TECHNOLOGY TRANSFER

Annual Report — Fiscal Year 2017

— December —

Idaho National Laboratory

Contents

On the Cover:
A licensing agreement with Dynexus Technology will commercialize INL technology for forecasting health and safety characteristics of advanced batteries.

Editor: Nicole Stricker

Writers: Paul Menser, Leslie Wright

Graphic Artist: Scott Brown

Photographer: Chris Morgan

From the Technology Deployment Director

As director of Technology Deployment at Idaho National Laboratory, I am proud to lead an organization with such dedication to our mission, outcome and strong spirit of innovation. Ensuring the nation's energy security requires not only research, development and demonstration, but actual deployment and industry use of INL's capabilities and innovations. Our goal is to build an inspiring legacy of impact by ensuring INL technologies are put to use to grow our economy, improve the quality of our lives and keep us safe from national threats.

Deploying an INL technology requires a team effort, which starts with our esteemed innovators and results in shared success among many individuals and organizations. The accomplishments cataloged in this report reflect a culmination of notable efforts and demonstrate the value of the hard work and combined talents of numerous INL employees.

Fiscal Year 2017 was INL's best year since 2012 for technology deployment. With over 260 active licenses — and more than 50 signed in 2017 — innovation deployment metrics, software and invention disclosures, patent licenses and overall license agreements have all increased. INL continued to execute Strategic Partnership Projects, User Facility and Cooperative Research and Development Agreements to address the challenges industry faces.

INL has assumed National Technology Transfer Working Group leadership positions and received honors including Federal Laboratory Consortium regional awards, Idaho Innovation Award finalists, an Idaho Genius award, and an R&D 100 Award finalist. We were leaders among Department of Energy labs in Technology Commercialization Fund (TCF) awards and Energy I-Corps participation.

It is an exciting time to be part of INL, and I believe we are setting the stage for new invention opportunities and discoveries that will factor into not only INL's growth, but also America's prosperity, for years to come.

Our organization also has focused on leadership, reporting more than 60 impact leadership achievements throughout the year. We've increased awareness of INL's impact nationally and regionally. We are enhancing the Gateway for Accelerated Innovation in Nuclear (GAIN) and other initiatives within DOE's Office of Nuclear Energy (DOE-NE). And we're expanding software deployment, establishing leadership in Open Source Software releases, supporting research strategy improvements and achieving operational excellence in licensing activities.

We're grateful for the encouragement received from private and government sponsors, the DOE, licensees, users and partners in FY 2017. We will continue to recognize INL's top innovators by establishing a Hall of Fame in their honor. Continued participation in the TCF and Energy I-Corps, launching an INL I-Corps lite program, and publishing inventor, author and training guides will help us continue to improve.

It is an exciting time to be part of INL, and I believe we are setting the stage for new invention opportunities and discoveries that will factor into INL's growth and America's prosperity for years to come.

Jason Stolworthy

Director, Technology Deployment

Abstract

Idaho National Laboratory (INL) is a U.S. Department of Energy (DOE) multiprogram national laboratory that conducts research and development in all DOE mission areas. Like all other national laboratories, INL has a statutory, technology transfer mission to make its capabilities and technologies available to federal agencies, state and local governments, universities and industry. To fulfill this mission, INL encourages its scientific, engineering and technical staff to disclose new inventions and creations to ensure the resulting intellectual property is captured, protected and made available to others who might benefit from it.

