SAND2020-0911R

LABORATORY DIRECTED RESEARCH & DEVELOPMENT
WHERE INNOVATION BEGINS

FY19 Annual Progress Report Submission Guidelines

Format:

Digital e-book (see example)

Content:

Short, crisp paragraphs with heavy graphic supplementation (NOTE: The IAs will not be covered individually. Rather, the IA accomplishments will be included in the organization of each goal/subcategory as outlined below.) Examples of accomplishments and photos are shown on page 4 of this document.

General structure of intro section:

Align to Tri-Lab LDRD program goals:

1) Mission agility/national security mission impact
2) Technical vitality and frontiers of S&T
3) Workforce development

Subcategories under each goal:

a. Mission connection (technology/capability affecting mission) *(only longer-term impact stories or recently-ended project stories need to be submitted)*
b. Technological breakthrough (R&D 100, Federal Consortium award)
c. Awards (Early career, Hruby, Truman, professional recognition, Fellows, PECASE, etc.)

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Content submissions template (all content must be UUR):

1) Which IA is sponsoring this accomplishment?

   Radiation Effects and High Energy Density Science

2) Who should we contact at Sandia if additional details are needed?
   William. R. Wampler 1866

3) Which **goal** above do you believe your update falls under? *(highlight your selection)*
   (1) Mission agility/national security mission impact
   (2) Technical vitality and frontiers of S&T
   (3) Workforce development

4) Which **subcategory** does your update align with? *(highlight your selection)*
   a. Mission connection (technology/capability affecting mission)
   b. Technological breakthrough (R&D 100, Federal Consortium award)
   c. Awards (Early career, Hruby, Truman, professional recognition, Fellows, PECASE, etc.)

5) Write a short 100- to 150-word description of the accomplishment. Include (as appropriate) the **significance of this accomplishment**, **how it benefits Sandia** (capability breakthrough, mission impact, workforce development), and **how it expands the forefront of Science, Technology & Engineering**. *(If there is a quote from someone on the team that you can include, these are very valuable.)*

Your accomplishment (100- to 200- words):

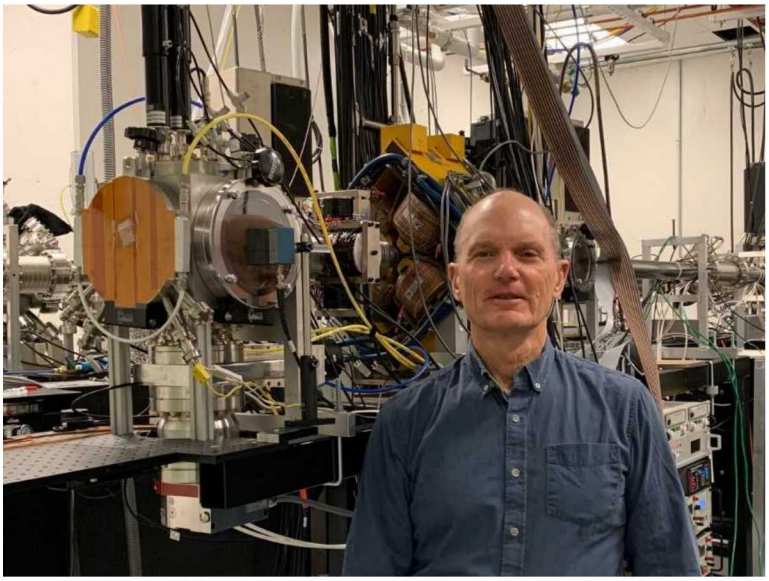
14 MeV DT Neutron Test Facility at the Sandia Ion Beam Laboratory

A recently completed LDRD project has provided a new facility at Sandia for testing effects of energetic neutrons on electronic components. 14 MeV neutrons are produced with a deuterium ion beam onto a thin-film tritide target. The goal of the project was to increase the neutron fluence to levels needed for radiation effects testing and qualification. This goal was achieved through two technical advances. First, a new multi-layer target concept was developed to reduce the rate of tritium loss from the target by isotope exchange, thereby reducing tritium usage and increasing target lifetime. The second advance was the construction of a new test chamber designed to maximize neutron flux at test locations. Together, these increased the available neutron fluence by several orders of magnitude. This new capability is being used in tests for Sandia nuclear weapon programs, evaluation of commercial parts such as highly-scaled CMOS SRAM ICs, and tests of new devices under development at Sandia such as III-V HBTs, gallium nitride high-voltage diodes, and for fundamental studies of physical mechanisms of device failure.

