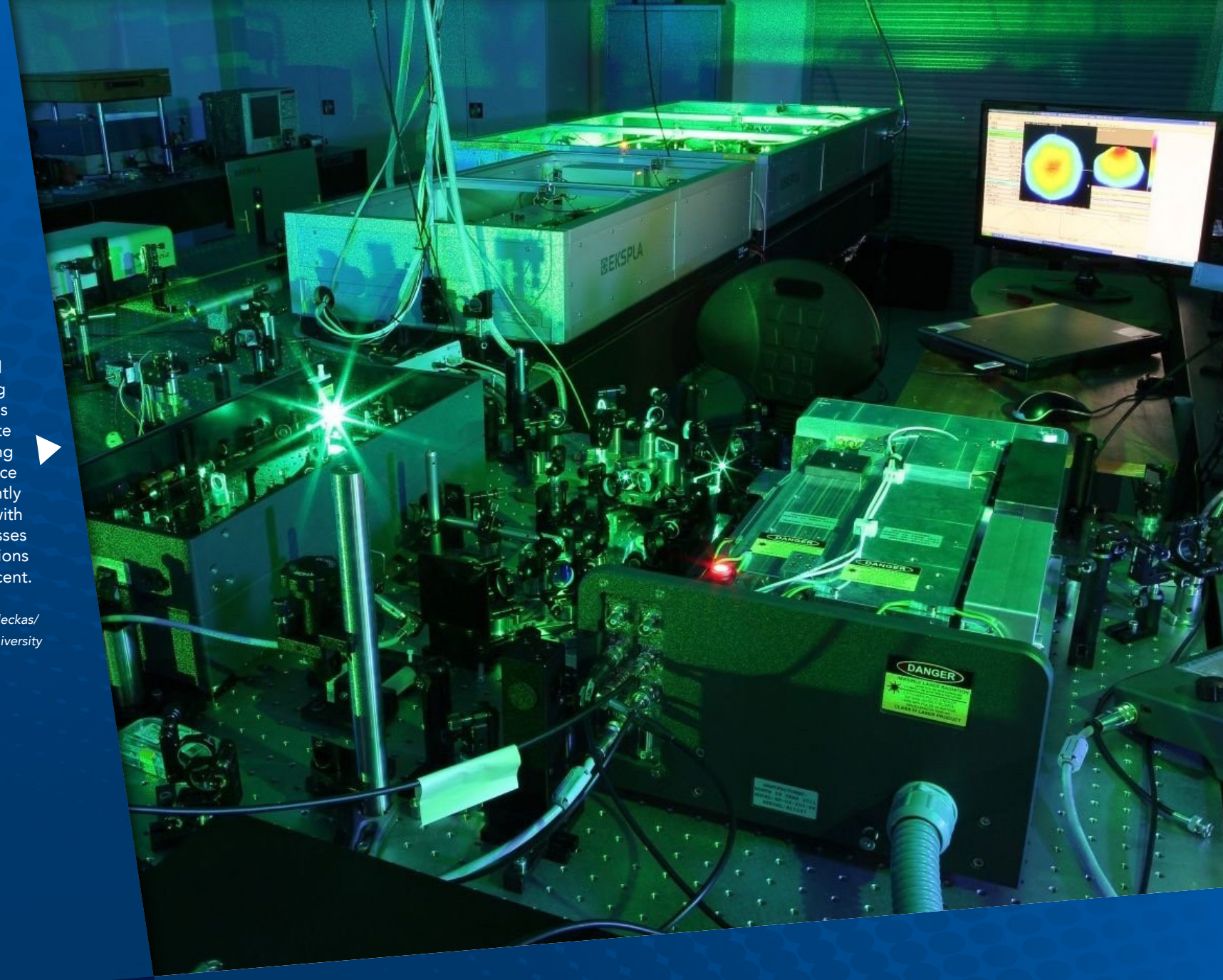
Swarovski has identified the technology's potential for creating products ranging from jewelry to interior lighting that require high refractive indices and optical dispersion. Optimax Systems, Inc., has recognized the unique process for the potential production of lightweight, robust mirrors to operate within laser systems. Several other corporations and institutions in the fields of laser and optical systems, aerospace, and national security and defense, have also expressed similar interest for this application.

"TGDIW offers a high-level design freedom and resilient construction over a broad range of applications."

Light-activated high voltage switch

To address inefficiencies in transmitting electricity over smart grids, engineers at Lawrence Livermore National Laboratory have developed a light-activated switch capable of switching high voltages up to 10 times faster than today's solid-state devices. If fully deployed along the electric grid this device could be used to efficiently control and transmit power with substantially lower energy losses and reducing carbon emissions by more than 10 percent.

