Technology Transfer at NNSA

2024
CALENDAR

NNSA
National Nuclear Security Administration

NNSA Technology Transfer Program

The National Nuclear Security Administration (NNSA) is a semi-autonomous agency responsible for carrying out the nuclear security responsibilities of the Department of Energy (DOE) including (1) the maintenance of a safe, secure, and reliable stockpile of nuclear weapons and associated special nuclear materials, capabilities, and technologies; (2) defense nuclear nonproliferation; and (3) naval nuclear propulsion. NNSA's enterprise consists of its headquarters (HQ), field offices, and national security laboratories, plants, and sites (LPS). NNSA is run from HQ buildings spread over three sites (Forrestal, Germantown, and the Albuquerque Complex) and conducts its critical missions at field offices and LPS nationwide. As shown in the national map (Figure 1), NNSA conducts research, development, and technology transfer programs at the national laboratories: Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), and Sandia National Laboratories (SNL) as well as plants and sites within the NNSA nuclear security enterprise: Nevada National Security Site (NNSS), Pantex Plant (Pantex), Kansas City National Security Campus (KCNSC), Y-12 National Security Complex (Y-12), and the Savannah River Site (SRS). Under the NNSA Act, the NNSA Administrator is given authority over all programs, activities, and contract administration duties for our Nation's nuclear security organizations.

Within the NNSA, one of the key mechanisms by which knowledge, intellectual property, and capabilities developed at NNSA LPS are transferred to other entities, such as external 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 LPS 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 by leveraging NNSA-sponsored technology, capabilities, and expertise and has led to a multitude of patents, agreements, companies, and awards. At NNSA HQ, the intersectionality of the Technology 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.

> “A key mission of the National Nuclear Security Administration (NNSA), as established in the NNSA Act, is to support the United States' leadership in Science and Technology. Technology transfer is vital to the scientific and technical advancement of the Nation and to its military and economic security. The Technology Transfer Program of the NNSA provides an effective process to allow cutting-edge science and technology advancements developed at the NNSA laboratories, plants, and sites to benefit the taxpayer and the economy. These technology transfer efforts yield significant returns, not only by economic measures but also by enhancing quality-of-life for our citizens and assuring the continued recognition of the Nation as a leader in scientific and technological innovation.”
>
> **- Dr. Kevin Greenaugh**
> *Chief Science and Technology Officer*
> *National Nuclear Security Administration*

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 have provided great impact to the global community. Several of the groundbreaking technologies developed within the Nuclear Security Enterprise are highlighted in this calendar.

NNSA's Chief Science and Technology Office (CSTO) has the primary responsibility for federal oversight of technology transfer activities. CSTO ensures that the LPS are able to deliver back to the American people the benefits of taxpayer-funded work in cutting-edge science and technology research and development (R&D). Management, oversight, and reporting requirements for technology transfer activities overseen by CSTO derive from multiple US Government laws, Federal statutes, and DOE Orders. Internally, the Technology Transfer Program priorities are guided by a Strategic Framework consisting of three pillars and six strategic actions that support the pillars. The three pillars are (1) technology transfer for mission, (2) data analysis in support of commercialization, and (3) commitment to diversity, equality, inclusion, and accessibility (DEIA) in the technology transfer and commercialization landscape. The six strategic actions are: (i) advancement, commercialization, and refinement of technology; (ii) development, recruitment, and retention of workforce; (iii) economic growth; (iv) establishing public recognition and brand awareness; (v) engaging in outreach and establishing collaborative partnerships ; and (vi) safeguarding U.S. technological innovations.

National Security Laboratories, Plants, and Sites

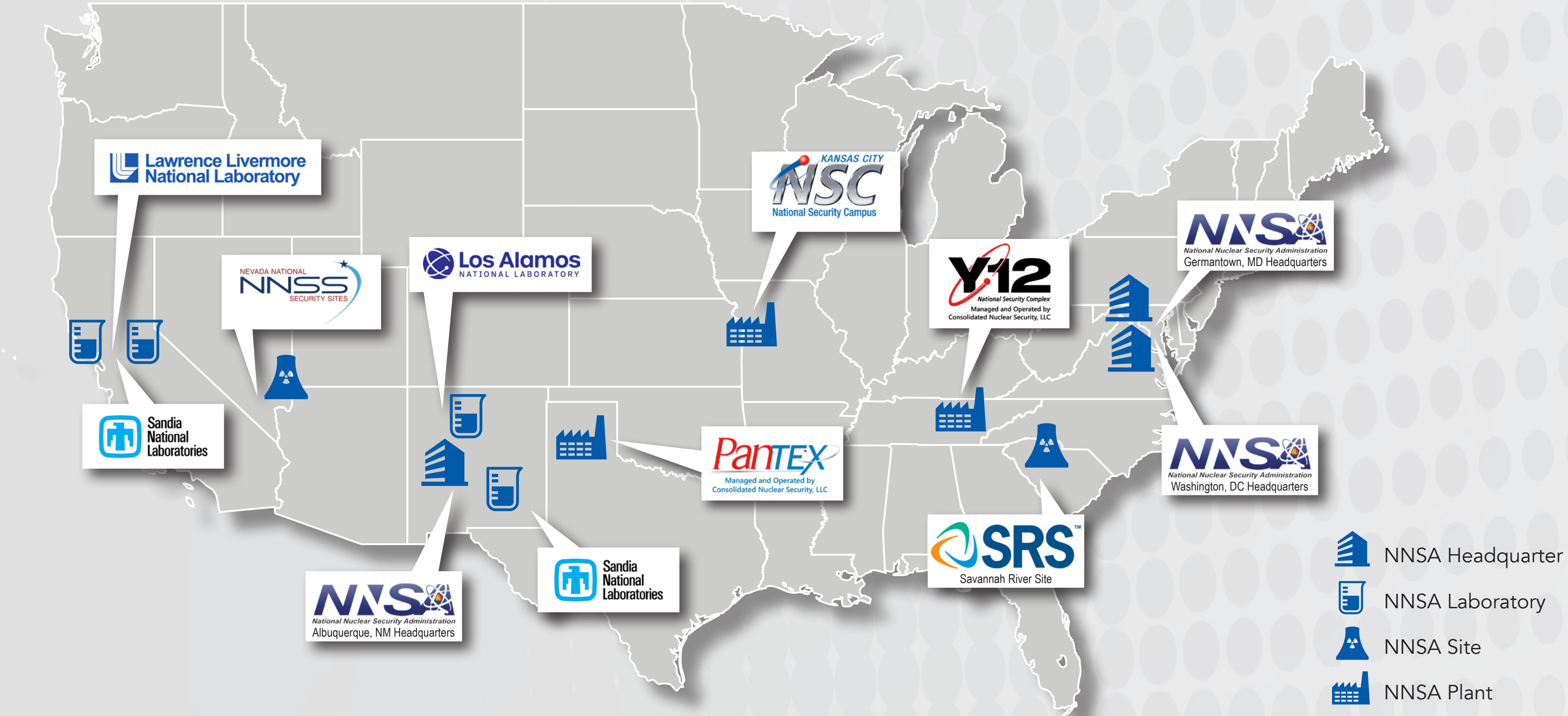
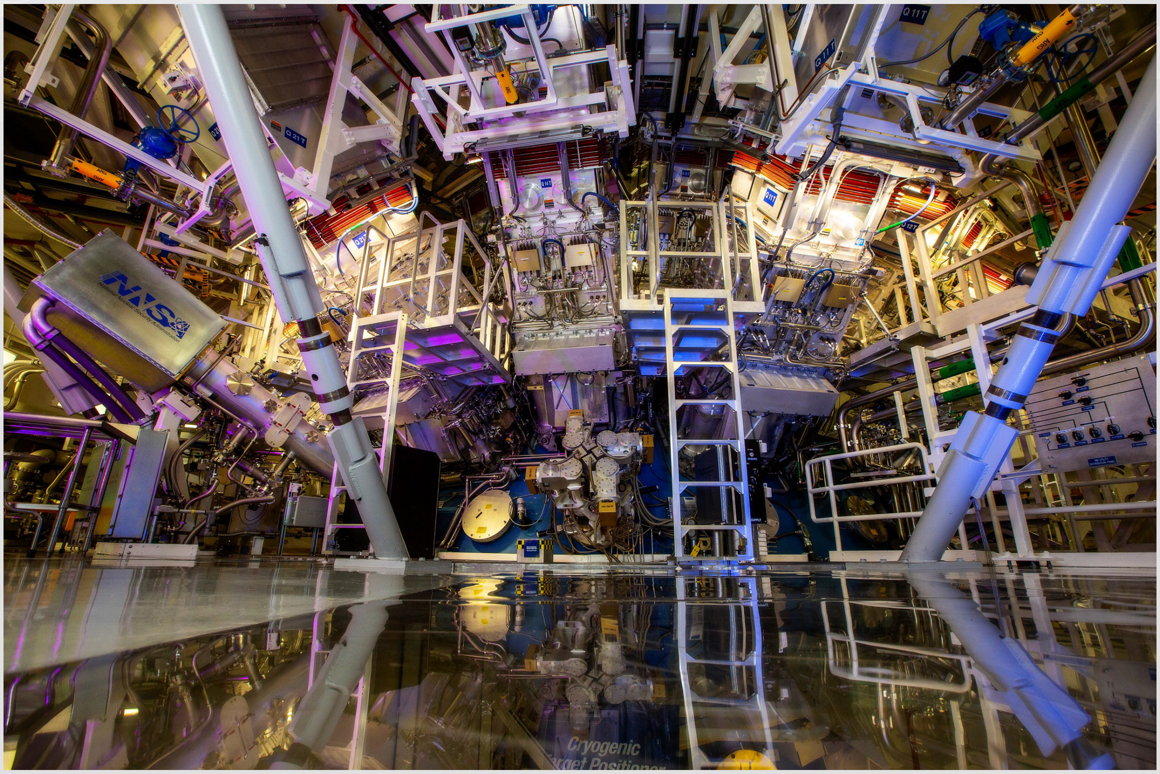


Figure 1

Fusion Ignition at the National Ignition Facility

The U.S. Department of Energy (DOE) and DOE's National Nuclear Security Administration (NNSA) announced the achievement of fusion ignition at Lawrence Livermore National Laboratory (LLNL)—a major scientific breakthrough decades in the making that will pave the way for advancements in national defense and the future of clean power. On December 5, 2022, a team at LLNL's National Ignition Facility (NIF) conducted the first controlled fusion experiment in history to reach this milestone, also known as scientific energy breakeven, meaning it produced more energy from fusion than the laser energy used to drive it. This historic, first-of-its kind achievement will provide an unprecedented capability to support NNSA's Stockpile Stewardship Program and will provide invaluable insights into the prospects of clean fusion energy, which would be a game-changer for efforts to achieve President Biden's goal of a net-zero carbon economy.



