High-impact innovations honored as R&D 100 Award Finalists

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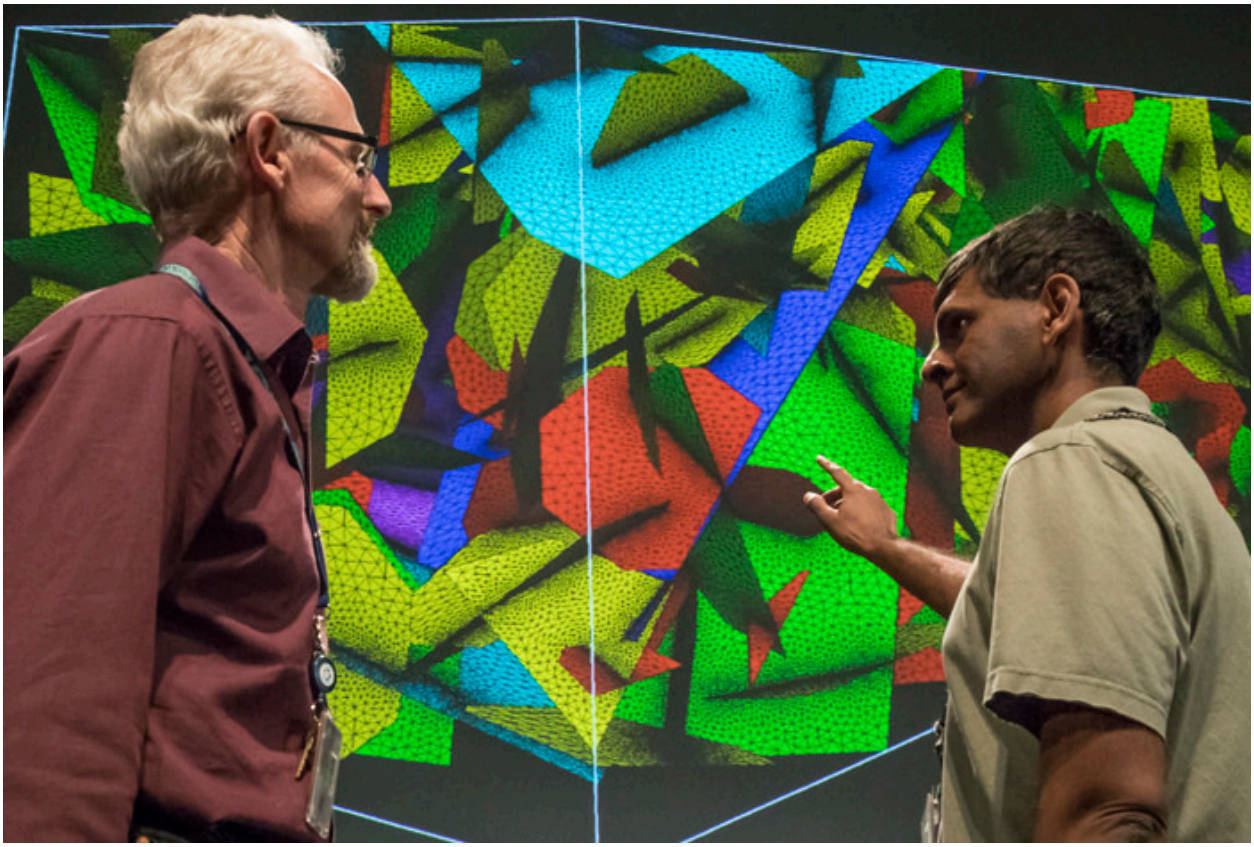

Los Alamos National Laboratory snags eight nominations for health, computer modeling, materials, engineering and energy technologies

LOS ALAMOS, N.M., Aug. 29, 2017—Eight Los Alamos National Laboratory innovations were selected as finalists for the 2017 R&D 100 Awards, which honor the top 100 proven technological advances of the past year as determined by a panel selected by *R&D Magazine*. The finalists, with projects covering energy, modeling and simulation, health, materials and engineering, demonstrate the continued success of Laboratory researchers in technical innovation for national security science.

“The R&D 100 finalists represent the broad scope of science and engineering capabilities that support the Laboratory’s national security mission,” said Carol Burns,

Los Alamos' deputy principal associate director of science, technology and engineering. "This year's finalists reflect the Lab's scientific creativity and technical achievement. Many of the innovations also demonstrate productive external partnerships with universities, private industry and other government laboratories to develop of technical solutions that serve the country."