Image Credit: Kipras Redeckas/ Vilnius University



Lawrence Livermore National Laboratory

May 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29 Memorial Day	30	31			

April 2023

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2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24	25	26	27	28	29

June 2023

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11	12	13	14	15	16	17
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25	26	27	28	29	30	

Quantum Dot Lightning Detection and Warning System and Method (Pantex)

In the Quantum Dots Lightning Detection and Warning System, UV and visible radiation from lightning initiates the photoluminescence of visible light of one or more given wavelengths from the Quantum Dots (QD). The QDs are operable for receiving UV, IR, visible, X-ray, and/or gamma ray radiation emanating from lightning and generating visible colored light that may be detected and utilized to generate topological event information, such that people and property may be safeguarded. The CNS team was recognized for this patented technology with a Calendar Year 2021 Defense Programs Award of Excellence.

Image Credit: iStock (1060120946)

PanTEX
Managed and Operated by
Consolidated Nuclear Security, LLC

June 2023

National Nuclear Security Administration

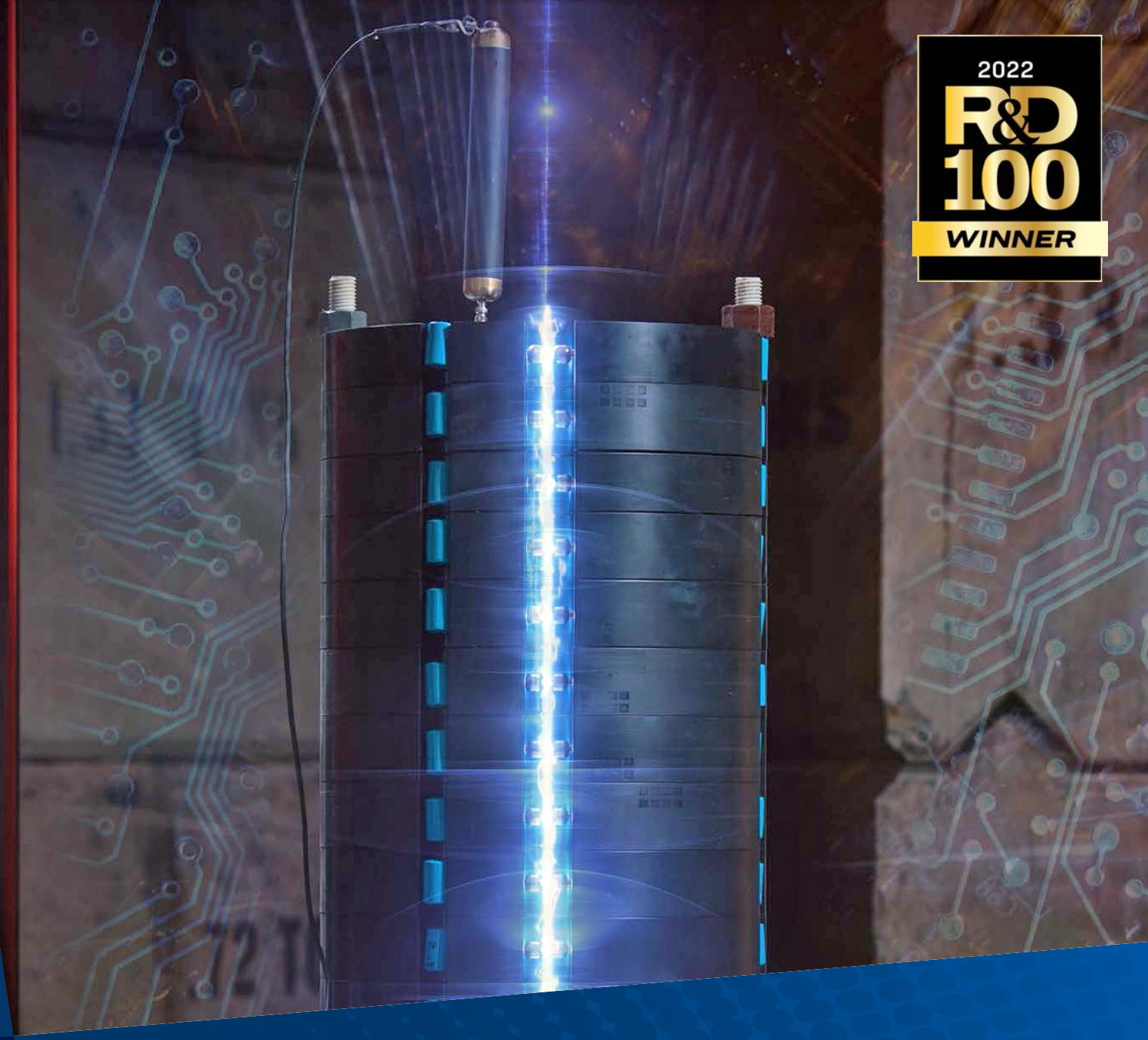
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	July 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 30 24 31 25 26 27 28 29			1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19 Juneteenth	20	21 Summer begins	22	23	24
25	26	27	28	29	30	