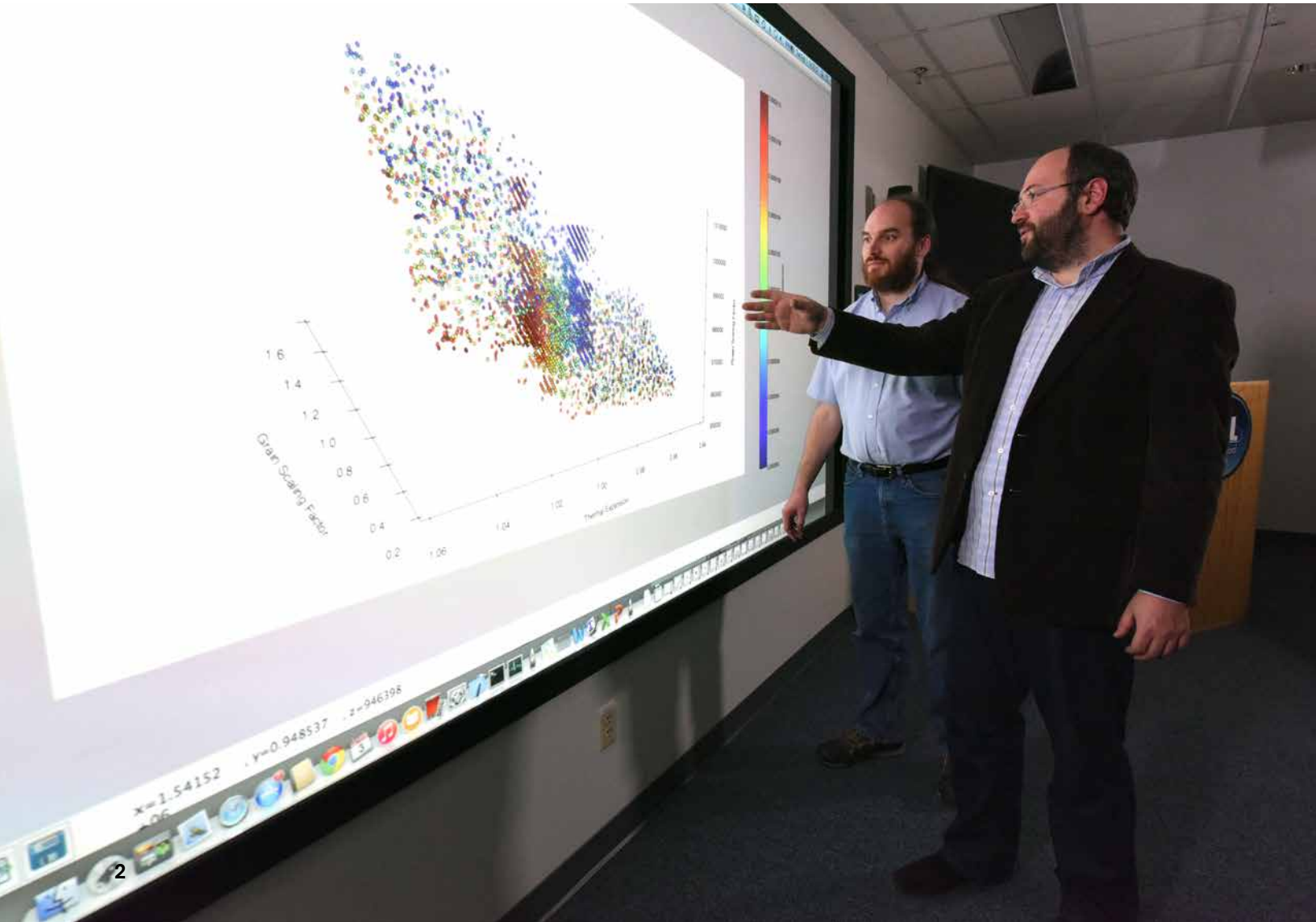
As part of the mission, intellectual property is licensed to industrial partners for commercialization, job creation and delivering the benefits of federally funded technology to consumers. In some cases, unique capabilities are made available to other federal agencies, international organizations, domestic and foreign commercial entities or small businesses to solve specific technical challenges. INL employees work cooperatively with researchers and technical staff from the university and industrial sectors to further develop emerging technologies. In this global economy, INL is contributing to the development of the next generation of engineers and scientists by licensing software to educational institutions throughout the world.