Fusion Ignition: The Chamber where it happened

The target chamber of LLNL's National Ignition Facility, where 192 lasers delivered more than 2 million joules of ultraviolet energy to a tiny fuel pellet to create fusion ignition on Dec. 5, 2022. Ignition is a potentially world-changing breakthrough for fusion energy and a key initial step in a decades-long quest for limitless clean energy. LLNL has been out in front in helping spur development of Inertial Fusion Energy (IFE), including sponsoring a community workshop on the potential for Inertial Confinement Fusion (ICF) research to generate commercially viable IFE and participating in a DOE workshop on public-private fusion energy partnerships. Photo Credit: Jason Laurea/LLNL

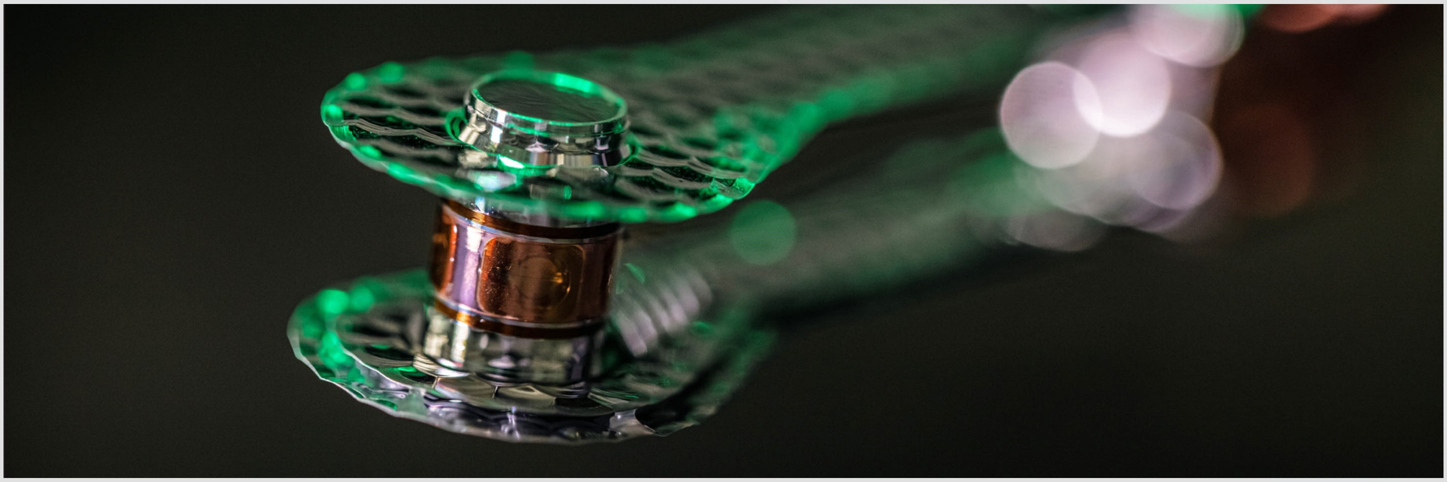
DOE National Laboratory Makes History by Achieving Fusion Ignition | Department of Energy

Lawrence Livermore National Laboratory

Fusion Ignition: The Team

Michael Stadermann, Jean-Michel Di Nicola, and Annie Kritcher (left to right) are three members of the large, cross-disciplinary team that achieved fusion ignition at LLNL in December 2022. Ignition is a potentially world-changing breakthrough for fusion energy and a key initial step in a decades-long quest for limitless clean energy. LLNL has been out in front in helping spur development of Inertial Fusion Energy (IFE), including sponsoring a community workshop on the potential for Inertial Confinement Fusion (ICF) research to generate commercially viable IFE and participating in a DOE workshop on public-private fusion energy partnerships. Photo Credit: Blaise Douros/LLNL

> **"This achievement… will provide valuable insights into the prospects of clean fusion energy…"**



Fusion Ignition: The Hohlraum

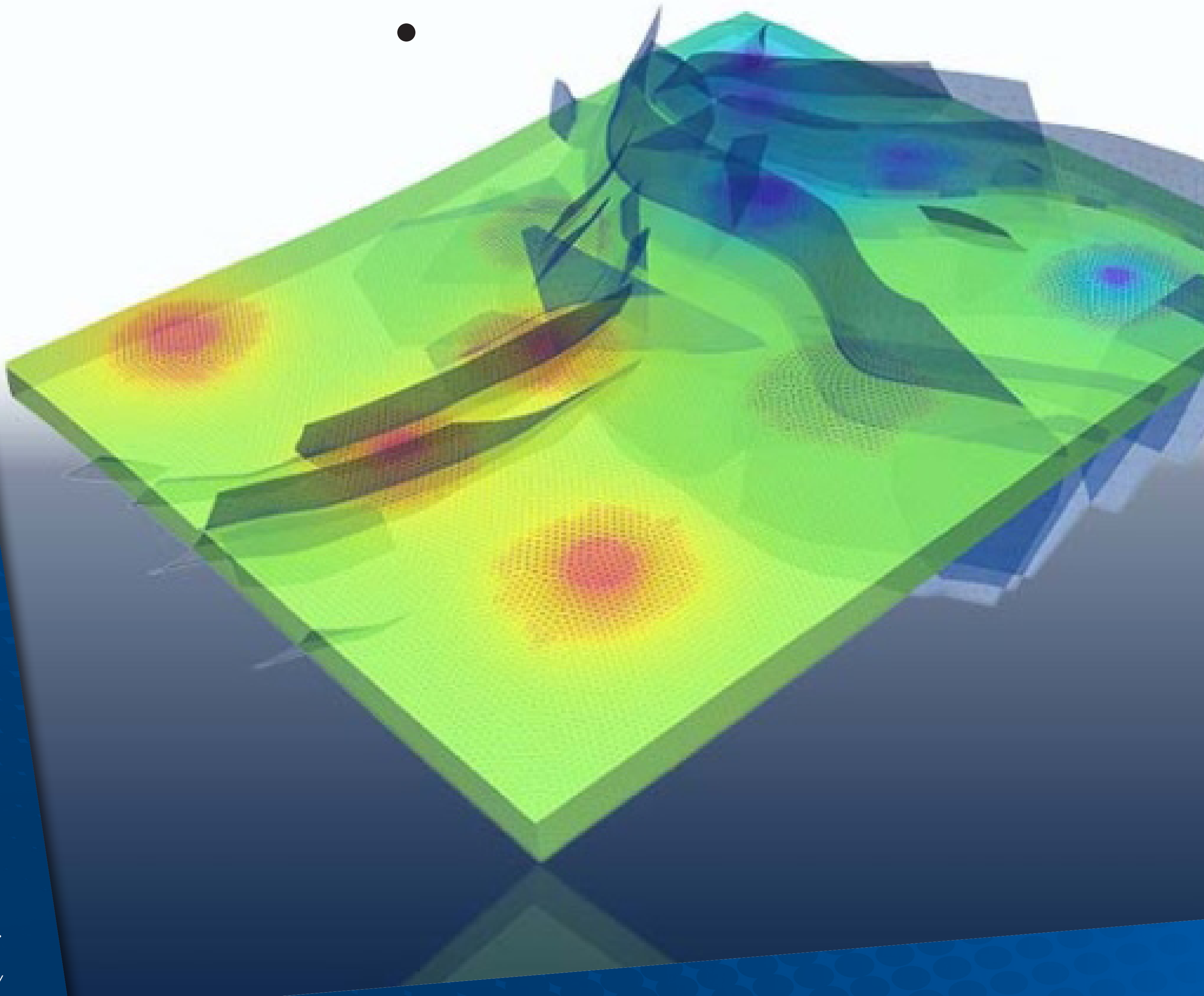
The hohlraum is a cylindrical X-ray oven used to achieve ignition in December 2022, at LLNL's National Ignition Facility (NIF). In inertial confinement fusion (ICF) experiments, NIF's 192 lasers focus on a capsule suspended inside the hohlraum (left, in the circle). Ignition is a potentially world-changing breakthrough for fusion energy and a key initial step in the quest for limitless clean energy. LLNL has been helping spur development of Inertial Fusion Energy (IFE), including sponsoring a community workshop on the potential for ICF research to generate commercially viable IFE and participating in a DOE workshop on public-private fusion energy partnerships. Photo Credit: Jason Laurea/LLNL

GEOSX Simulator

After more than two years of joint research, Lawrence Livermore National Laboratory (LLNL), Total and Stanford University are releasing an open-source, high-performance simulator for large-scale, geological, carbon dioxide (CO2) storage. The GEOSX simulator will enable researchers around the world to build on the work of the three partners, providing an open framework to accelerate the development of carbon capture, utilization and storage (CCUS) technologies. It also has application to a variety of other subsurface energy technologies. The simulator uses field data to predict the behavior and impact of CO2 stored in deep geological repositories. Its resolution and speed were made possible by new technological developments in the fields of algorithmics and high-performance computing. It will be used to improve the management and security of geological CO2 repositories and to plan for the widespread implementation of these projects at an industrial scale.

