LDRD

Quarterly Highlights

Mission Agility | Technical Vitality | Workforce Development

FY26 Q1

FEATURED HIGHLIGHTS FOR Q1

NEVADA NATIONAL NNSS SECURITY SITES

NNSS Science and Technology Director José Sinibaldi giving opening remarks.

National Security Science Shines at the SDRD Annual Program Review

At the end of each fiscal year, the Site-Directed Research and Development (SDRD) program hosts its Annual Program Review (APR) showcasing the high-risk, high-value research conducted by its principal investigators (PIs). Taking place September 9–11 at the North Las Vegas facility (NLVF), this year's APR was attended by employees from

across the NNSS' locations, as well members of the External Advisory Board (EAB) and the National Nuclear Security Administration Nevada Field Office. Read more…

- **Mission Agility, Technical Vitality, Workforce Development**

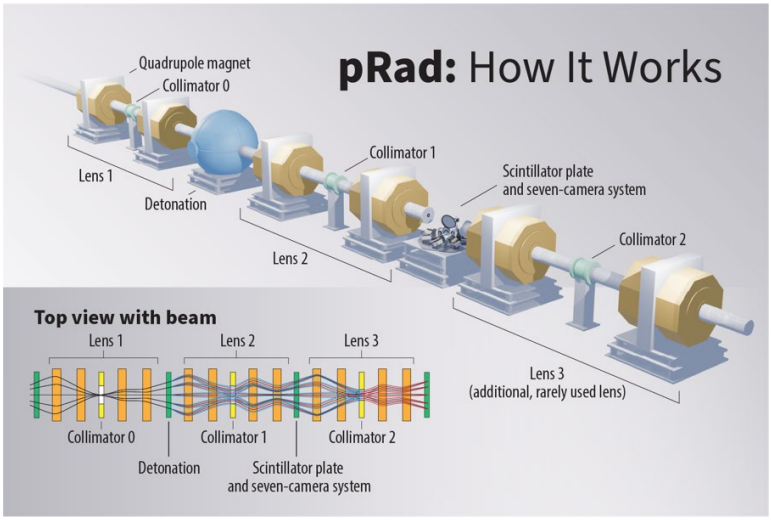
Piotr Wiewior presents about the Strategic Initiative at the FY25 SDRD Annual Program Review.

Piotr Wiewior Establishes Strategic Initiative Colloquium at the NNSS

The Nevada National Security Sites' (NNSS') Site-Directed Research and Development (SDRD) program is instrumental in performing high-risk, potentially high-value experiments to enrich national security science. While each principal investigator (PI) is involved in producing knowledge in their subject areas, learning from community partners can often lead to fresh approaches and enhanced collaboration. In the spirit of scientific advancement, SDRD PI Dr. Piotr Wiewior has organized the Strategic Initiative Colloquium, a monthly series of scientific talks given by NNSS collaborators, to support SDRD's Strategic Initiative in Accelerator Science and Beam Physics. Read more…

- **Technical Vitality, Workforce Development**

Los Alamos
NATIONAL LABORATORY



In this LANL's proton radiography experiment lets scientists see how materials behave during detonations. **Watch this video** to learn more about how pRad works. Image courtesy: LANL

pRad and the future of stockpile stewardship

Los Alamos National Laboratory's proton radiography (pRad) facility was created more than 25 years ago through a series of LDRD projects led by Lab physicist Chris Morris. "It was the rebirth of my career," says Morris. "Really, it was part of the rebirth of the Lab." Now, after 25 years and nearly 1000 experiments, pRad, as part of the Los Alamos Neutron Science Center (LANSCE), is the focus of a multiyear signature institutional commitment that will direct funding toward modernizing these key facilities that have never been more critical to the Lab's mission. In the wake of 1996's Comprehensive Nuclear-Test-Ban Treaty, the U.S. was faced with the challenge of maintaining the safety and reliability of its nuclear stockpile without detonating live weapons. Experimental facilities like pRad allow scientists to conduct multitudes of targeted tests on a smaller scale. pRad uses high-energy protons passed through an explosion to capture crucial data on how materials behave under extreme conditions, and the data it creates feeds the models that ensure America's nuclear weapons remain reliable—without the need for full-scale denotations. Read more….

- **Mission Agility, Technical Vitality, Workforce Development**

The team applied THOR AI to validate the new method using molecular dynamics simulations of copper, illustrated here in relation to its crystalline form within copper ore.
Image credit: Dreamstime