6) Please include any photos you have that may go with the accomplishment (consider photos of people, technology, test shots, etc.).

Include a short 25- to 50-word caption to accompany the accomplishment. Include the photo attribution if known. (The photo attribution (see below) doesn't count against the word count of your caption.)

Your photo with a 30- to 50-word caption: *(If no photo exists, state **N/A.**)*



New 14 MeV neutron test facility at the Sandia Ion Beam Laboratory with LDRD principal investigator William Wampler.

FY19 LDRD Annual Report Accomplishments

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Note: If you need to submit additional content, just copy the template above, paste here, and fill in as appropriate.

FY19 LDRD Annual Report Accomplishments

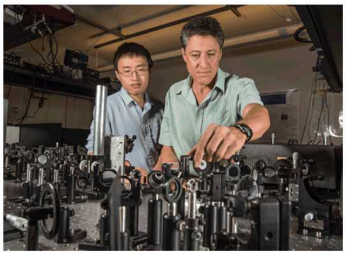
Example accomplishments:

Nanotechnology experts at Sandia create first terahertz-speed polarization optical switch.
A Sandia National Laboratories-led team has, for the first time, used optics rather than electronics to switch a nanometer-thick thin film device from completely dark to completely transparent, or light, at a speed of trillionths of a second. Ultrafast information processing "matters in computing, telecommunications, signal processing, image processing and in chemistry and biology experiments where you want very fast switching," Igal Brener said. "There are some laser-based imaging techniques that will benefit from having fast switching, too." Done in collaboration with North Carolina State University, the work was funded by Sandia's LDRD program and published in *Nature Photonics*.

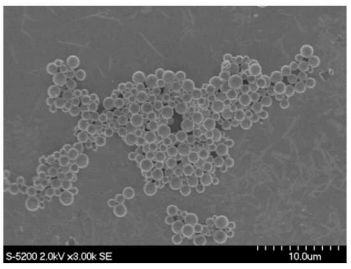
A splash of detergent makes catalytic compounds more powerful. Sandia researcher Hongyou Fan has produced a uniform powder that outperforms commercial varieties used as catalysts in solar cells and could be used to produce clean-burning hydrogen fuel. Fan is working on optimizing materials for potential applications like energy conversion in solar cells, phototherapy for cancer treatment, and hydrogen production for clean fuel sources by creating well-known particles in brand new shapes. LDRD researcher David Rosenberg is scaling up the technology for application to his explosives work for national security, where unpredictable materials are unacceptable. The technology is the subject of a recent paper in *Nano Letters*.

R&D 100 Award Winner - ADDSec: Artificial Diversity and Defense Security, principal investigator Adrian Chavez
Industrial control-system environments, such as the electric power grid, oil and natural gas refineries and water pipelines, continue to use predictable communication paths, static configurations and unpatched software, all of which benefit adversaries. Sandia has developed a technology that automatically detects and responds to threats within critical infrastructure environments in real time. The detection approach uses a set of machine learning algorithms that recognizes anomalous behavior and then classifies those anomalies into categories of attacks. The response approach uses software-defined networking to randomize IP addresses and application port numbers, invalidating the attacker's knowledge of the network and preventing successful deployment of attacks.

Example photo(s)/caption(s) with photo attribution:



USING OPTICS—*Former Sandia researcher Yuanmu Yang, left, and Sandia's Igal Brener set up to do testing in an optical lab. The pair were part of the nanotechnology team team that created the first terahertz-speed polarization optical switch. (Photo by Randy Montoya)*



Under high-power microscopy*, a powder made with detergent-based technology at Sandia National Laboratories consists of perfect spheres. Without it, the material would look like coarse gravel. Consistency makes catalytic materials considerably more effective. (Photo courtesy of Hongyou Fan)*

R&D 100 Winner — Artificial Diversity and Defense Security principal investigator Adrian Chavez *(Photo by Randy Montoya)*