LLNL, partners open access to CO2 storage simulator | Lawrence Livermore National Laboratory.

Image Credit: Geologic data courtesy Gulf Coast Carbon Center.



Lawrence Livermore National Laboratory

January 2024

NNSA
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 Martin Luther King Jr. Holiday	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 31	25	26	27	28	29	30

February 2024

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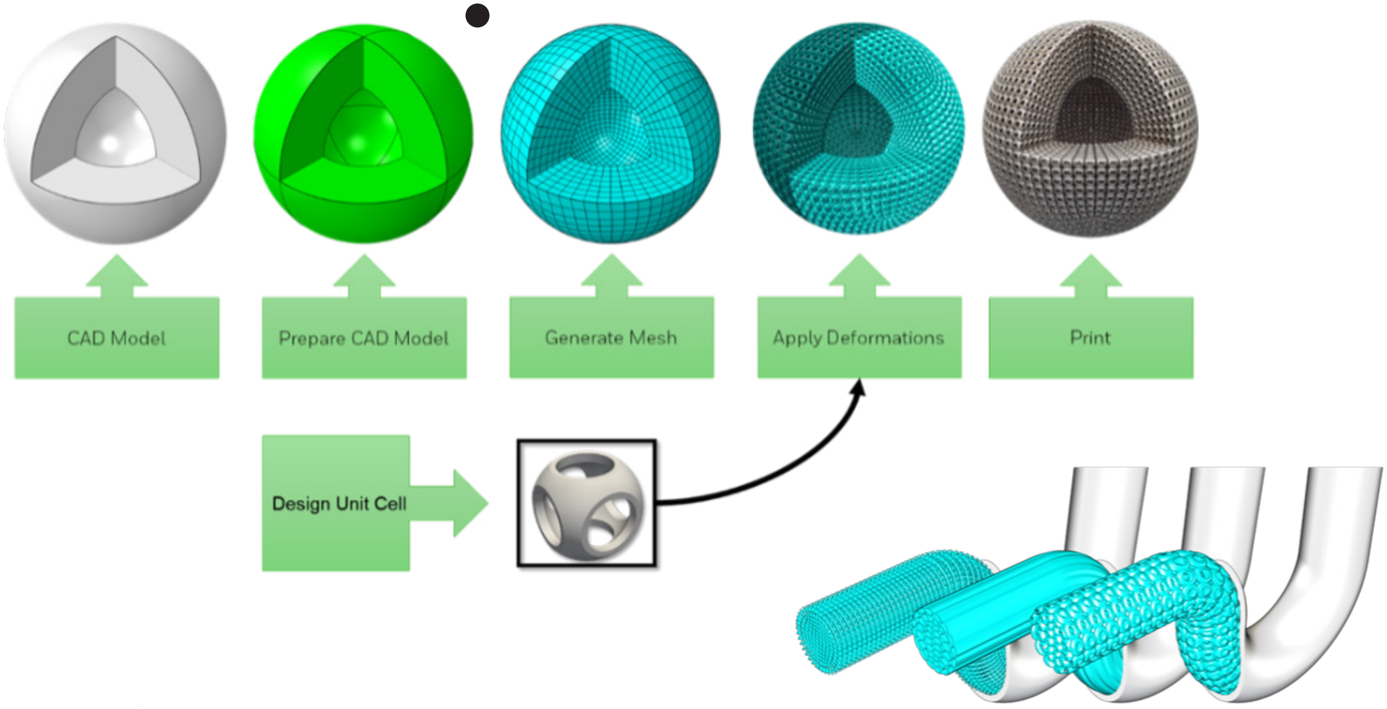
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29		

Geometry Compliant Lattice Structures

The Advanced Engineering Simulations & Analysis (AESA) group at the Kansas City National Security Campus has developed new methods to better model structures for Additive Manufacturing. Geometry Compliant Lattice Structures (GCLS) provides advancements in meshing and Finite Element Analysis (FEA) and combines improvements in computing, unit cell treatment, and local environment modeling. The result is a significantly shorter model to three-dimensional (3D) print time, a more efficient use of computing resources, more accurately modeled parts, and higher quality printed objects with engineered material properties.

Image Credit: Kansas City National Security Campus



CAD Model

Prepare CAD Model

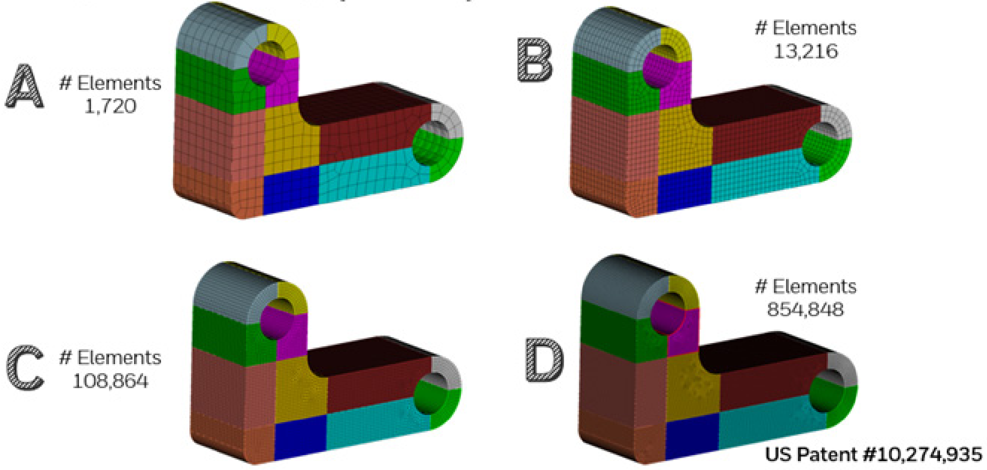
Generate Mesh

Apply Deformations

Print

Design Unit Cell

MESH DENSITIES (HEX27)



US Patent #10,274,935

February 2024

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 KANSAS CITY NSC National Security Campus 1949	15	16	17
18	19 Presidents' Day	20	21	22	23	24
25	26	27	28	29		

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			

March 2024

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

X-Ray Toolkit for Emergency Responders

X-Ray Toolkit (XTK) is a software program developed by Sandia National Laboratories with funding from the National Nuclear Security Administration (NNSA). XTK is a radiograph acquisition and processing program designed specifically for explosive ordnance disposal (EOD) technicians. EOD technicians use portable X-ray scanners with image-processing software to look inside and analyze suspicious objects ranging from backpacks to battlefield improvised explosive devices (IEDs) to shipping containers. Before XTK, technicians had to learn to use multiple software packages, most developed for medical X-ray or photography applications rather than emergency response. Today, XTK is the standard in the field both nationally and internationally.

Image Credit: Photo courtesy of the National Nuclear Security Administration

Sandia
National
Laboratories

March 2024

National Nuclear Security Administration

February 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		

April 2024

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7	8	9	10	11	12	13
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21	22	23	24	25	26	27
28	29	30	26	27	28	29

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

K-Modules

Mission Need

An understanding of materials and physical processes is critical for the science of national security. 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. DoD labs and defense contractors generate intense electron beams for radiation effects characterization of high value electronic circuits. Devices called Febetrons use stacks of capacitive energy modules as their pulsed power source to generate the X-rays or electron beams for these studies. The module design has not been updated in 40 years, resulting in aging, failing, and difficult to replace components. Moreover, the module quality and their commercial supply are unreliable.

Technology Advancement

Kalpak Dighe led a Los Alamos National Laboratory team to engineer K-modules, a newcapacitive energy module technology. K-modules are the result of sophisticated simulations,rigorous testing and refinement, and use of state-of-the-art components. A stack of K-Modules substantially increases the output voltage and power of flash X-ray devices, allowing the X-rays to penetrate farther through material. The higher X-ray dose results in clearer radiographs of dense objects moving at extremely high speeds. Similarly, the higher output voltage of KModules installed in electron-beam devices enhances the number of electrons emitted per unit area on objects, such as

K-Module stack firing. Photo credit: David Woodfin, Hans Sundquist, and Allen Hopkins, Los Alamos National Laboratory

K-Modules Ensure Continuity of Pulsed Power Applications for National Security Mission

electronic circuit boards, for improved radiation effect characterization. K-Modules are reliable, customizable, easy to replace, and most components are recyclable. The new modules maintain the same physical dimensions as the original Febetron modules, allowing for a simple "remove and replace" process for users.

Technology Transfer

Dighe entered the Entrepreneur Leave of Absence program to commercialize the K-Module technology for both commercial and core mission customers. As part of this program, he assessed the market and customers' needs for new K-Modules through Los Alamos National Laboratory's DisrupTECH and Technology Maturation Investment activities. Dighe also prepared a winning R&D 100 Award application and explanatory video. During his Entrepreneur Leave of Absence experience, Dighe identified and connected with commercial partners in the aerospace industry, as well as NNSA and DoD customers that leverage electron beam generation and use flash X-ray radiography. Dighe launched KALTRON Pulsed Power Systems (KALTRON), a New Mexico startup company. The company executed a non-exclusive license to manufacture and sell the patented K-Module technology for commercial, NNSA and DoD core mission customers. Local machine shops in economically under-developed regions in the state of New Mexico provide key components in KALTRON's supply chain. KALTRON has completed an order for The Boeing Company of a stack of 90 K-Modules for the Febetron at Hill Air Force Base's Little Mountain Test Facility in Utah. Also, KALTRON has secured a contract from NNSA/Los Alamos National Laboratory to produce a stack of 90 K-Modules for the first of their five Febetrons. Ready availability of the K-Modules will ensure continuity of operations for both commercial and critical national security missions applications.