K-Modules: Capacitive energy modules for pulsed power applications

NNSA laboratories operate flash X-ray radiography devices during dynamic experiments to produce photographs of dense objects that are moving at extremely high speeds. Radiographic images can be used to validate computer models for device behavior under extreme conditions. X-ray generating devices use a capacitive module stack as their energy source. DoD labs and defense contractors use the stack to generate intense electron beams for radiation effects characterization of high value electronic circuits. Current capacitor modules, which are based on 40+ year old technology, are aging and unreliable. Los Alamos National Laboratory developed K-Modules—new capacitive energy modules—using sophisticated design and simulation software and state-of-the-art components. The K-Modules offer extended stack lifetime, enhance safety, and increase resolution of radiographs. A patent is pending. The K-Module technology received a 2022 R&D 100 Award.

Image: K-Module stack firing.

Image Credit: David Woodfin, Hans Sundquist, and Allen Hopkins, Los Alamos National Laboratory



2022 R&D 100 WINNER

Los Alamos NATIONAL LABORATORY EST.1943

July 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
June 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	August 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31					1
2	3	4 Independence Day	5	6	7	8
9	10	11	12	13	14	15
16 Trinity Test Day (1945)	17	18	19	20	21	22
23 30	24 31	25	26	27	28	29

Customized Capacitor CRADA:

CRADA with TPL, Inc./customed capacitors for new generation of Z Machine

Sandia National Laboratories' Z Machine uses multiple capacitors and creates intense magnetic fields associated with high electrical currents. As part of Sandia's efforts to design a Z Machine successor pulsed power facility and improve capacitors for broader applications, Sandia is investigating customized capacitors that demonstrate increases in lifetime, capacity, and overall performance. In 2021, Sandia entered into a Cooperative Research and Development Agreement (CRADA) with TPL Inc., a company specializing in capacitor design, testing, evaluation, and manufacturing that has developed a range of custom capacitors for multiple federal agencies.

Sandia's Electrical and Radiation Sciences Center is working with TPL to support the development of advanced capacitor devices. These activities will be instrumental in demonstrating a new capacitor analysis method for validating reliable performance of TPL's domino style capacitors for defense applications. The improved capacitors will likely be used for Sandia's Z Machine, the next-generation pulsed power facility, and other federal customers.