This report is a catalog of select INL technology transfer activities, including commercialization transactions and research agreements, executed during this past year. The size and diversity of INL technical resources, coupled with the large number of relationships with other organizations, virtually ensures that a report of this nature will fail to capture all interactions. Recognizing this limitation, this report focuses on transactions that are specifically authorized by technology transfer legislation (and corresponding contractual provisions) or involve the transfer of legal rights to technology to other parties.

This report was compiled from primary records that were readily available to the INL's Technology Deployment and Agreement Management offices. Accomplishments cataloged in the report reflect the achievements and creativity of the researchers, technicians, support staff and operators of the INL workforce.

Prepared for the
U.S. Department of Energy
Under DOE Idaho Operations Office

Contract DE-AC07-05ID14517



Intellectual Property

The Intellectual Property (IP) portfolio for INL includes invention disclosure records, patent applications, issued patents and copyright assertions. INL's IP portfolio provides a basis for collaboration with commercial enterprises, academia and other parties, both domestic and international. INL's science, engineering and technical IP portfolios provide the opportunity for the laboratory to deploy its creative, meaningful research.

Technology Deployment (TD) works closely with INL management and researchers to identify and pursue opportunities for technology commercialization and business development.

In Fiscal Year 2017, INL inventors submitted to Battelle Energy Alliance, LLC (BEA) 56 invention disclosure records (IDR) and 15 software disclosures (SDR).

In FY 2017, 20 U.S. patents were issued to either INL or the DOE based on the inventions of INL scientists and researchers.

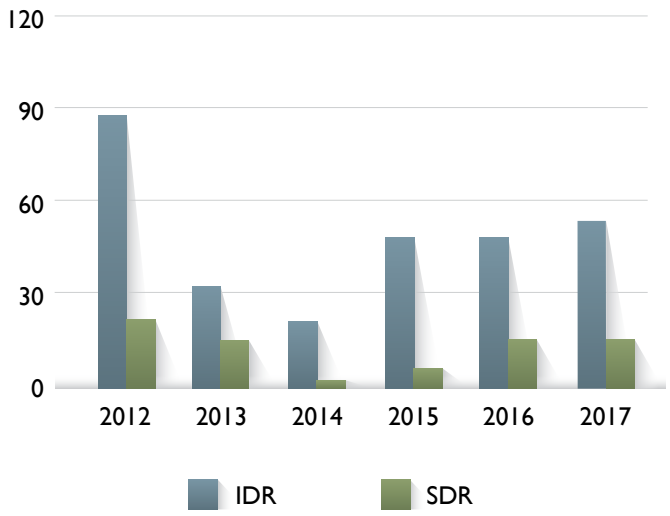
Since the commencement of BEA's contract to manage INL, laboratory researchers have generated 995 IDRs. These IDRs have resulted in more than 470 issued U.S. patents.

BEA has IP rights under its contract with DOE and can elect to retain title to inventions and seek patent protection, subject to some exceptions. The decision of whether or not to seek patent protection is based on market and technical assessments of the technology and its subsequent programmatic value.

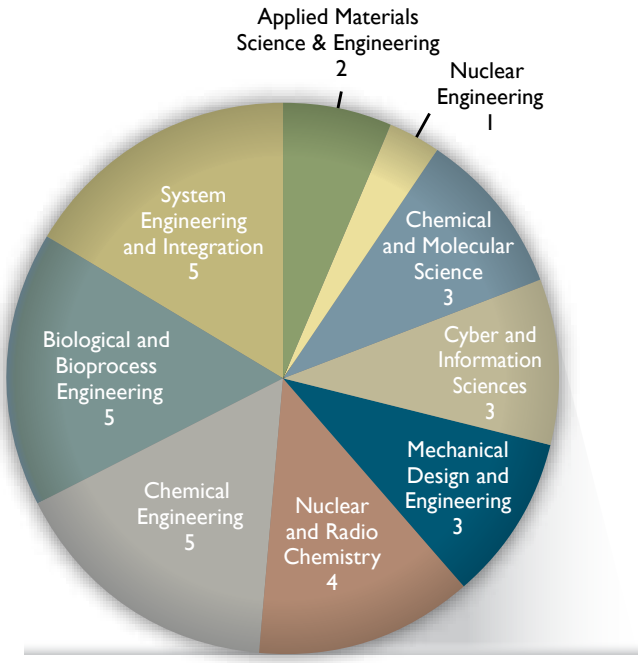
Market assessments inform a recommendation presented to a committee composed of department or project managers, an assistant laboratory director or designee, market analysts, commercialization managers, and patent attorneys. The TD director makes a final decision to elect or decline the technology for patent protection. Generally, if the invention is judged to be commercially valuable, crucial to a primary mission, or valuable in terms of motivating further research funding, it is elected.