> **"Programs like DisrupTECH, TechMat, and R&D 100, and direct engagement with FCI's assigned Business Development Executive played a vital role in customer discovery andmaturing K-Modules for potential commercialization."**

Kalpak Dighe with a Febetron containing a K-Module stack. Photo credit: David Woodfin and Allen Hopkins, Los Alamos National Laboratory

Additive Manufacturing of Hardened Tooling

Metal powder additive manufacturing (AM) builds hardened machine tooling. Material addition, densification, and hardening take place in a single process. This avoids the long heat treatment and post machining steps of traditional methods for machine tooling manufacture. Complex designs, interior features, and material characteristics can be tailored for weight, thermal properties, strength, and wear resistance. Printing provides greater accuracy, flexibility, and repeatability than conventional methods. AM solves manufacturing issues in speed, cost, and material waste. The patent-pending technology won a 2023 R&D 100 Award and a R&D 100 Gold Special Recognition Medal for Market Disruptor Products.

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

2023 R&D 100 WINNER

Los Alamos
NATIONAL LABORATORY

April 2024

NNSA
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 Los Alamos NATIONAL LABORATORY EST. 1943 1943
21	22 Passover begins at sundown	23	24	25	26	27
28	29	30			March 2024	May 2024

March 2024

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

May 2024

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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	

Polymer Production Enclave Fully Operational

Through a strong partnership between Lawrence Livermore National Laboratory (LLNL) and Kansas City National Security Campus (KCNSC), a new concept of concurrent engineering and accelerated development became a reality with the start of an enclave designed to deliver key components for the U.S. nuclear warhead modernization programs. Completed in 2021 as a state-of-the-art design and production facility, the Polymer Production Enclave at LLNL now is fully operational and will house both LLNL and KCNSC personnel working in tandem. The initial concept for the enclave began in 2019 when KCNSC and LLNL recognized the need for a facility on LLNL's campus where both additive manufacturing design and production capabilities to support the U.S. nuclear deterrent could be integrated.

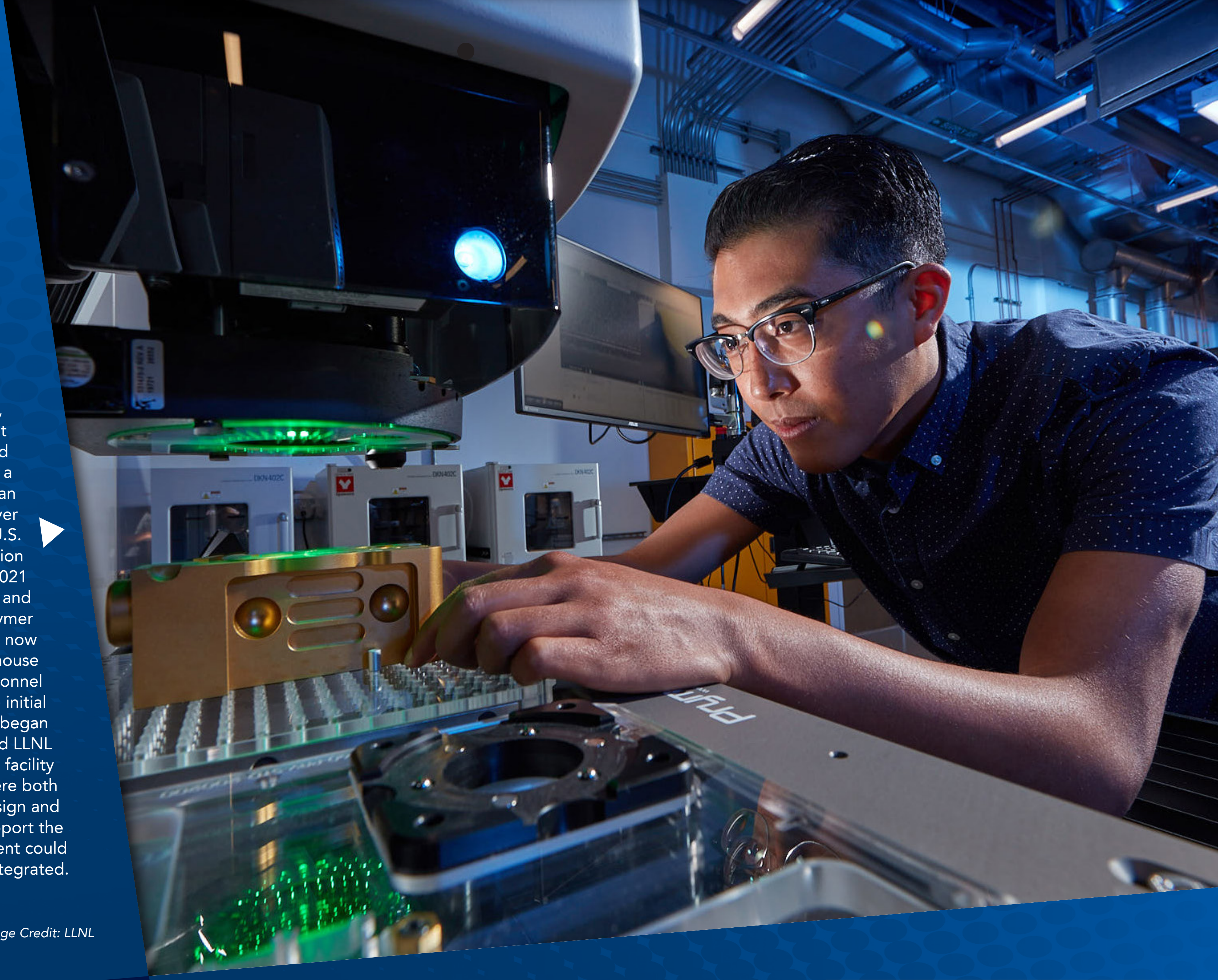


Image Credit: LLNL

Lawrence Livermore National Laboratory

May 2024

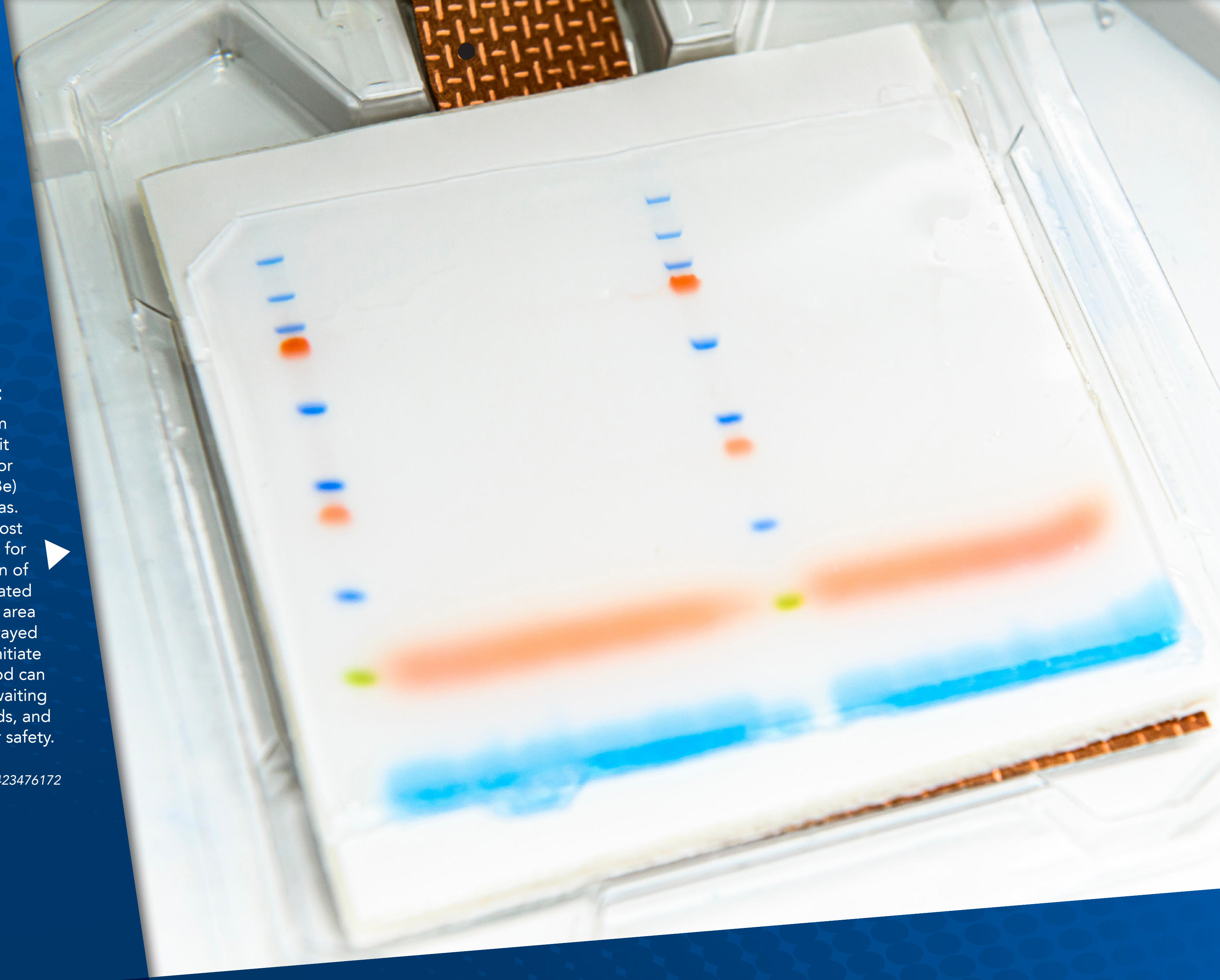
National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
April 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	June 2024 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	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27 Memorial Day	28	29	30	31	

Colorimetric Beryllium Detection Method and Kit

This Colorimetric Beryllium Detection Method and Kit uses a dye with a visible color change for beryllium (Be) detection in workspace areas. The color change occurs almost instantaneously, allowing for rapid, near-real-time detection of Be. A swab or smear is saturated with a dye, used to swab an area suspected of having Be, and sprayed with an activator solution to initiate the color change. This method can save costs, reduce time lost waiting for test results of other methods, and increase worker safety.