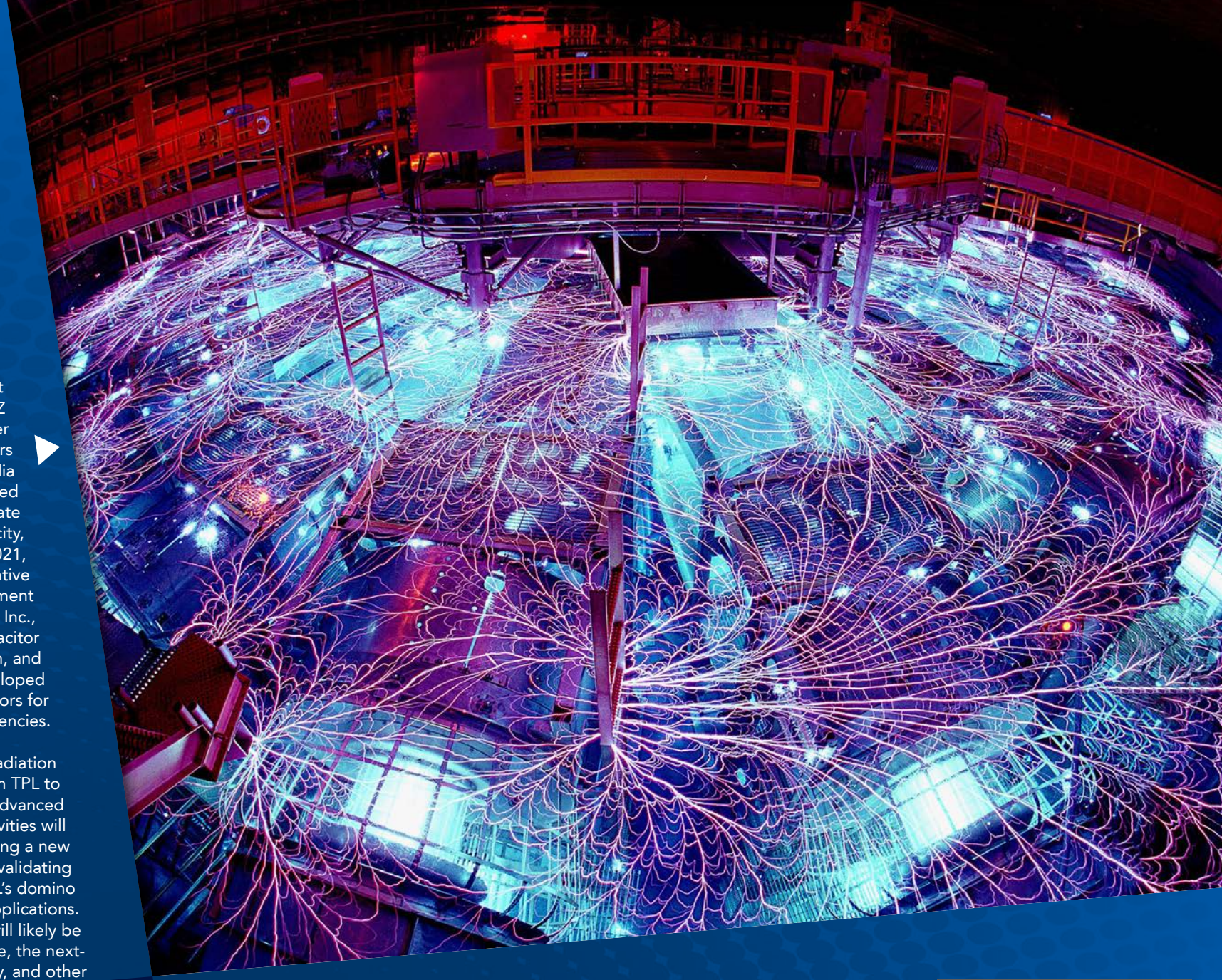


Image Credit: Randy Montoya

Sandia National Laboratories

August 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
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27	28	29	30	31		

July 2023

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2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23 30	24 31	25	26	27	28	29

September 2023

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3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Success Story

Pajarito Powder LLC

Pajarito Powder designs and manufactures advanced catalysts used in electrolyzers and fuel cells. The catalyst powder made by Pajarito Powder—using technology licensed from Los Alamos National Laboratory—is at the heart of hydrogen fuel cell systems central to the functionality of commercial and personal vehicles.

To enter the global market, the company needed to optimize their catalyst powders and certify operation, durability, and performance. This would also help them in developing the next generation of catalysts to meet future customer demands. Durability is particularly important to industry success since car buyers want vehicles which will maintain performance for years to come.

Siddharth Komini Babu and his team aided Pajarito Powder through a Technology Readiness Gross Receipts Initiative (TRGR) Technology Readiness Project.

LANL's advanced catalysts used in electrolyzers and fuel cells

A TRGR Technology Readiness Project enabled the company to work with Los Alamos scientist Siddharth Komini Babu and his team (Xiaojing Wang, Rangachary Mukundan, and Rod Borup) to investigate the degradation process of the catalyst products. Komini Babu and his team used methods pioneered at Los Alamos National Laboratory to test durability and performance, and identify current degradation mechanisms that wear down the catalyst over time. This benchmarked the catalyst's performance and durability, and also identified areas where the catalyst could be optimized.

Pajarito Powder used the results and guidance provided by Los Alamos to expand their customer base and deploy their fuel cells globally. They also have been able to hire six New Mexicans in the past six months. The company continues to work with Los Alamos through a second Technology Readiness Project to develop their next-generation catalyst.