If BEA decides to decline title, DOE can seek patent protection in its own name. If DOE decides not to seek patent protection, the inventor(s) may petition to have the title assigned to them by DOE with the expectation that they will pursue patent protection using their own resources.

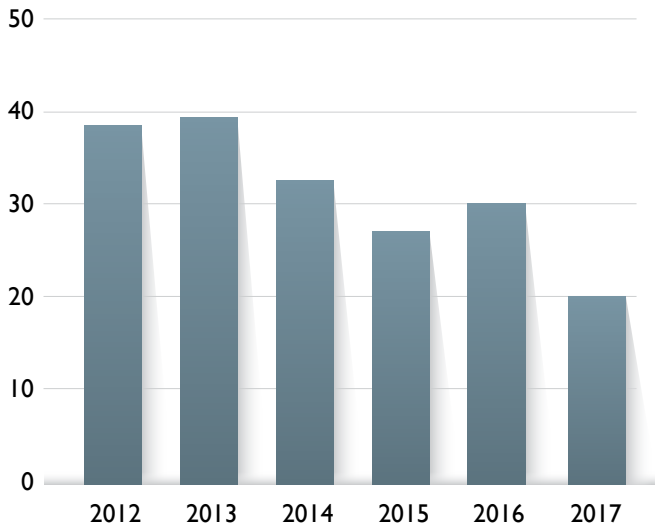
Disclosure records received FY 2012–2017



Core competencies associated with FY 2017 patents



U.S. patents issued FY 2012–2017



Patents

Energy Harvesting Devices, Systems and Related Methods

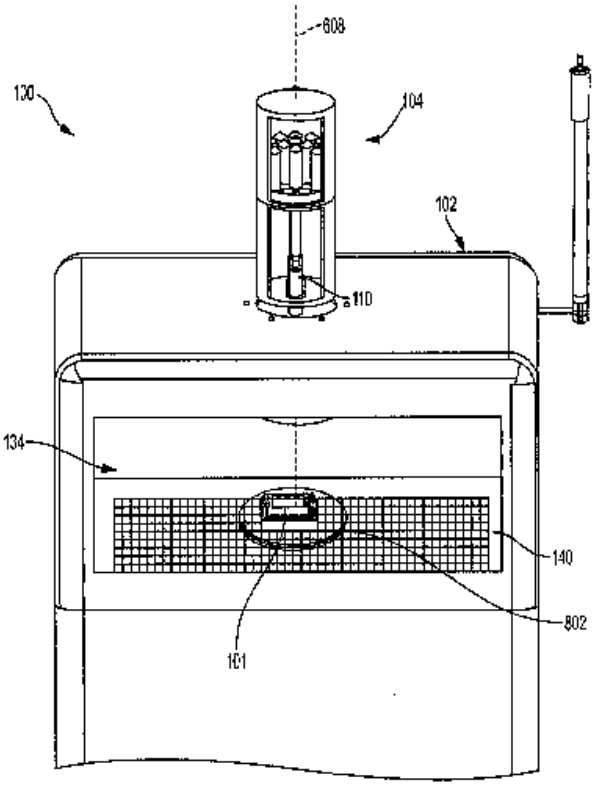
This invention seeks to tap into electromagnetic radiation in the ultraviolet, visible and infrared spectrum as an energy source. The patent describes an energy harvesting device with frequency selective surfaces consisting of a two-dimensional periodic array of electromagnetic antenna elements that can make use of radiation in the ultraviolet, visible and infrared spectra as a potential source of energy.