The Los Alamos projects selected as finalists are:

- Clean-Energy Catalysts Without Precious Metals: Making next-generation fuel cells cost effective
- Discrete Fracture Network Modeling Suite (dfnWorks): Transforming simulations of flow and transport through fractured rock
- EDGE Bioinformatics: Making genomics accessible to everyone
- High-Temperature Electric Submersible Pump Motor (HT-ESP): Keeping cool in deeper, extremely hot environments
- National Risk Assessment Partnership Toolset (NRAP): A set of computational tools to inform decision making for geological carbon storage sites amidst uncertainty
- SHIELDS Space Weather Platform: Predicting hazards that result from solar storms
- WikiEpiCast: Using Wikipedia to perform real-time disease monitoring and forecasting
- Zirconia Electrochemical Hydrogen Safety Sensor: Ready to protect the new-energy economy

"These R&D 100 Finalists demonstrate the innovative technologies from Los Alamos that have potential for wide-ranging impact on industry," said Dave Pesiri, director of the Richard P. Feynman Center for Innovation. "Many of these R&D finalists are already working to spur commercialization and industry development to be new products or services in the global marketplace."

The R&D 100 Winners will be announced November 17.

About the Finalists

Clean-Energy Catalysts Without Precious Metals uses inexpensive, Earth-abundant and easily sourced precursor materials for the synthesis of electrocatalysts for hydrogen-based fuel cells. The fuel cells produce electrical energy and emit one byproduct: water. Conventional fuel cells rely on costly precious metal catalysts, such as platinum. The new precious-metal-free electrocatalysts generate performance approaching that of precious metal catalysts but at a fraction of the cost.

Los Alamos submitted the joint entry with Pajarito Powder, LLC based on technology that Pajarito Powder licensed from the Lab. Piotr Zelenay led the Los Alamos team of Hoon Taek Chung, Edward Holby and Ulises Martinez. Pajarito Powder collaborators include Barr Zulevi, Alia Lubers, Geoff McCool and Sam McKinney.

dfnWorks: Discrete Fracture Network Modeling Suite is a computational suite that simulates and predicts the flow and transport of fluids through underground fractured rock. It covers length scales that range from millimeters to kilometers, can run on computers as small as a laptop and as large as a supercomputer and requires minimal effort to create representative models. Applications for dfnWorks include helping catch

rogue nations performing underground nuclear tests and maximizing the extraction of natural gas, oil and geothermal wells while minimizing environmental impacts.

Los Alamos submitted the joint entry with Oak Ridge National Laboratory. Carl Gable led the Los Alamos team of Jeffrey Hyman, Satish Karra, Nataliia Makedonska and Hari Viswanathan, with Oak Ridge collaborator Scott Painter.

EDGE (Empowering the Development of Genomics Expertise) Bioinformatics "democratizes" the genomics revolution by enabling any researcher or physician to analyze complex genomics data quickly and easily. The intuitive, web-based platform can be applied to a wide variety of genome-sequencing samples ranging from individual isolates (from a culture of a single organism) to much more complex metagenomics (microbiome) projects. The platform addresses the problem of handling big data, without requiring users to possess bioinformatics expertise. EDGE brings the power of complex, big-data sequencing analysis to smaller research laboratories, including clinics, hospitals, universities and remote sites.

Los Alamos submitted EDGE as a joint entry with the Naval Medical Research Center. Patrick Chain led the Los Alamos team of Po-E Li, Chien-Chi Lo, Karen Davenport, Yan Xu, Pavel Senin and Migun Shakya. Collaborators at the Naval Medical Center include Theron Hamilton, Kimberly Bishop-Lilly, Joseph Anderson, Logan Voegtly and Casandra Philipson.

High-Temperature Electric Submersible Pump Motor (HT-ESP) is rugged and reliable, offering improved thermal performance compared to conventional submersible pumps used in deep underground and extremely hot environments. Whether electric submersible pump motors are used in drilling deeper for oil and gas reservoirs or tapping into geothermal resources of energy, they must operate in harsh, extremely hot environments. Current pump motors overheat and must be replaced often. To solve this, the Los Alamos/Chevron Energy Technology Company research team developed two technologies for HT-ESP to lower the internal operating temperature of the motor.