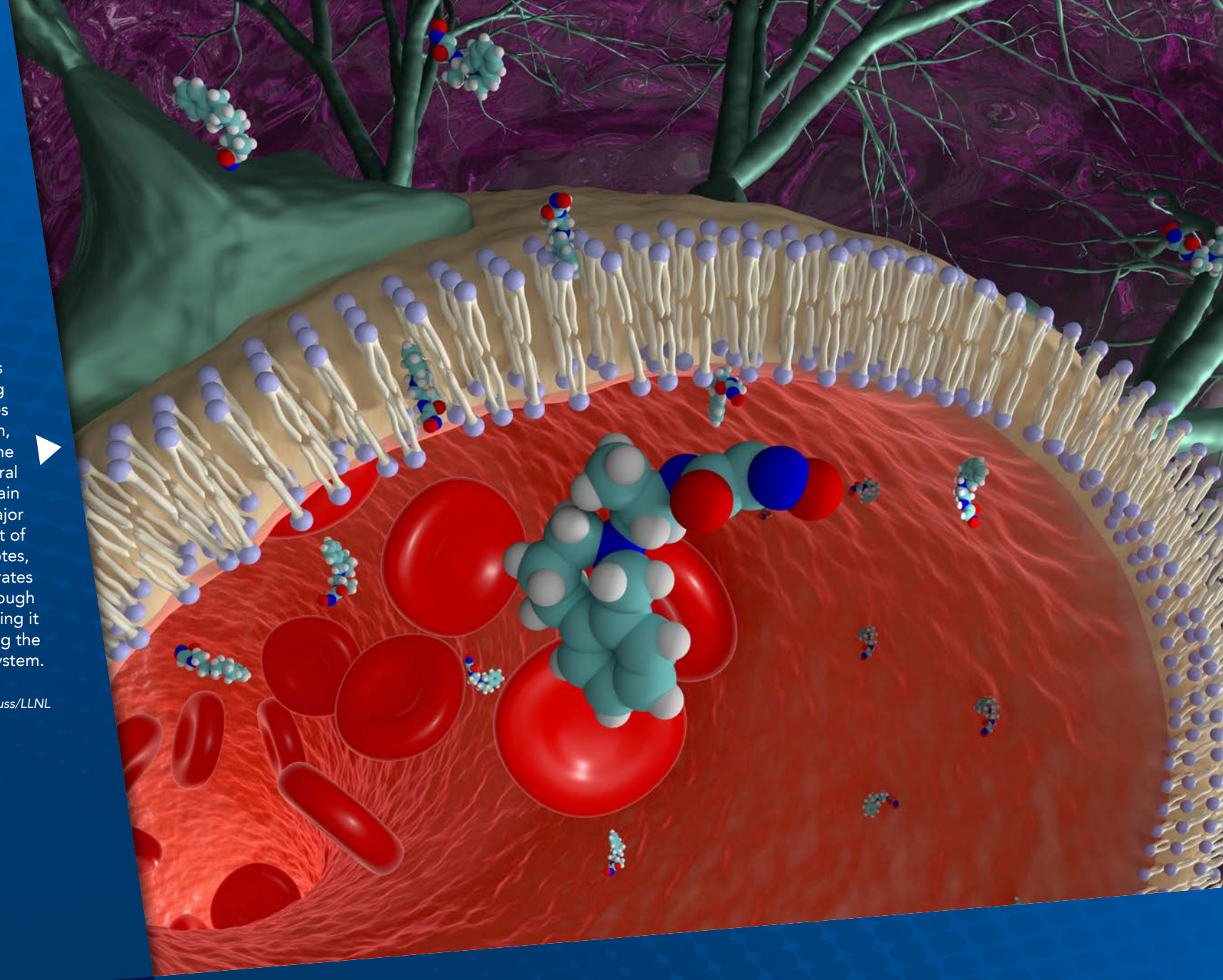
"Los Alamos helped us understand how our catalyst materials work and how to improve them. Better materials allow us to expand our customer base and therefore our footprint and workforce in New Mexico."

- Barr Zulevi
CTO of R&D and President
Pajarito Powder, LLC

Nerve Agent Antidote

Lawrence Livermore National Laboratory developed a versatile antidote called LLNL-02 to counteract exposure to nerve agent poisoning. Chemical weapon nerve agents typically function by blocking the transmission of messages from the central nervous system, composed of the brain and the spinal cord. The brain's natural protection — the blood-brain barrier — has long been a major obstacle to the development of effective nerve agent antidotes, until now. This image illustrates LLNL-02s ability to pass through the blood-brain barrier, making it more effective in protecting the central nervous system.