Patent No. 9,472,699 granted 10/18/2016 to Dale K. Kotter

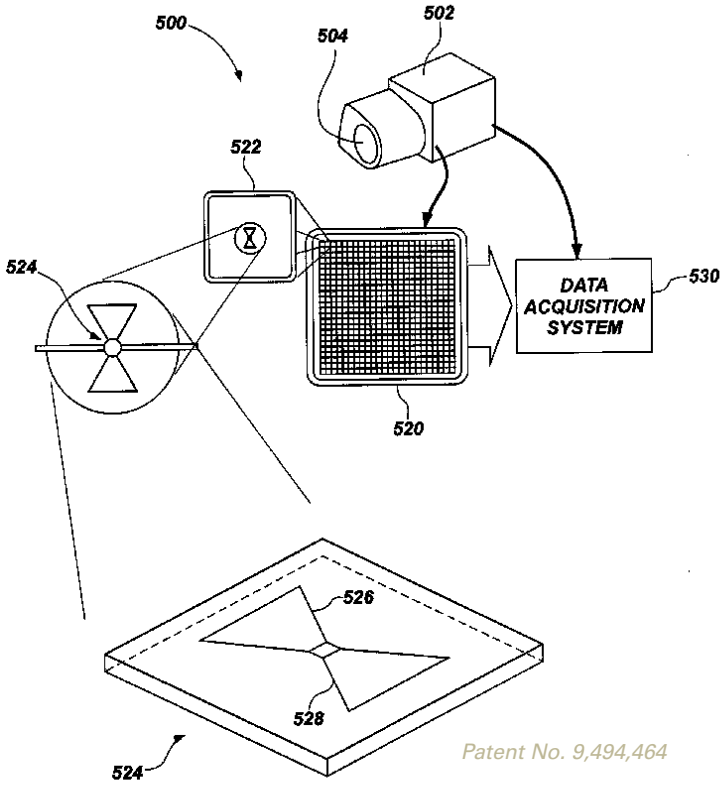
Energetic Materials and Methods of Tailoring Electrostatic Discharge Sensitivity of Energetic Materials

Energetic materials, especially those used as first-fire mixes, are susceptible to unintentional electrostatic discharge (ESD) initiation, which presents risks and is difficult to eliminate in real-world situations. Carbon nanofibers filled with a manganese oxide composition exhibited reduced friction sensitivity and decreased ESD sensitivity when compared to a composition lacking the carbon nanofibers.

Patent No. 9,481,614 granted 11/1/2016 to Michael A. Daniels, Ronald J. Heaps, Ronald S. Wallace, Michelle Pantoya and Eric Collins



Patent No. 9,488,452



Patent No. 9,494,464

Apparatus for Rendering at Least a Portion of a Device Inoperable and Related Methods

Electronic devices often have memory portions that can contain data that may need to be eliminated. Though several methods exist for this disposal, some data may still be retrievable. This apparatus has a device containment structure and a movable member to move a data cartridge within the structure and ignite a reactant material, liquefying and expelling molten metal onto the device and rendering it inoperable.

Patent No. 9,488,452 granted 11/8/2016 to Michael A. Daniels, Eric D. Steffler, Steven D. Hartenstein and Ronald S. Wallace

Terahertz Imaging Devices and Systems, and Related Methods, for Detection of Materials

There is a security interest in detecting threatening materials, such as radioactive materials or explosives, in public places. Frequency selective surfaces (FSS), used in a variety of applications, generally include a metallic grid of antenna elements formed on a dielectric substrate. The antenna elements may be designed to generate different spectral responses, enabling an FSS to serve as a terahertz imaging device to detect materials from a greater distance than conventional radiation detectors.