Los Alamos submitted the HT-ESP as a joint entry with Chevron. Todd Jankowski led a Los Alamos team of Dallas Hill, Britton Lambson, James Stewart, Robert Bourque and Coyne Prenger. Chevron collaborators include Jose Gamboa, Daniel Hunt, Max Bough and Yamila Orrego.

National Risk Assessment Partnership (NRAP) Toolset is a set of 10 science-based computational tools developed to assess long-term environmental risks of geologic carbon dioxide (CO_2) storage sites. This novel toolset is the only product suite that allows rapid, site-specific quantitative and probabilistic risk performance evaluation of the whole geological CO_2 storage system – from storage reservoir to overlying groundwater and the atmosphere. These tools support industry and regulatory stakeholders as they design and implement safe and effective geological CO_2 storage projects to sequester large volumes of human-made CO_2.

The National Energy Technology Laboratory submitted the joint entry with Los Alamos National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory and Pacific Northwest National Laboratory. Rajesh Pawar led the Los Alamos team of Chris Bradley, George Guthrie, Elizabeth Keating, Phil Stauffer, Shaoping Chu, Dylan Harp, Richard Lee and Bill Carey.

SHIELDS (Space Hazards Induced near Earth by Large, Dynamic Storms) protects communication, navigation and scientific satellites orbiting the Earth's magnetosphere

by predicting hazards resulting from solar storms that cause space weather. Space weather could damage onboard electronics in satellites and thus interrupt radio and television reception, disrupt the operation of cellphones and GPS, shut down the Internet and endanger military and civilian operations. Researchers developed the software platform to understand, model and predict this weather about an hour before it hits satellites, enabling instruments to be placed in a safe mode.

Los Alamos submitted SHIELDS as a joint entry with the University of Michigan. Vania Jordanova led the Los Alamos team of Gian Luca Delzanno, Humberto Godinez, J. David Moulton, Daniil Svyatsky, Michael Henderson, Steve Morley, Jesse Woodroffe, Thiago Brito, Christopher Jeffery, Alin-Daniel Panaitescu, Collin Meierbachtol, Earl Lawrence and Louis Vernon. University of Michigan collaborators included Gabor Toth, Daniel Welling, Yuxi Chen and John Haiducek.

WikiEpiCast framework combines mathematical models with clinical surveillance data and readership traffic from Wikipedia to forecast the spread and severity of diseases around the world. Successfully demonstrated on forecasting influenza in the United States, WikiEpiCast's framework can be applied to any communicable disease, from Ebola and tuberculosis to Zika virus. The tools being developed within WikiEpiCast present probabilistic forecasts, similar to how nightly newscasts present weather updates. As a result, such forecasts are easy for nonscientist decision makers to digest and in turn make informed decisions that could save lives and potentially mitigate the potential impacts of an epidemic or pandemic of a burgeoning communicable disease.

Los Alamos submitted the WikiEpiCast entry. Sara Del Valle led the team of Nicholas Generous, Geoffrey Fairchild, Kyle Hickmann, Reid Priedhorsky and David Osthus.

Zirconia Electrochemical Hydrogen Safety Sensor makes filling up hydrogen-fueled vehicles a lot safer. Hydrogen gas is highly flammable, colorless and odorless and propagates very quickly if released into the air. It is not possible to introduce odorants to detect the presence of hydrogen leaks because the chemicals used to create a foul warning odor would damage the catalysts and internal components of the vehicle's fuel-cell stack. The Hydrogen Safety Sensor is made of safe, durable and long-lasting ceramic sensor elements of the type used in automotive oxygen sensor technology. The safety sensors can be placed anywhere in the hydrogen supply chain, from hydrogen production and distributions to a critical component of the hydrogen pump at a filling station to a functioning safety component of the consumer product itself.

Los Alamos submitted the Hydrogen Safety Sensor as a joint entry with Lawrence Livermore National Laboratory and Hydrogen Frontier, Inc. Eric Brosha led the Los Alamos team of Christopher Romero, Rangachary Mukundan and Cortney Kreller. Collaborators include Amanda Wu and Robert Glass (Lawrence Livermore National Laboratory) and Daniel A. Poppe (Hydrogen Frontier, Inc.).

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 137 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.

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