Image Credit: Liam Krauss/LLNL



Lawrence Livermore National Laboratory

September 2023

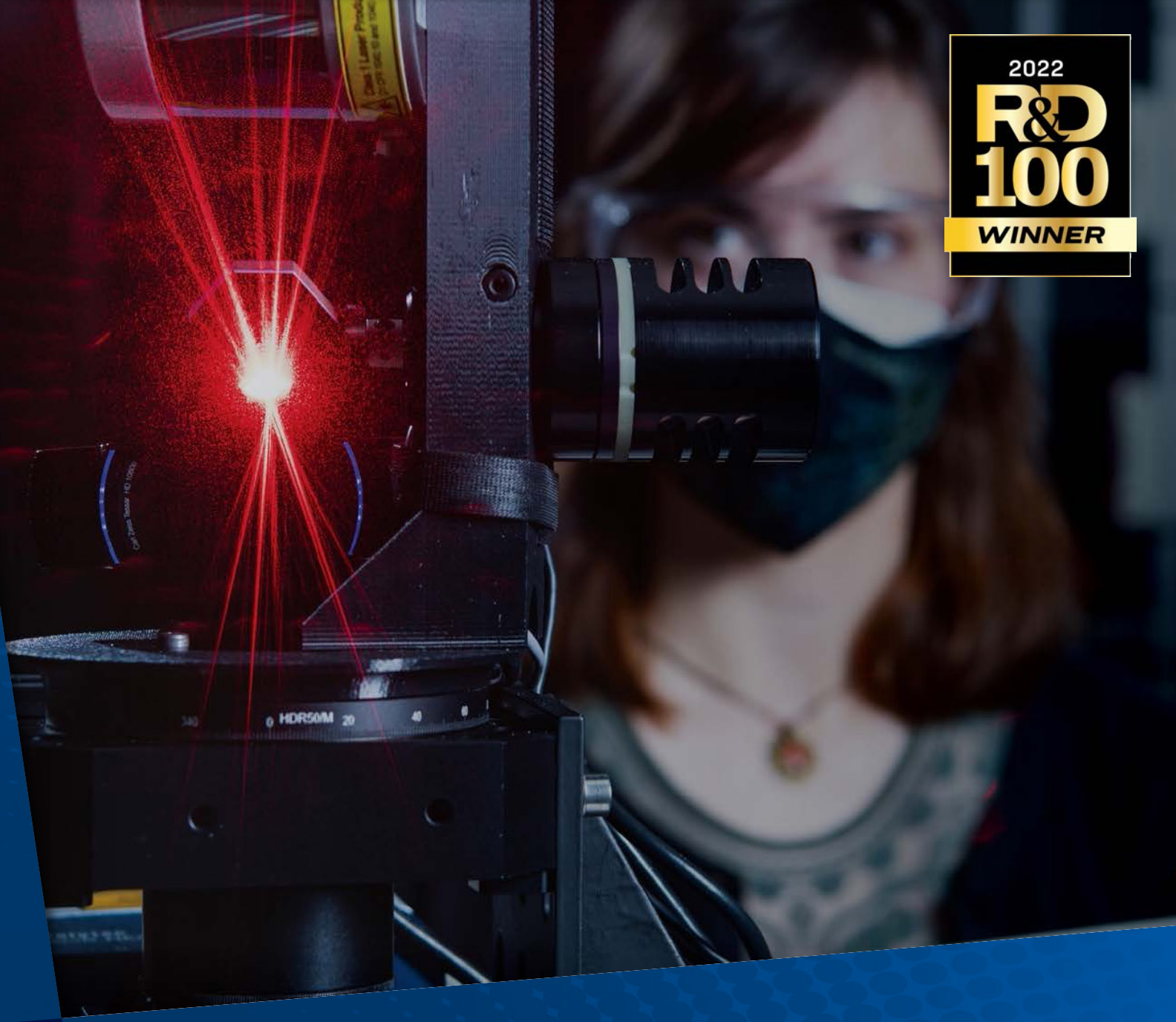
National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
August 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	October 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31				1	2 Lawrence Livermore National Laboratory 1952
3	4 Labor Day	5	6	7	8	9
10	11	12	13	14	15	16
17 PanTEX 1942	18	19	20	21	22	23 Fall Begins
24	25	26	27	28	29	30

ASSESS: Acoustic Steady-State Excitation Spatial Spectroscopy for rapid nondestructive three-dimensional evaluation of hidden material defects

ASSESS is a full-structure, three-dimensional (3D) nondestructive evaluation tool that quickly identifies subtle, hidden material defects, such as corrosion, cracking, and delamination, which can undermine structural integrity. The versatile technology applies to metals, plastics, composites, and additively manufactured components. Modern systems and infrastructure that support national security rely on advanced materials, designs, and manufacturing processes. To maximize asset readiness, ASSESS can provide a means of cradle-to-grave state-of-health monitoring through rapid, full-body inspection both during manufacturing and throughout the service life of the system. A CRADA with an industry collaborator has resulted in jointly developed intellectual property that is being field-tested for a variety of applications and prospective commercialization opportunities. ASSESS won a 2022 R&D 100 Award.

Image Credit: David Woodfin, Kendra Castle, and Allen Hopkins, Los Alamos National Laboratory



2022 R&D 100 WINNER

Los Alamos NATIONAL LABORATORY EST.1943

October 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5 NNSA 1999	6	7
8	9 Columbus Day	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September 2023

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

November 2023

			1	2	3	4
5	6	7	8	9	10	11
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19	20	21	22	23	24	25
26	27	28	29	30		

RAPTR: Reusable N95 mask/ R&D100

The COVID-19 Pandemic has uncovered shortcomings in our personal protective equipment, commonly referred to as "PPE," and our dependence on foreign supply chains. Many medical professionals and other essential, frontline workers have struggled with persistent shortages of N95 masks. A Sandia team has developed and tested a preliminary design for a reusable N95 respirator intended for medical applications, both for the current pandemic as well as any future pandemics, outbreaks, or epidemics that could occur worldwide. This design, called the Rapidly Producible/Reusable N95 Respirator (RAPTR), will offer many advantages to first responders and medical staff, including the ability to fully disassemble the mask so that each part can be cleaned or replaced independently. RAPTR has been designed for rapid producibility using standard injection molding processes and filters both inhaled and exhaled air with nonproprietary, replaceable N95 material stored inside two disc-shaped cases, protecting wearers and patients. The prototype won an R&D100 award in 2021.