Patent No. 9,494,464 granted 11/15/2016 to Dale K. Kotter

Transcriptional Control in Alicyclobacillus Acidocaldarius and Associated Genes, Proteins, and Methods

The genome of Alicyclobacillus acidocaldarius contains coding sequences for proteins related to the cell's growth and carbon processing. Genes and proteins described in this patent may represent targets for the metabolic engineering of this or other organisms. This genetic engineering may optimize cellular processes and directly affect enzymes used to process biomass outside the cell or control production of valuable secondary metabolites. These metabolites can be used in the production of renewable fuels and other valuable chemicals.

Patent No. 9,499,824 granted 11/22/2016 to Brady D. Lee, David N. Thompson, William A. Apel, Vicki S. Thompson, David W. Reed and Jeffrey A. Lacey

Methods of Decontaminating Surfaces and Related Compositions

To respond to nuclear, biological or chemical emergencies, government agencies must be prepared to mitigate hazards. A method of decontamination includes applying this patented foam composition to a contaminated surface and then removing the foam, along with the contamination, from the surface.

Patent No. 9,499,772 granted 11/22/2016 to Rick L. Demmer, Daniel J. Crosby and Christopher J. Norton

Gadolinium-loaded Gel Scintillators for Neutron and Antineutrino Detection

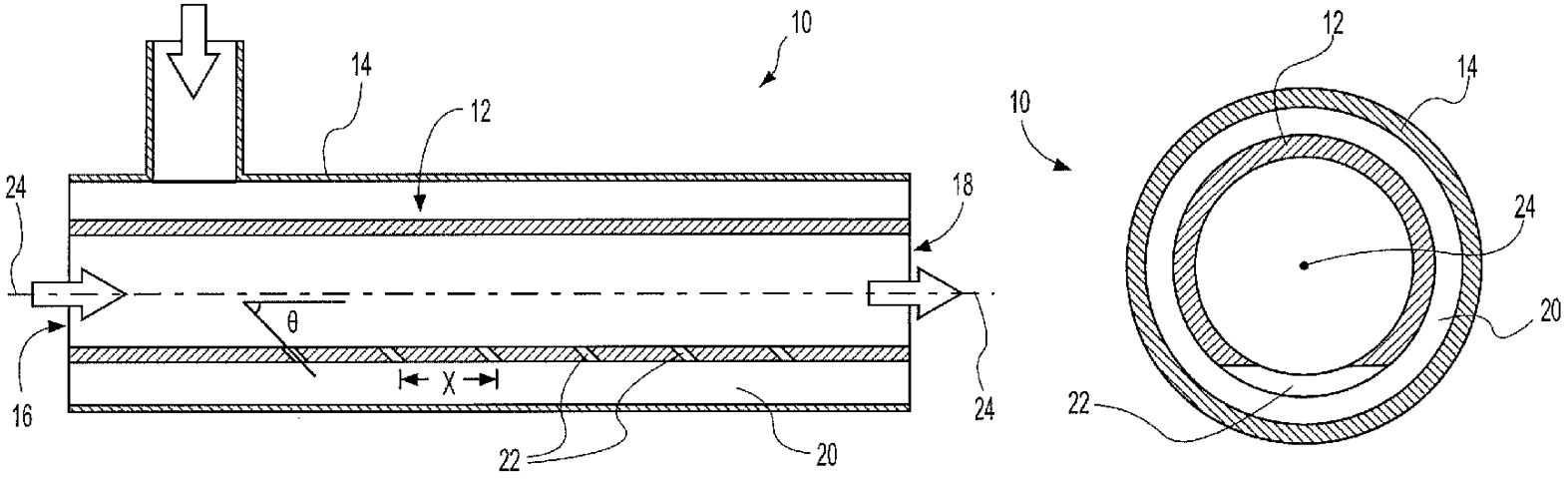
Radiation detection is used in many applications including science, medicine and security. A wide range of such applications may benefit from improvements in materials used in radiation detectors. A gel scintillator exploits positive aspects of liquid scintillators while avoiding stability problems of solid polymers. It will allow for neutron and gamma-ray detection and for more efficient, stable and safe operation of radiation detectors.