Image Credit: iStock 423476172



June 2024

Department of Energy · United States of America

NNSA
National Nuclear Security Administration

May 2024

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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 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			

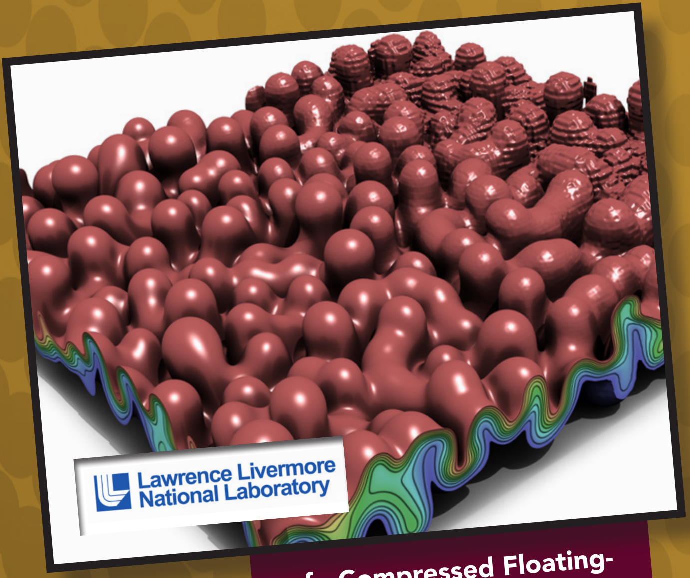
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19 Juneteenth	20 Summer begins	21	22
23 30	24	25	26	27	28	29

2023
R&D
100
WINNER

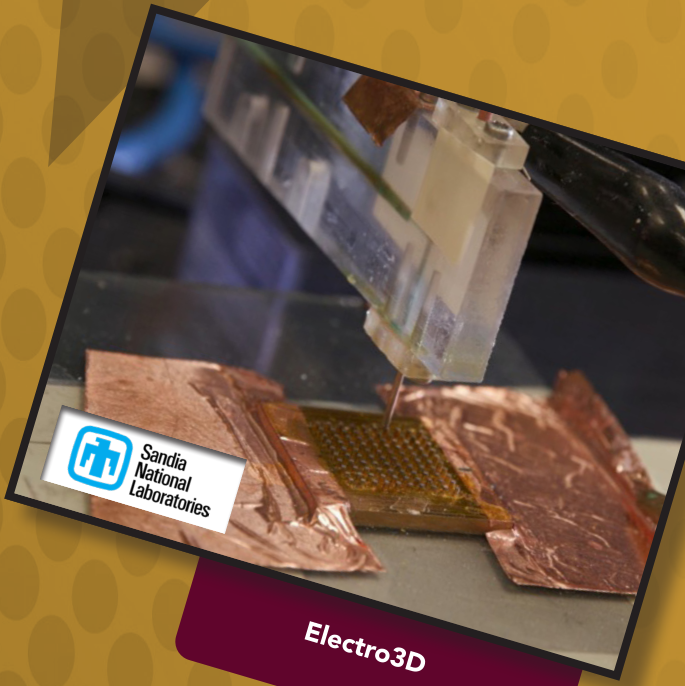
Congratulations to the 2023 R&D 100 Award winners! There were 17 from LANL, LLNL, and SNL. NNSA's national security laboratories account for the largest accumulation of patents that have been issued to the Federal Government.

NNSA LABS RECEIVED
17
AWARDS FOR 2023

Additive Manufacturing of Hardened Tooling



zfp Compressed Floating-Point and Integer Arrays



Electro3D

17
AWARDS
FOR 2023

2023
R&D 100
WINNER

Analytical/Test category

NACHOS: NanoSatellite Atmospheric Chemistry Hyperspectral Observation System
Los Alamos National Laboratory

Pre-Symptomatic VOC Detector of Seizure Events
Sandia National Laboratories (SNL)
KNOW Biological Atlanta, GA

IT/Electrical category

Ordered Key-value Computational Storage Device (KV-CSD)
Los Alamos National Laboratory
SK hynix

Mechanical/Materials category

FABIA: Fieldable Atomic Beam Isotopic Analyzer
Los Alamos National Laboratory

Grid Regulation Delivered by Aggregations of Loads (GRID-BAL)
Los Alamos National Laboratory
University of Michigan, Ann Arbor; Pecan Street Inc.; University of California, Berkeley

Hyperspectral X-ray Imaging Detector (HXI)
Los Alamos National Laboratory
National Institute of Standards, Boulder, CO; University of Colorado, Boulder, CO.

Process/Prototyping category

Electro3D
Sandia National Laboratories (SNL)

Rapid Response Steel Tooling using Additive Manufacturing
Los Alamos National Laboratory

Solution-processed Perovskite Crystalline Films (SPeC)
Los Alamos National Laboratory

Software/Services category

CANDLE (CANcer Distributed Learning Environment)
Argonne National Laboratory
Oak Ridge National Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory Fredrick National Laboratory for Cancer Research

FEVER: Fast Evaluation of Viral Emerging Risks
Los Alamos National Laboratory

MALA: Materials Learning Algorithms
Sandia National Laboratories (SNL)
Center for Advanced Systems Understanding (CASUS) at the Helmholtz-Zentrum Dresden-Rossendorf (Germany)

Meta Optics Studio
Sandia National Laboratories (SNL)
Stellar Science Ltd. Co.

Materials Data Driven Design (MAD3)
Sandia National Laboratories (SNL)

PowerModelsONM: Optimizing Operations of Networked Microgrids for Resilience
Los Alamos National Laboratory
National Renewable Energy Laboratory, Sandia National Laboratories, National Rural Electric Cooperative Association

Variorum: Vendor-Agnostic Computing Power Management
Lawrence Livermore National Laboratory

ZFP: Fast, Accurate Data Compression for Modern Supercomputing Applications
Lawrence Livermore National Laboratory

2023
R&D 100
GOLD

Special Recognition: Battling COVID-19

FEVER: Fast Evaluation of Viral Emerging Risks
Los Alamos National Laboratory

Special Recognition: Corporate Social Responsibility

FEVER: Fast Evaluation of Viral Emerging Risks
Los Alamos National Laboratory

Special Recognition: Market Disruptor – Products

Rapid Response Steel Tooling using Additive Manufacturing
Los Alamos National Laboratory

Special Recognition: Market Disruptor – Services

Grid Regulation Delivered by Aggregations of Loads (GRID-BAL)
Los Alamos National Laboratory; University of Michigan, Ann Arbor; Pecan Street Inc.; University of California, Berkeley

2023
R&D 100
SILVER

Special Recognition: Corporate Social Responsibility

Grid Regulation Delivered by Aggregations of Loads (GRID-BAL)
Los Alamos National Laboratory; University of Michigan, Ann Arbor; Pecan Street Inc.; University of California, Berkeley

Special Recognition: Market Disruptor – Products

Materials Data Driven Design (MAD3)
Sandia National Laboratories

2023
R&D 100
BRONZE

Special Recognition: Market Disruptor – Products

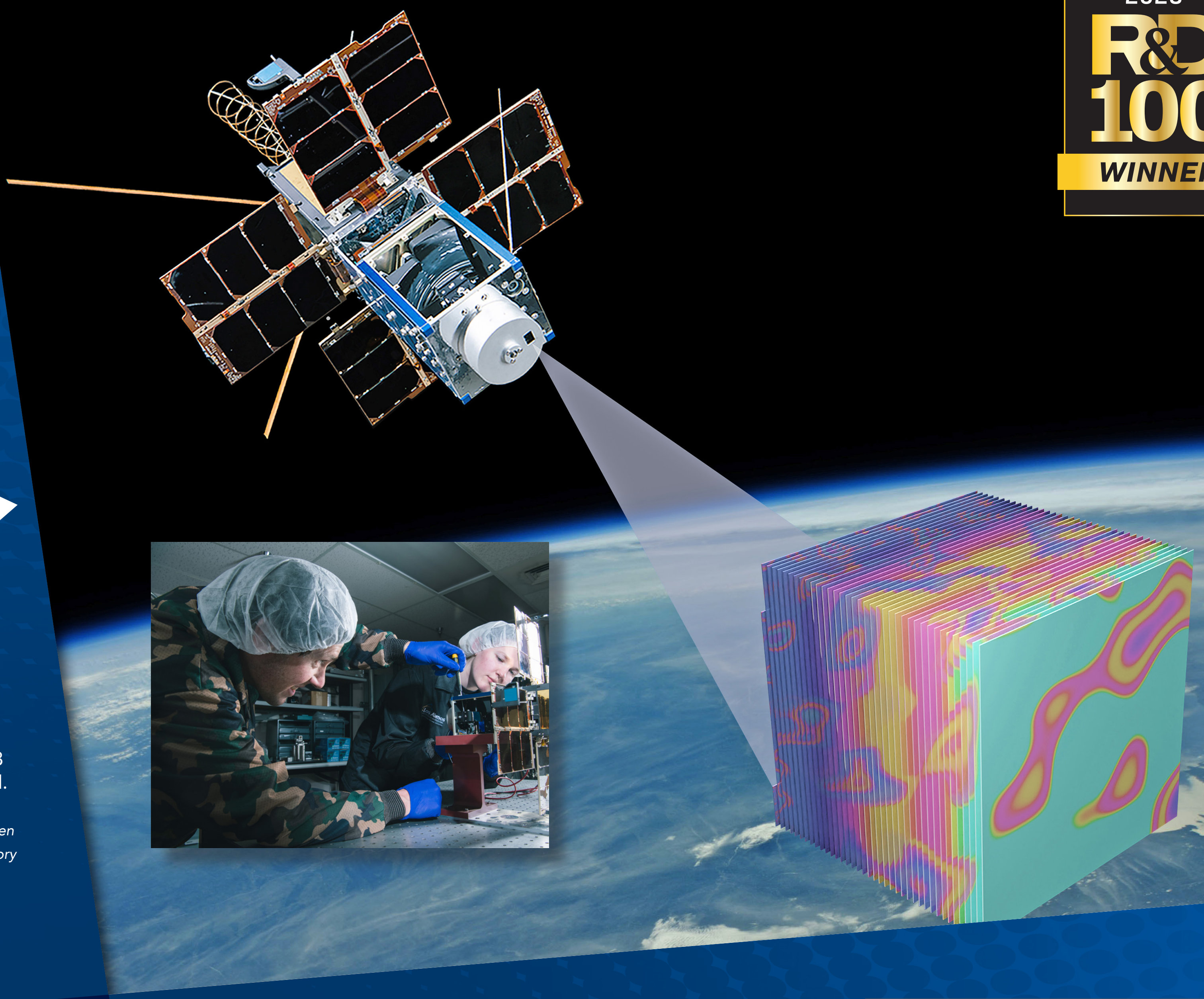
Solution-processed Perovskite Crystalline Films (SPeC)
Los Alamos National Laboratory

