Nine Los Alamos projects win R&D 100 Awards

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LOS ALAMOS, N.M., Nov. 6, 2019—Nine Los Alamos National Laboratory technologies won R&D 100 Awards and three inventions have won Special Recognition Awards, including a Gold and Silver for Corporate Social Responsibility, and a Gold Award for Market Disruptor Products.

"It's an honor to have Los Alamos National Laboratory's innovation recognized by the broader community with these nine R&D 100 awards," said Laboratory Director Thom Mason. "Behind all of these awards are people willing to take risks and think unconventionally about big problems in areas like national security, big data, and energy transmission. Their originality has brought the Laboratory to where we are today. Congratulations to the winners, special recognition awardees, and finalists for their outstanding achievements."

The Los Alamos projects selected as R&D 100 Winners are:

- **ALFa LDS:** Autonomous, low-cost, fast leak detection system can be flown on a drone or attached to a vehicle to locate, attribute, and distinguish natural gas leaks from biogenic methane sources.
- **Atomic Armor:** Nanomaterials protect sensitive technologies with a one-atom-thick shield.
- **DeltaFS: Open-source file system r**apidly searches big data to accelerate scientific discovery.
- **FEARCE:** Fast, easy, accurate and robust continuum engineering models processes in internal combustion engines to aid enhanced fuel efficiency and reduced emissions.
- **MC-15 Portable Neutron Multiplicity Detector:** Small, light, and fast portable neutron multiplicity detector enables nuclear response teams to quickly identify and assess nuclear-based threats.
- **Severe Contingency Solver for Electric Power Transmission Analysis:** Open-source software analyzes severely damaged electric power networks, assessing how damage from extreme events will restrict power delivery from utility grids.
- **SimCCS$^{2.0}$:** Open-source software enables the design of CO_2 capture, transport, and storage infrastructure.
- **SPLASH:** Smart platforms leveraging automated sample handling use magnetically actuated microfluidic operations to create complex fluid circuits for point-of-need applications of complex laboratory processes.

- **Unified Communications X (UCX):** Provides an open-source, exascale-ready communications framework for high performance computing.

"I congratulate the R&D 100 Award teams," said John Sarrao, Deputy Laboratory Director for Science, Technology, and Engineering. "These innovations continue the Laboratory's tradition of scientific and engineering excellence in support of our national security mission, industrial competitiveness, and the broader technical community. The awards demonstrate the strength of our partnerships with industry, academia, and other national laboratories in developing innovative solutions to challenging problems."

The R&D 100 Awards

The prestigious "Oscars of Invention" honor the latest and best innovations and identify the top technology products of the past year. The R&D 100 Awards span industry, academia and government-sponsored research organizations.

Since 1978 Los Alamos has won more than 162 of the prestigious R&D 100 Awards. The Laboratory's discoveries, developments, advancements and inventions make the world a better and safer place, bolster national security and enhance national competitiveness.

See all of the [2019 R&D 100 Winners](#). Read more about the [Laboratory's past R&D 100 Awards](#).

About the winners

ALFa LDS

The platform is an affordable, robust, autonomous system for the detection of natural gas leaks quickly and at low cost. Gas sensor data and atmospheric wind measurements from two compact instruments are fed into an artificial neural network that can detect, locate and quantify a leak. The lightweight instrument can be flown on a drone or attached to a vehicle to pinpoint, attribute, and distinguish natural gas leaks from biogenic methane sources.

Manvendra Dubey led the team of Bryan Travis, Keely Costigan, Jeremy Sauer, and collaborators from Aeris Technologies and Rice University.

Atomic Armor

The diamond-hard, flexible 2-D coating shields sensitive materials and devices from harsh environments while extending a device's lifetime and maximizing its functionality. Atomic Armor can be coated on solid surfaces of any shape or material. The Materials by Design approach for the one-atom-thick tunable coating enables it to be customized for many applications, including selective permeability.

Nathan Moody and Hisato Yamaguchi led the team of Fangze Liu, Enrique Batista, Gaoxue Wang, Ping Yang, Vitaly Pavlenko, Philip Fernandes and Jeffrey DeFazio (Photonis Scientific, Inc).

In addition to the R&D 100 Award, Atomic Armor won a Gold Medal in the Market Disruptor-Products Special Recognition Category. This award is designed to highlight any product that has changed the game in any industry.

DeltaFS

The DeltaFS open-source distributed file system for massively parallel applications creates, updates, and manages extreme numbers of files, alleviating the metadata bottleneck and accelerating highly selective queries. DeltaFS creates billions of files per second and does not require any additional compute resources or post-processing to create its data index. The performance and scalability capabilities that DeltaFS introduces are critical for storing and accessing data in the era of exascale computing.

Los Alamos led the joint entry with Carnegie Mellon University. Bradley Settlemyer directed the team of Gary Grider and collaborators from Carnegie Mellon University.

[FEARCE](#)

The software models engine motion, the motion of parts and their influence on the gases, multiphase injection of sprays and fuel droplets, the turbulent mixing of fuel and air, and subsequent chemical reactions in combustion engines. This modeling helps enable the design of engines for higher fuel efficiency and lower harmful emission. FEARCE models an engine's operating properties and ranges that can't be addressed readily with experiments. The software also enables designers to develop and optimize engines to run on alternative fuels, such as biofuels, which may require different operating conditions than those required for conventional fuels.

David Carrington lead the team with Jiajia Waters.

MC-15 Portable Neutron Multiplicity Detector

The MC-15 instrument is the smallest, lightest, and fastest portable neutron multiplicity detector, recording neutrons with 100-nanosecond time resolution. The MC-15 requires little training to operate, provides onboard or remote operation, and processes data in real time. Two units can be used in tandem to double the detection efficiency. The invention enables nuclear emergency response teams to quickly identify and assess nuclear-based threats, and it has applications for research in nuclear data and radiation transport validation.