Image Credit: Randy Montoya

Sandia National Laboratories

November 2023

National Nuclear Security Administration

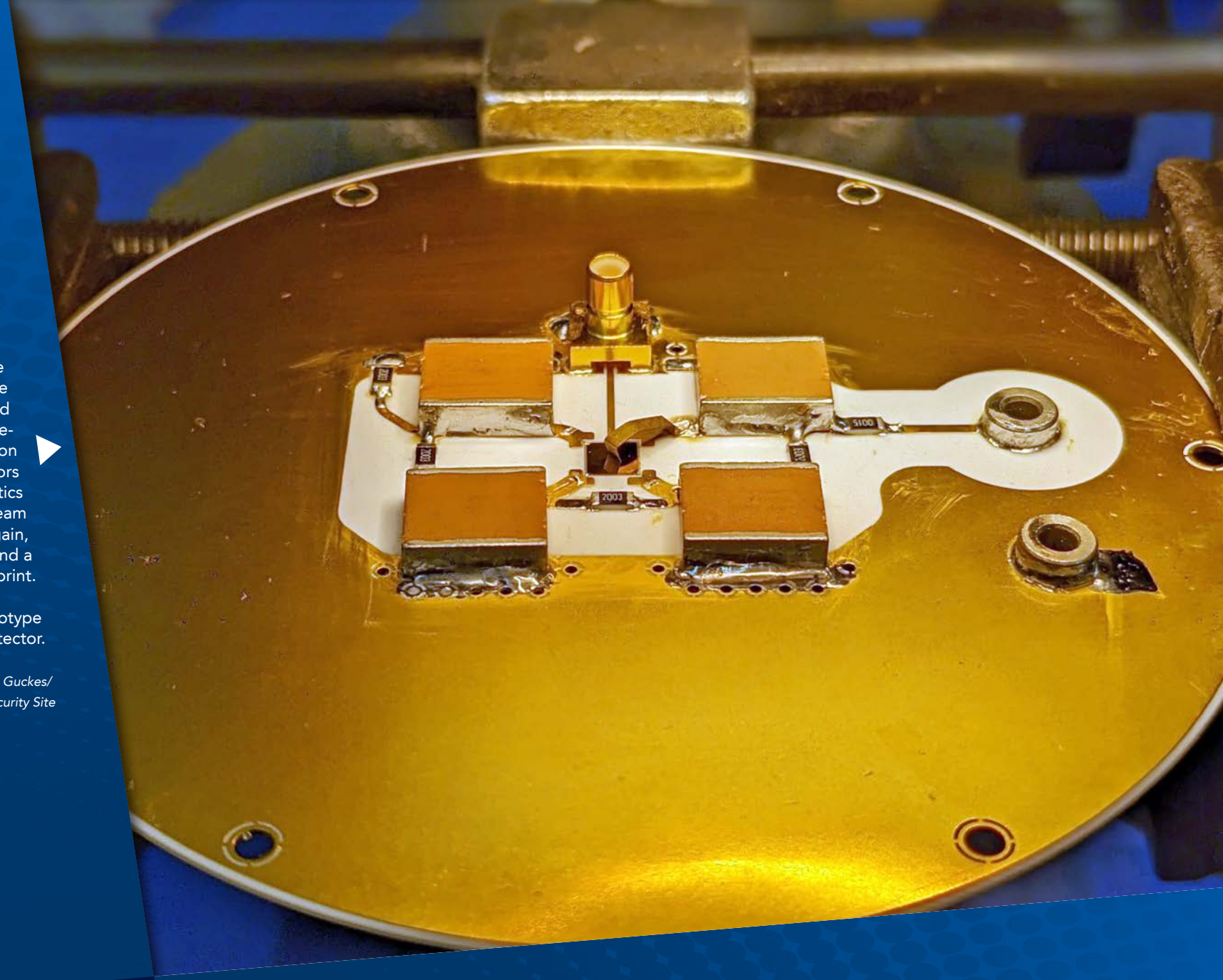
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1 Sandia National Laboratories 1949	2	3	4 Y-12 National Security Complex 1943
5 Daylight Saving Time ends	6	7 Election Day	8	9	10	11 Veterans Day
12	13	14	15	16	17	18
19	20	21	22	23 Thanksgiving Day	24	25
26	27	28	29	30	October 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	December 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

MAD (Multi-Layered Avalanche Diamond) Detector

Researchers at the Nevada National Security have designed and fabricated two prototype multi-layered avalanche diamond (MAD) detectors for use in measuring pulsed neutrons from a dense plasma focus. Taking advantage of the intrinsic avalanche and atomic properties of a single-crystal chemical vapor deposition diamond, these MAD detectors improve upon current diagnostics required for accurate in-beam measurements, adding inherit gain, improved detection efficiency, and a small footprint.

Image: Close up of prototype MAD detector.