7 SPECIAL RECOGNITION
GOLD • SILVER • BRONZE
AWARDS

NACHOS

NACHOS is the first CubeSat-based hyperspectral imaging system for atmospheric trace gas detection. It analyzes the spectral fingerprint of each gas and processes raw data onboard to find harmful gas sources on Earth. The patent-pending satellite design is over fifty times smaller and lighter, and ten times less power hungry, than existing technologies. This allows flights on smaller satellites and ridesharing. Potential applications for space-based, airborne, and ground-based mission deployment include pre-eruption volcano monitoring, urban pollution management, climate science, treaty verification, and nuclear proliferation detection. Two NACHOS systems have flown in space, and the technology won a 2023 R&D 100 Award.

Image Credit: David Woodfin, Jacob HasseT, Allen Hopkins, Los Alamos National Laboratory



2023 R&D 100 WINNER

Los Alamos
NATIONAL LABORATORY

July 2024

National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	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	24	25	26	27
28	29	30	31			

June 2024

						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

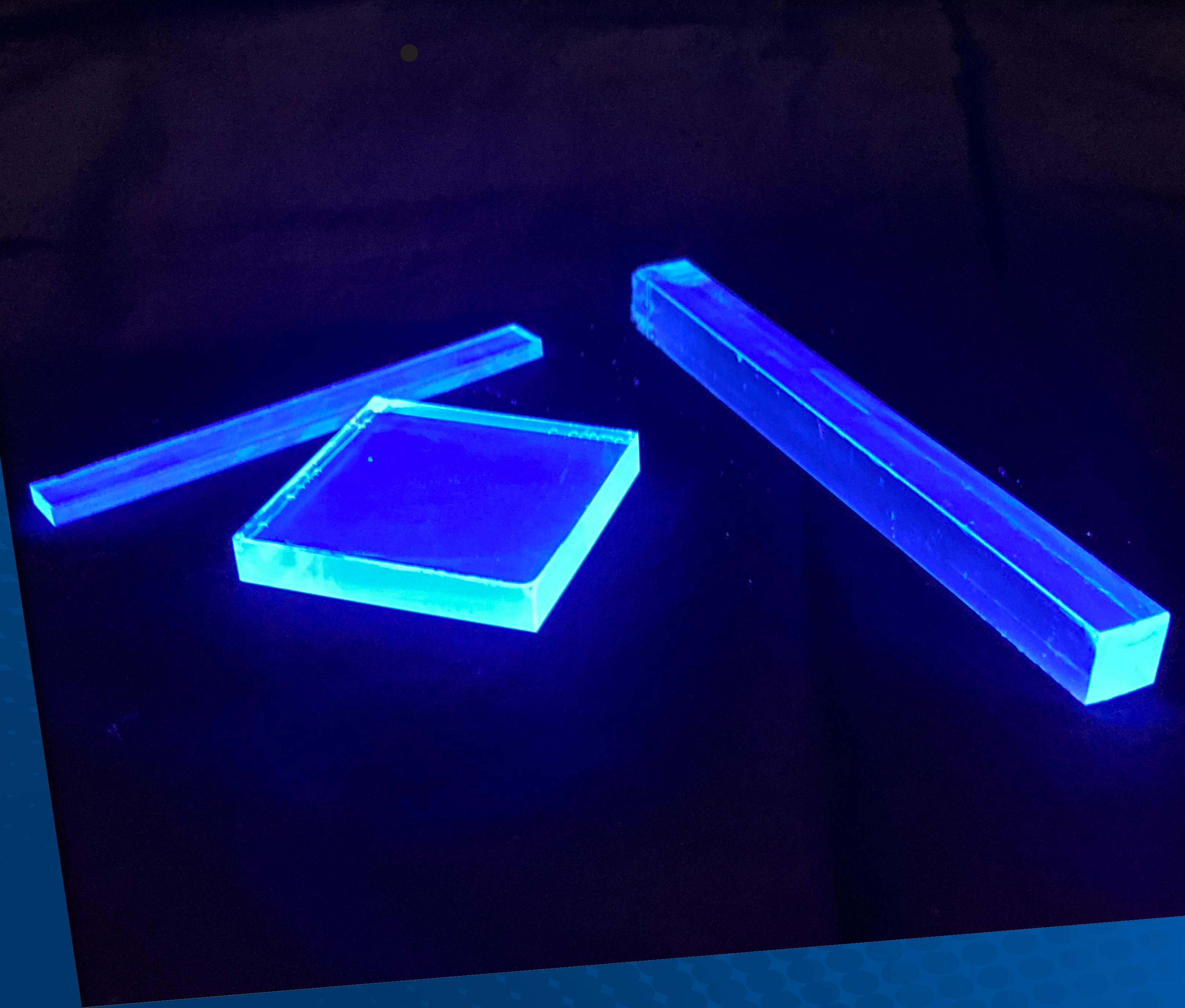
August 2024

				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

BlueShift Optics

Although interest in the Organic Glass Scintillator (OGS) technology for nuclear physics and medical imaging applications has grown in recent years, its production has not expanded beyond the laboratory until now. Blueshift Optics, LLC licensed the OGS technology, intending to build in-house expertise to improve the technology and develop proprietary manufacturing techniques relevant to commercialization. Blueshift Optics was founded in 2019 with the goal of bringing the latest advancements of scintillator materials technology to the radiation detection community.

Image Credit: Photo courtesy of Blueshift Optics



Sandia National Laboratories

August 2024

DEPARTMENT OF ENERGY UNITED STATES OF AMERICA

NNSA
National Nuclear Security Administration

July 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			

September 2024

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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Li-Fi

Light Fidelity (Li-Fi) is an emerging technology that uses networked light emitting diode (LED) bulbs that emit pulses of light rather than radio waves to transmit data. Specialized receivers with photo-sensors receive the light pulses and convert them back to digital data. The use of light as a transmission medium allows the network to be secured via a simple wall. This property raises the potential for Li-Fi to be safely and securely used for wireless access needs. An evaluation test effort is expected to take place in fiscal year (FY) 2024 with Pantex Weapon Training, Pantex Mission Engineering, and West Texas A&M University (WTAMU) working together to test the feasibility of this amazing technology.

Image Credit: iStock 253890898

PanTEX
Managed and Operated by
Consolidated Nuclear Security, LLC

September 2024

NNSA
National Nuclear Security Administration

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

August 2024

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October 2024

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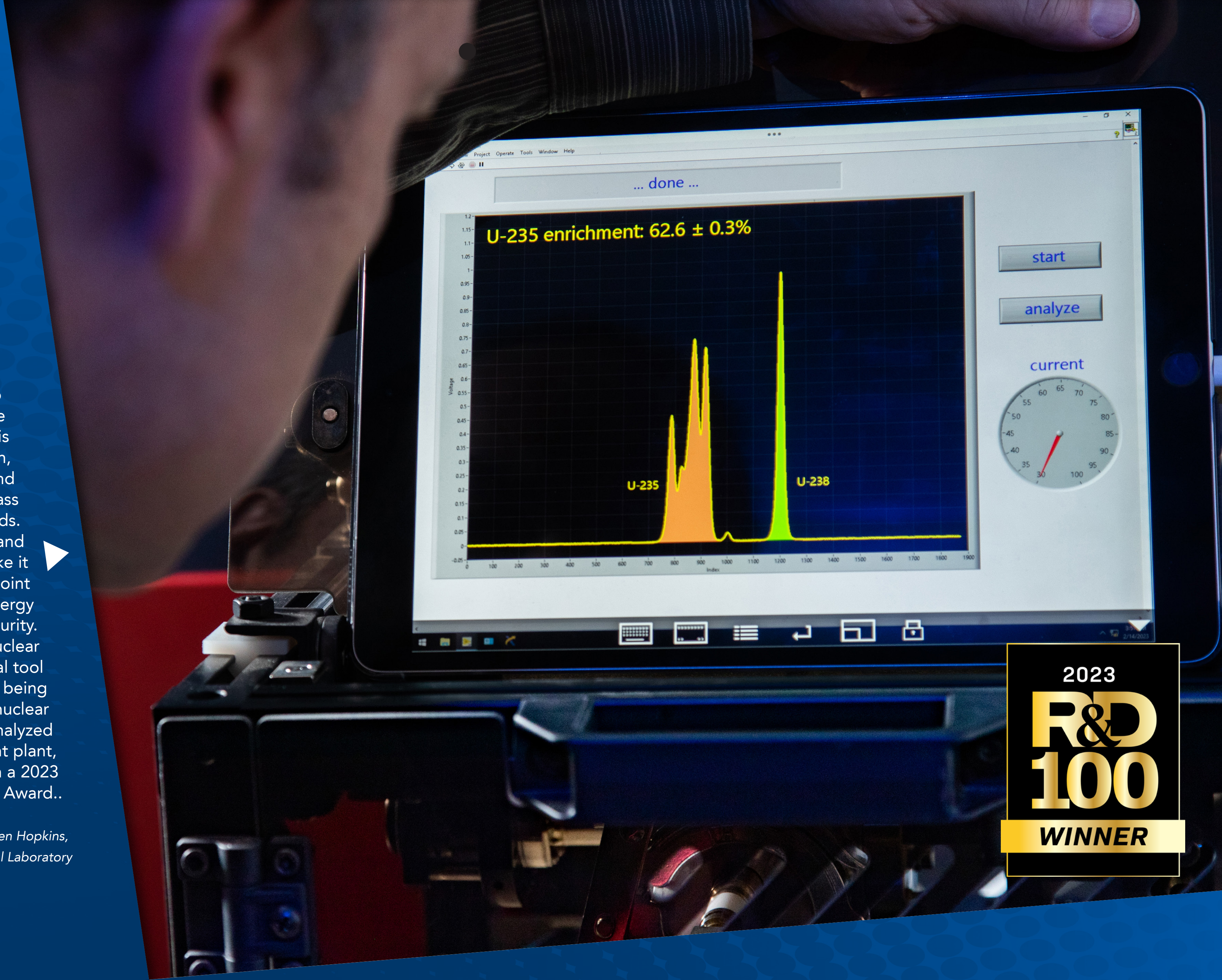
Fieldable Atomic Beam Isotopic Analyzer (FABIA)