Los Alamos led the joint entry with Lawrence Livermore National Laboratory and Sandia National Laboratories. The Los Alamos team consisted of Mark Nelson, Eric Sorensen, Brian Rooney, Richard Rothrock, Kiril Ianakiev, Metodi Iliev, Samual Salazar, Christopher Romero, David Jones, Jesson Hutchinson, and Matthew Newell plus collaborators from Lawrence Livermore National Laboratory and Sandia National Laboratories.

[Severe Contingency Solver for Electric Power Transmission Analysis](#)

Electric power transmission networks are critical for modern societies, but these networks are vulnerable to threats from extreme events. The Severe Contingency Solver open-source software analyzes severely damaged electric power networks that have hundreds to thousands of damaged components. The software removes the need for human intervention when assessing how damage from extreme events will restrict power delivery from utility grids.

Carleton Coffrin led the team of James Arnold, Scott Backhaus, Russell Bent, David Fobes, Kaarthik Sundar, and Byron Tasseff.

SimCCS[2.0]

The open-source software optimizes the design of carbon dioxide (CO_2) capture, transport, and storage infrastructure while reducing industry's carbon footprint and enhancing carbon tax credits and oil production. The fully integrated, end-to-end software package accounts for geographic and social constraints to geolocate pipelines in the real world. Industry, government, and stakeholders could use the software to design cost-effective pipeline networks linking CO_2 sources (such as power plants) with sites where CO_2 can be stored in deep saline aquifers or reused to increase oil and gas production.

Los Alamos led the joint entry with Indiana University and Montana State University. Richard Middleton directed the team of Bailian Chen, Dylan Harp, Brendan Hoover, Rajesh Pawar, Philip Stauffer, and Hari Viswanathan plus collaborators from Indiana University and Montana State University.

In addition to the R&D 100 Award, SimCCS[2.0] won a Silver Medal in the Corporate Social Responsibility Special Recognition Category. This award honors organizational efforts to be a greater corporate member of society, from a local to global level.

SPLASH

The miniature platform technology performs sequential operations involved in complex laboratory processes. SPLASH uses novel and powerful magnetically actuated valves and pumps to create complex microfluidic circuits with minimal peripheral hardware, tubing, and power requirements. The small size and simplicity of operation enable automated sample preparation and processing for point-of-need applications.

Pulak Nath led the team of Dylan Purcell, Jackson McFall, Aneesh Pawar, Tony Huang, Kiersten Haffey, and Hasibul Islam.

Unified Communications X

As supercomputers move towards exascale—a quintillion calculations per second—they incorporate a variety of hardware and processing systems. All of the elements in these systems must communicate harmoniously to operate efficiently. UCX is an open-source software for high performance computers that allows diverse hardware systems and architectures to communicate by creating common interface definitions.

Los Alamos led the joint entry with Advanced Micro Devices, Argonne National Laboratory, Arm Ltd, Mellanox Technologies, NVIDIA, Stony Brook University, Oak Ridge National Laboratory, and Rice University. Stephen Poole directed the team of Jeffery Kuehn and Howard Pritchard and collaborators from Advanced Micro Devices, ANL, Arm Ltd, Mellanox Technologies, NVIDIA, Stony Brook University, ORNL, and Rice University.

Additional Recognition

The Laboratory also received a Gold Medal for Corporate Social Responsibility. This award honors organizational efforts to be a greater corporate member of society, from a local to global level. **RETRO Rx:** Rapid, easy tools for responding to outbreaks and re-emergence events uses web-based information to assess infectious disease outbreaks and then provides visual analytics and actionable information to mitigate them and protect the population. The analytic tools require minimal effort and expertise and can be used for research, decision-making, analysis, forecasting, and training and education.

Alina Deshpande led the team of Geoffrey Fairchild, Derek Aberle, William Rosenberger, Ashlynn Daughton, Nidhi Parikh, Antonietta Lillo, Nileena Velappan, Attelia Hollander, Emily Alipio Lyon, Forrest Altherr, Maneesha Chitanvis, Lauren Castro, Reid Priedhorsky, Grace Vuyisich, Eric Generous, Kristen Margevicius, Kirsten McCabe, and collaborators from University of New Mexico, University of Virginia, University of California – Santa Barbara, and Specifica Inc.

The Laboratory also received two R&D 100 Finalist Awards:

BOM

The energetic material bis(1,2,4-oxadiazole)bis(methylene) dinitrate, or BOM, is the next generation of high-performance explosives. BOM is a higher-performing, safer explosive designed to replace toxic TNT in civilian and military applications. Unlike TNT, BOM is a standalone explosive that does not require the addition of an enhancer.

Los Alamos submitted the joint entry with the U.S. Army Research Laboratory. David E. Chavez led the team of collaborators from the U.S. Army Research Laboratory.

Falcon Plasma Focus:

The device is a portable, compact neutron generator utilizing pulsed power technology. The technology produces short, high-output neutron pulses that can be applied to a variety of uses including nuclear material detection, explosives detection, materials research, and other industrial applications.

Nevada National Security Site Mission Support and Test Services LLC submitted the joint entry with Los Alamos National Laboratory, Sandia National Laboratories, Lawrence Livermore National Laboratory, University of Nevada, Las Vegas; Powder River Geophysical; Alameda Applied Sciences; Sigma Science/Keystone Global Engineering and Technology, Inc. Jessie Walker was the Los Alamos team member.

Read more about the Laboratory's past R&D 100 Awards.

Caption for image below: *Jiajia Waters and David Carrington discuss the FEARCE model of an internal combustion engine.*