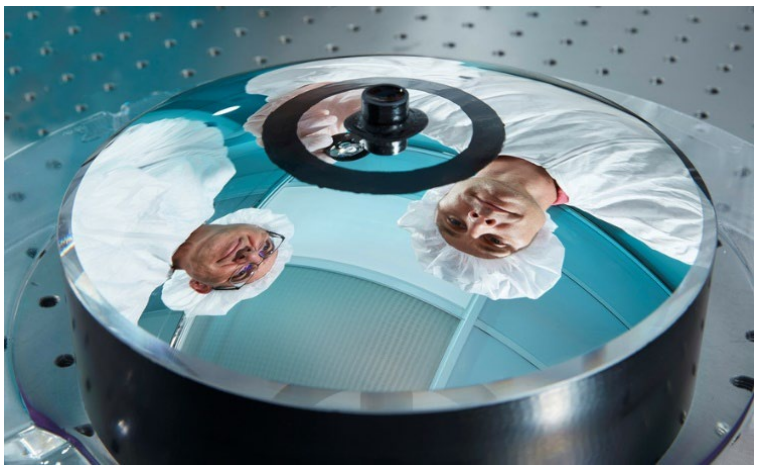
THOR AI cracks a 100-year-old physics challenge

Researchers from Los Alamos National Laboratory and the University of New Mexico have developed a novel computational framework that addresses a longstanding challenge in statistical physics. The Tensors for High-dimensional Object Representation (THOR) AI framework employs tensor network algorithms to efficiently compress and evaluate the extremely large configurational integrals and partial differential equations central to determining the thermodynamic and mechanical properties of materials.

“This breakthrough replaces century-old simulations and approximations of configurational integral with a first-principles calculation,” said Duc Truong, Los Alamos scientist and lead author of the study published in Physical Review Materials. “THOR AI opens the door to faster discoveries and a deeper understanding of materials.” Read more….

- **Mission Agility, Technical Vitality**

Lawrence Livermore National Laboratory



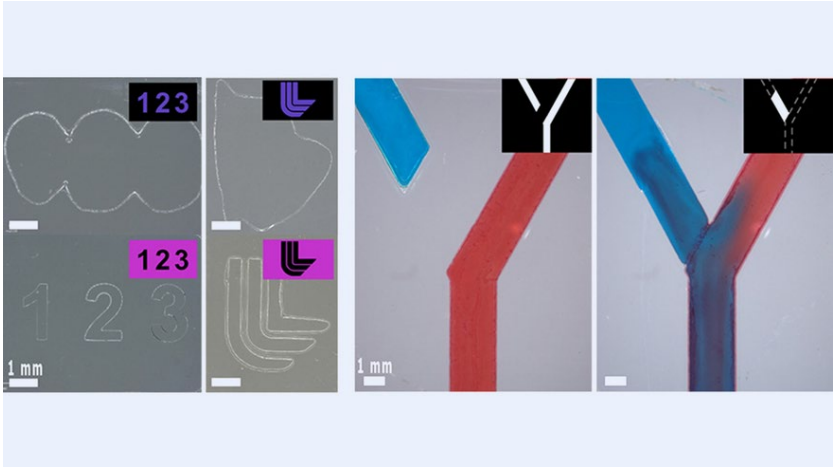
Shown here in the primary mirror surface on a monolithic telescope — one of LLNL's four R&D100 awards — are reflections of Brian Bauman (left), the space hardware principal optical engineer and inventor of the monolithic telescope, and Frank Ravizza, the space hardware optical engineering lead. (Courtesy image)

Lab scientists win four 2025 R&D 100 awards

Lawrence Livermore National Laboratory (LLNL) scientists and engineers have earned four awards among the top 100 inventions worldwide.

The trade journal *R&D World Magazine* recently announced the winners of the awards, often called the "Oscars of innovation," recognizing new commercial products, technologies and materials that are available for sale or license for their technological significance. With this year's results, the Laboratory has now collected a total of 186 R&D 100 awards since 1978. Submitted through LLNL's Innovation and Partnerships Office (IPO), these awards recognize the impact that Livermore innovation, in collaboration with industry partners, can have on the U.S. economy as well as globally. Read more…

- **Mission Agility, Workforce Development, Technical Vitality**



Demonstrations of a new corrective manufacturing technique. In the left panel (a), low resolution printed shapes are shown at top and corrected shapes are shown at bottom. In the right panel (b), hybrid manufacturing is used to correct a gap in a fluidic structure. (Credit: Howard et al.)

Unique resin allows 3D-printing method to add and subtract

In a new study, published in Advanced Materials Technologies, researchers at Lawrence Livermore National Laboratory (LLNL) developed a hybrid additive and subtractive manufacturing system with a unique resin that enhances traditional 3D printing by introducing dual-wavelength behavior. Under blue light, the resin cures and hardens. Under ultraviolet light, it degrades back into a liquid. The hybrid printing system enables corrective manufacturing, provides improved print resolution and allows for upcycling and recycling of parts. Read more…

- **Mission Agility, Technical Vitality**

Sandia National Laboratories

Sandia cybersecurity expert Adrian Chavez, left, and computer scientist Logan Blakely work to integrate a single-board computer with their neural-network AI into the Public Service Company of New Mexico's test site. This code monitors the grid for cyberattacks and physical issues. (Photo by Bret Latter)