FABIA uses high-resolution absorption spectroscopy to reveal the isotopes in a sample quickly and accurately. This avoids the sample preparation, isotopic interference, and chemical waste of mass spectrometry and other methods. The small size, light weight, and simple infrastructure make it portable. Fast analysis at the point of generation aids nuclear energy production and global security. The device could serve as a nuclear non-proliferation analytical tool to safeguard that uranium is being enriched only enough for nuclear energy fuel. FABIA has analyzed samples at a uranium enrichment plant, and it has won a 2023 R&D 100 Award..

Image Credit: James Blake and Allen Hopkins, Los Alamos National Laboratory



Los Alamos
NATIONAL LABORATORY

October 2024

NNSA National Nuclear Security Administration

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5 NNSA National Nuclear Security Administration 1999
6	7	8	9	10	11	12
13	14 Columbus Day	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	September 2024	November 2024

September 2024

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November 2024

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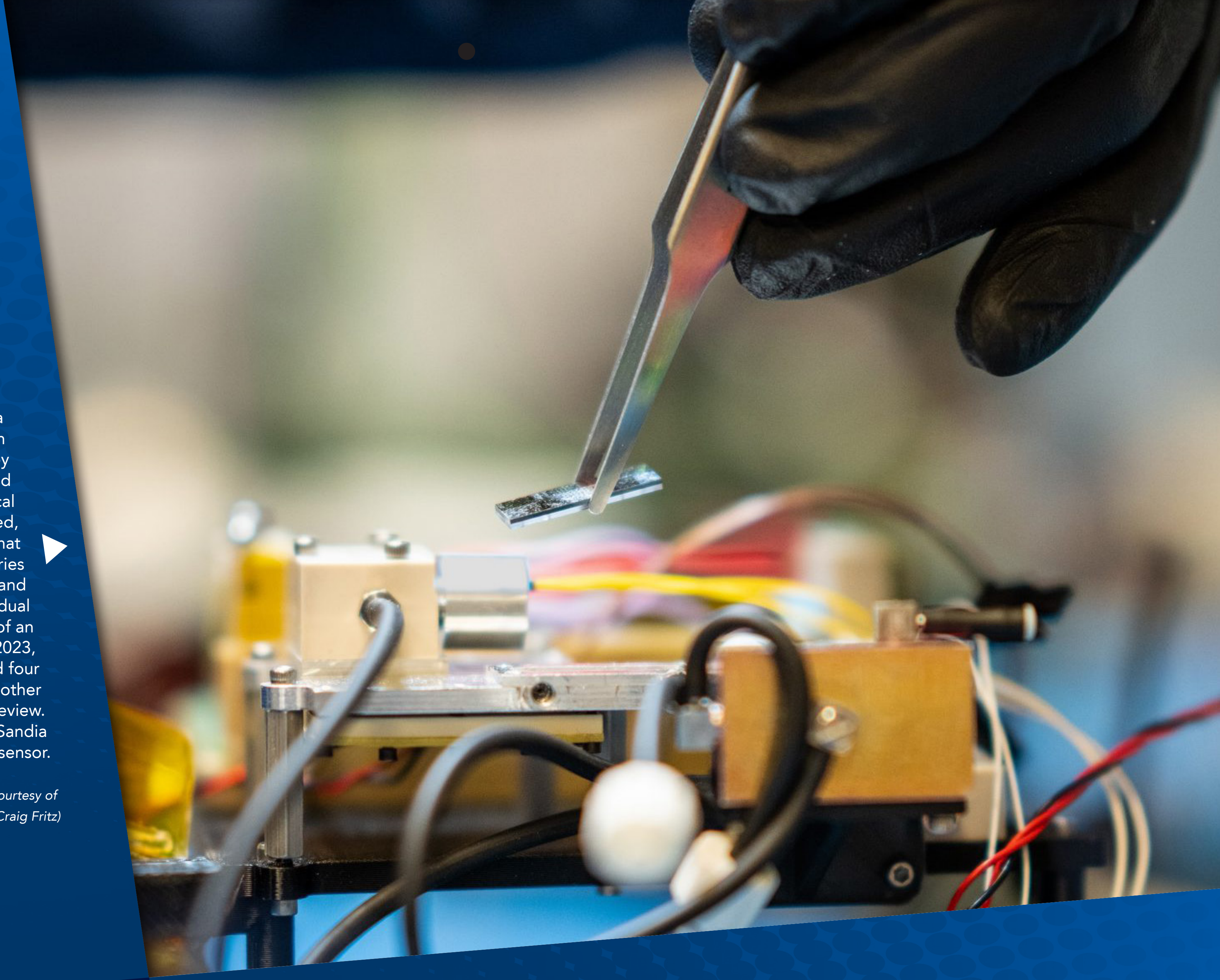
Small sensor 'smells' incipient seizures

For people who have epilepsy, knowing they will have a seizure in advance–even if just by a few minutes–can make a big difference in their health and well-being. Inspired by medical alert dogs, Sandia and research partner Know Biological have developed a miniaturized, wearable sensor system that constantly surveys the chemistries released from a person's skin and can identify and alert the individual to biomarkers indicative of an imminent seizure. As of June 2023, Sandia and Know have received four joint patents and have two other patent applications under review. Know also has licensed several Sandia technologies to test in this sensor.

Image Credit: Photo courtesy of Sandia National Laboratories (Craig Fritz)



November 2024

NNSA National Nuclear Security Administration

October 2024

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December 2024

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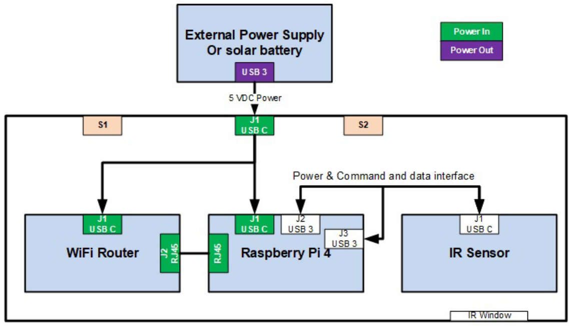
22	23	24	25	26	27	28
29	30	31				

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 Sandia National Laboratories 1949	2
3 Daylight Saving Time ends	4 Y12 National Security Complex 1943	5 Election Day	6	7	8	9
10	11 Veterans Day	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28 Thanksgiving Day	29	30

NNSS-Developed Methane Turbulence Detection: Plumarea's Evolution

The challenge fugitive methane leaks, which pose safety risks, contribute to revenue losses, and significantly increase greenhouse gas emissions, required an innovative solution. The Nevada National Security Sites (NNSS) took a leading role in addressing this issue. Through dedicated research and expertise, the NNSS developed and patented a method grounded in turbulence theory. The NNSS intellectual property, tailored for remote detection and pinpointing of gas leaks, even under low contrast scenarios, became the foundation for Plumarea Imaging, LLC which is lead by former and current NNSS staff. With the ongoing support and collaboration from the NNSS, Plumarea continues to make strides in product development and commercialization through a Cooperative Research and Development Agreement (CRADA) with the Nevada National Security Sites.

Plumarea's endeavors have led to the creation of a portable system adept at detecting and locating not only methane but other gases of interest. This cost-effective alternative promotes the continuous monitoring of minuscule leaks using economical micro-bolometers and optics, eliminating the need for larger, pricier cooled cameras. Furthermore, Plumarea is venturing into developing an ultra-affordable solution that can be integrated with mobile devices, streamlining the manual detection processes prevalent with many current technologies.



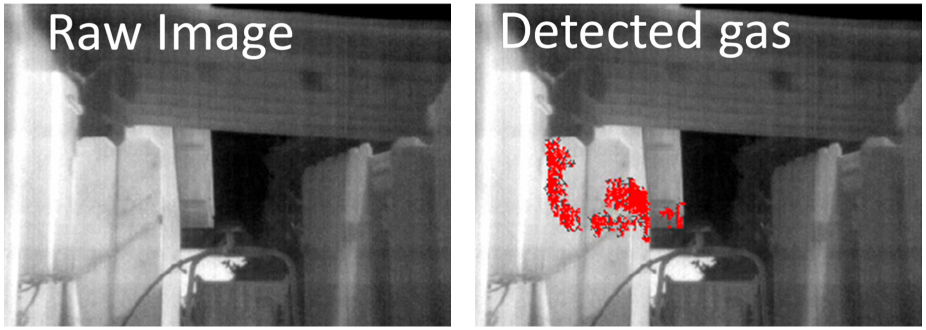


Image Credit: Courtesy of Plumarea Imaging, LLC.