Image Credit: Amber Guckes/ Nevada National Security Site



NEVADA NATIONAL NNSS SECURITY SITE

December 2023

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
November 2023 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	January 2024 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31				1	2
3	4	5	6	7 Hanukkah begins at sundown	8	9
10	11	12	13	14	15	16
17	18 NEVADA NATIONAL NNSS SECURITY SITE 1950	19	20	21 Winter Begins	22	23
24 31	25 Christmas Day	26 Kwanzaa begins	27	28	29	30

Timeline

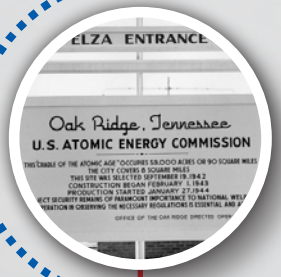
National Security Laboratories, Plants, and Sites

The desperate need for munitions to fight World War II led to the creation of the **Pantex** Ordnance Plant, built on 16,000 acres of land east of Amarillo, Texas. Operations began on September 17, 1942, only nine months after the commencement of construction. Pantex continues its key role of ensuring the safety, security and reliability of the nation's nuclear stockpile by dismantlement of excess weapons, conducting surveillance on the stockpile, and maintaining aging weapons through Life Extension Programs.

September 17
1942

The first week of April, the **Los Alamos National Laboratory (LANL)** hosted its first, major technical conference: The Los Alamos Primer Conference. The proceedings were transcribed and became LA-1, the Lab's first report. On April 20, 1943, the University of California signed the contract to operate the Los Alamos Laboratory with a single mission: to design and build an atomic bomb. Today, different research programs at the Lab directly and indirectly support the current mission: maintaining the safety, security and reliability of the nation's nuclear deterrent without the need to return to underground testing.

April 20
1943



In the midst of the second World War, ground was broken in rural East Tennessee for the first production building at the **Y-12** Electromagnetic Separation Plant and operations began on November 4, 1943. The plant's job was to make enough enriched uranium for a new kind of bomb, an atomic bomb. Thirty months later the success of Y-12's mission was announced to the world when two atomic weapons were detonated, the Empire of Japan surrendered, and World War II ended. Today, Y-12 processes and stores special materials vital to our national security and contributes to the prevention of the spread of weapons of mass destruction.

November 4
1943

The Kansas City Division became a reality on February 14, 1949, after the Bendix Corporation, a subsidiary of Honeywell International Inc., was selected by the Atomic Energy Commission to perform "certain operations; the exact details of which are classified." The employees guarded the nature of the mission so well that, for many years, the community assumed the plant made washing machines. Today the **Kansas City National Security Complex's (KCNSC)** primary focus is manufacturing 85 percent of non-nuclear components that go into the nuclear stockpile and developing advanced solutions for complex national security issues, ranging from prototype simulations to production to quality.

February 14
1949

Sandia National Laboratories began in July 1945 as the "Z Division" of Los Alamos National Laboratory. On November 1, 1949, Sandia Corporation took over its management as it separated from Los Alamos. A second site was opened in California's Livermore Valley in 1956. Although Sandia originated as a single-mission engineering organization for nonnuclear components of nuclear weapons, today, under National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., it is a multiprogram laboratory engaging in research supporting a broad spectrum national security issues.

November 1
1949

On December 18, 1950, President Harry Truman authorized a 680-square mile section of the Nellis Air Force Gunnery and Bombing Range in Southern Nevada as the Nevada Proving Grounds, and on January 27, 1951, the first atmospheric nuclear test was detonated at the Proving Grounds. Following a few name changes and an international ban on nuclear testing the **Nevada National Security Site (NNSS)** reflects a current mission of planning, experimentation and training to prevent and counter global and homeland security threats.

December 18
1950

On September 2, 1952, the Atomic Energy Commission granted the request of Los Alamos National Laboratory scientist, Edward Teller, to establish a laboratory as a branch of the Berkeley-based University of California's Radiation Laboratory (UCRL). Located at a deactivated naval air station, **Lawrence Livermore National Laboratory (LLNL)** addressed urgent national security needs by advancing nuclear weapons science and technology at the height of the Cold War. Over its history, LLNL has strengthened national security by developing and applying world-class science, technology and engineering that enhances the nation's defense, reduces the global threat from terrorism and weapons of mass destruction, and responds to scientific issues of national importance.

September 2
1952

On October 5, 1999, President Bill Clinton signed the National Defense Authorization Act, bringing the **National Nuclear Security Administration (NNSA)** into existence. The NNSA operates as a semi-autonomous agency within the U.S. Department of Energy (DOE) and is responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad and provides safe and secure transportation of nuclear weapons and components and special nuclear materials.

October 5
1999

January

February

March

April

May

June

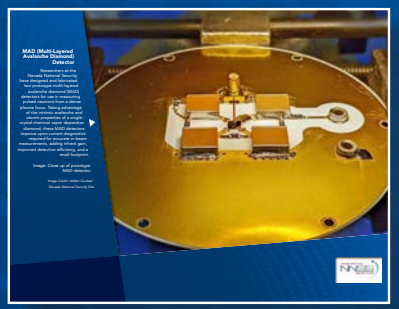
July

August

September

October

November



December

National Nuclear Security Administration