Protecting the grid with artificial intelligence

Creating new capabilities to protect the electric grid from severe storms and advanced attackers is critical, so the brain-inspired AI algorithms that detect physical problems, cyberattacks and both at the same time is an amazing achievement. This neural-network AI developed by Sandia researchers can run on inexpensive single-board computers or existing smart grid devices. "As more disturbances occur, whether from extreme weather or from cyberattacks, the most important thing is that operators maintain the function and reliability of the grid," said Shamina Hossain-McKenzie, a cybersecurity expert and leader of the project. Read more…

- **Mission Agility, Technical Vitality**

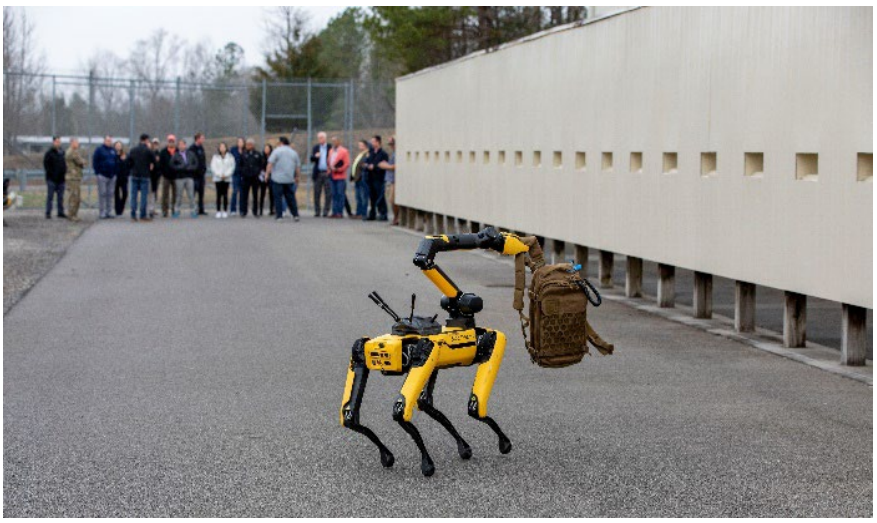
Noelle Collins uses ball calibration while setting an X-ray CT scan.
(Photo by Craig Fritz)

Creating X-ray images of the future

A team of Sandians believe they've found a better way to create X-ray images by harnessing different metals and the colors of light they emit. It's called colorized hyperspectral X-ray imaging with multi-metal targets, or CHXI MMT for short. With this new technology, Sandia is essentially going from the old way, which is black and white, to a whole new colored world where materials and defects of interest can be better identified. This breakthrough, which has roots in four LDRD projects, won a 2025 R&D 100 Award. Read more…

➢ **Technical Vitality**

Y-12 National Security Complex
Managed and Operated by
Consolidated Nuclear Security, LLC



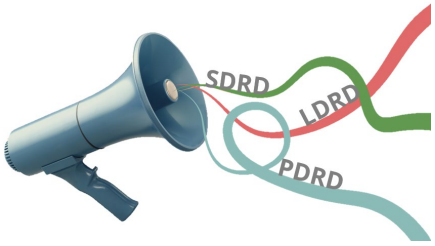
The Y-12 National Security Complex's Spot retrieves a suspicious package while personnel monitor from a safe distance.

Spot on!

Across the National Security Enterprise, many people work in high-consequence environments. An accident involving any number of materials onsite can be extremely serious.

On June 19, 2025, Y-12 National Security Complex's (Y-12) emergency responders were alerted to a potential hazardous chemical spill on-site. At the time of the initial call, what was spilled was unknown, making the potential dangers also unknown. The emergency responders requested a hand (or a paw) from the Y-12's Plant Directed Research, Development, and Demonstration (PDRD) Spot research project. Read more…

➢ **Mission Agility, Technical Vitality**



AMAZING LDRD HIGHLIGHTS

LANL SCIENTISTS CRACK A CENTURY-OLD MATH MYSTERY: Quantum computers tackle a math puzzle> **Mission Agility, Technical Vitality, Workforce Development**

LANL SCIENTISTS UNRAVEL PLUTONIUM'S ATOMIC SECRETS: Understanding how atoms

bond in Plutonium's alpha phase> **Mission Agility, Workforce Development, Technical Vitality**

LLNL'S NONDESTRUCTIVE EVALUATION (NDE) TECHNIQUES CAN BECOME ENABLING TECHNOLOGIES FOR METAL ADDITIVE MANUFACTURING: How metal additive manufacturing structures behave as they are 3D printed **> Mission Agility, Technical Vitality, Workforce Development**

SANDIA 2025 R&D 100 AWARD WINNER: Prolific LDRD principal investigator wins Researcher of the Year **> Mission Agility, Technical Vitality, Workforce Development**

This newsletter, published quarterly, features LDRD, SDRD, and PDRD work done by Lawrence Livermore, Los Alamos, Nevada National Security Sites, Sandia, and Y-12 National Security Complex. To see a PDF with all articles referenced in this newsletter or review past issues, visit https://organizations.lanl.gov/nnsa-directed-r-and-d/ and click on the Quarterly Highlights tab. **NNSS eDC/RO ID: 82123**

For more information:

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National Nuclear Security Administration