December 2024

NNSA
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 NEVADA NATIONAL NNSS SECURITY SITES 1950	19	20	21 Winter Begins
22	23	24	25 Christmas Day Hanukkah begins at sundown	26 Kwanzaa begins	27	28
29	30	31				

November 2024

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January 2025

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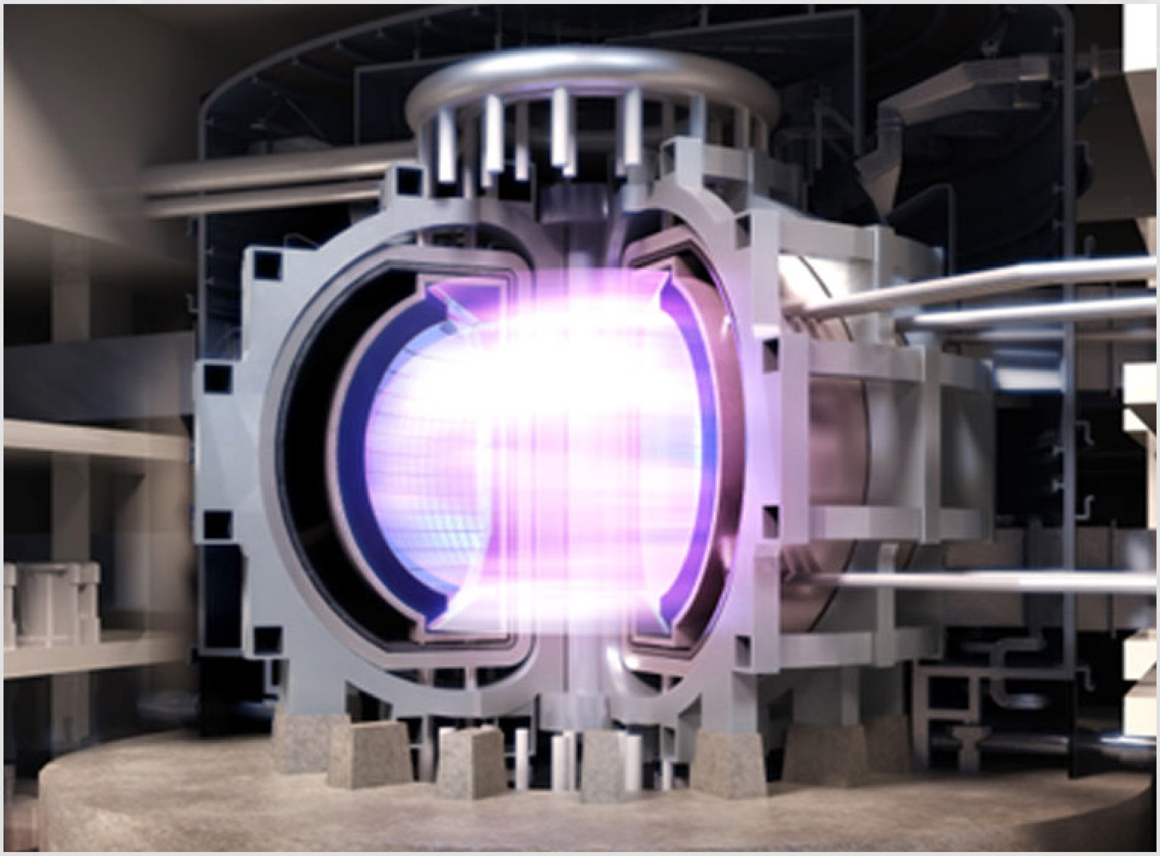
Fusion Pilot Plant Power and Exhaust Handling

GeGeneral Atomics (GA) and Lawrence Livermore National Laboratory (LLNL) have been awarded funding to advance power and particle exhaust capabilities in commercial-scale fusion energy pilot plants (FPPs) using machine learning.

A public-private partnership funded by the U.S. Department of Energy (DOE), the Innovation Network for Fusion Energy (INFUSE) program promotes collaboration between private-sector fusion energy companies, universities, and the DOE's national laboratories to accelerate research and to develop cost-effective, innovative fusion energy technologies. Fusion is the process that powers the stars and offers the potential for nearly limitless clean, safe, and economic electricity. The process occurs when two light nuclei combine to form a new one, releasing vast amounts of energy. At scale, fusion energy holds the promise of replacing fossil fuel plants and providing always-on, carbon-free electricity that will be critical to reaching net-zero emissions.



GA and LLNL Announce Partnership to Advance Power and Exhaust Handling in Fusion Pilot Plants

Lawrence Livermore
National Laboratory

Researchers can create fusion using a tokamak, a device that uses heat, magnets, and microwaves to create a plasma—a highly ionized "soup" of charged particles that can be controlled by magnetic fields in a vacuum. Plasma must be heated to temperatures exceeding 100 million degrees Celsius, approximately ten times the temperature at the center of the sun, to achieve fusion conditions relevant for energy production.

However, plasma particles and their associated heat exhaust must be efficiently removed from the system. For this reason, tokamaks incorporate a device called a divertor that removes the exhaust from the edge regions of the plasma. The heat and particle flow along the magnetic field lines in the edge region is intense enough to damage the inside surfaces of the tokamak, as heat levels can exceed those found in a rocket engine nozzle.

> **"Fusion is the process that powers the stars and offers the potential for nearly limitless clean, safe, and economic electricity."**

The design of the divertor system is one of the critical challenges that must be overcome for a FPP and at-scale fusion energy. Current tools used for simulating the movement of exhaust away from the plasma core typically requires computing times exceeding several weeks.

GA's partnership with LLNL will utilize machine learning methods trained on a database of plasma simulations to address this challenge. The results of the research will be used to improve the speed and effectiveness of GA's FPP divertor design cycle.

GA announced its concept for a fully-integrated FPP in October 2022, envisioning a steady-state, compact, advanced tokamak design. By utilizing a steady-state approach, the GA FPP would maintain the plasma for long periods of time, which would maximize efficiency, reduce maintenance costs, and increase the lifespan of the facility. Fueled primarily by isotopes of hydrogen found in seawater and capable of generating its own fuel during operation, the GA FPP would provide around-the-clock, sustainable energy without any harmful emissions or long-lived waste.

GA previously was awarded funding under the INFUSE program for a collaboration with Savannah River National Laboratory (SRNL) to research methods for recycling tritium, one of the two hydrogen isotopes used as fusion fuel. The research integrates SRNL's world-leading expertise in tritium fuel handling with GA's proprietary Fusion Synthesis Engine software. GA's concept for an advanced modular blanket would efficiently breed tritium as part of a self-sustaining fuel cycle utilizing silicon-carbide-based materials that can withstand the intense conditions within a high-power fusion device.

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.

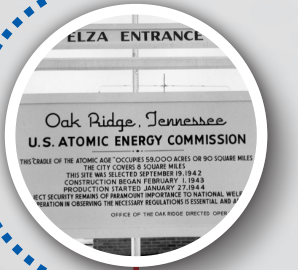
September 17

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

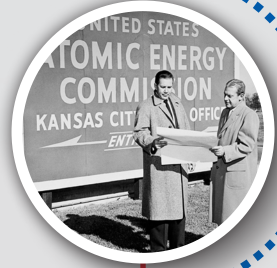


In the midst of the second World War, ground was broken in rural East Tennessee for the first production building at the **Y-12** Electromagnetic Separation Plant and operations began on November 4, 1943. The plant's job was to make enough enriched uranium for a new kind of bomb, an atomic bomb. Thirty 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.

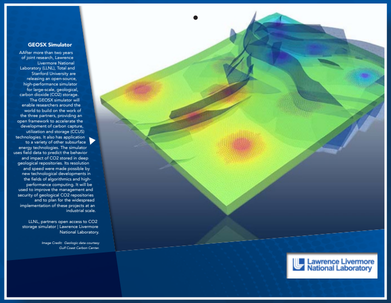
September 2

1952

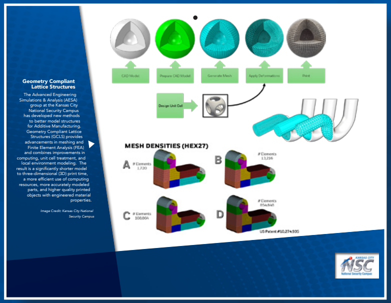
On October 5, 1999, President Bill Clinton signed the National Defense Authorization Act, bringing the **National Nuclear Security Administration (NNSA)** into existence. The NNSA operates as a semi-autonomous agency within the U.S. Department of Energy (DOE) and is responsible for the management and 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

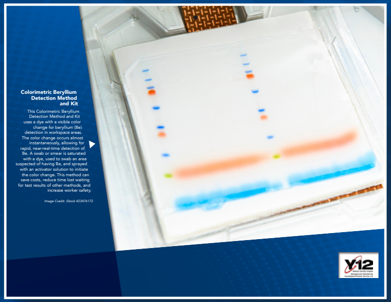


February

March

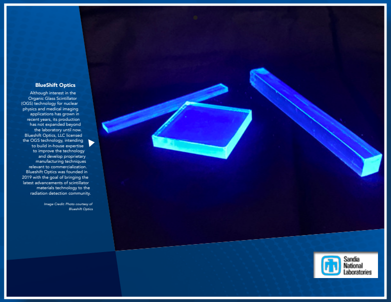
April

May



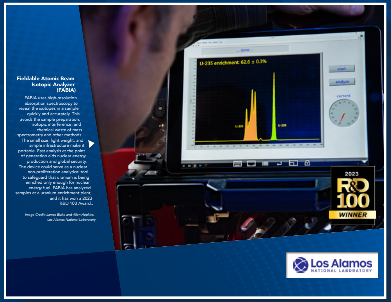
June

July

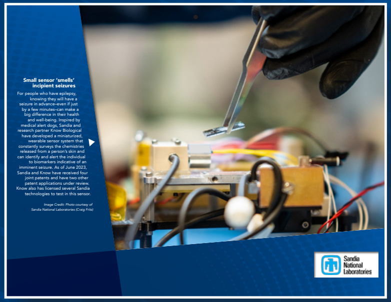


August

September



October



November

December

DEPARTMENT OF ENERGY
UNITED STATES OF AMERICA

NNSA
National Nuclear Security Administration