Patent No. 9,505,977 granted 11/29/2016 to Catherine L. Riddle, Douglas W. Akers, Rick L. Demmer, Patricia D. Paviet and Mark W. Drigert

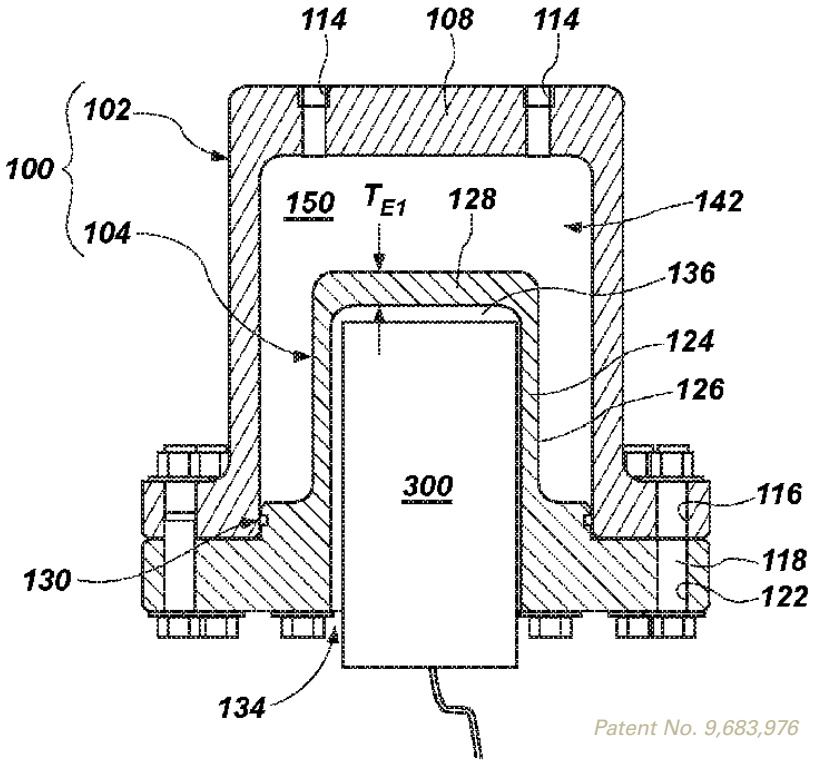
Circuits and Methods for Impedance Determination Using Active Measurement Cancellation

As a battery ages its storage capacity will decrease, so observations of battery parameters are necessary. For many systems, measurements need to be performed without disconnecting the terminals of the battery. This is conventionally done by placing a shunt with known impedance in series with the battery and injecting a signal into the shunt and battery. Active Measurement Cancellation is a simple, real-time method for directly measuring impedance without the use of an imbedded system shunt.

Patent No. 9,519,031 granted 12/13/2016 to David K. Jamison



Patent No. 9,574,713



Patent No. 9,683,976

Methods and Apparatuses Using Filter Banks for Multi-carrier Spread-spectrum Signals

As the demand for personalized applications continues to grow in mobile communications, there is an increasing need for seamless connectivity between different multi-carrier modes. Multi-Carrier Spread Spectrum (MC-SS) is a particular form of spread-spectrum technique that is designed to be resistant to narrow and/or partial band interference. There is a need for apparatuses and methods such as this Filter-Bank MC-SS that generate and detect MC-SS that can carry information at a very low power level distributed over the frequency spectrum.

Patent No. 9,559,748 granted 1/31/2017 to Hussein Moradi, Behrouz Farhang and Carl A. Kutsche

Type II Restriction-modification System Methylation Subunit of Alicyclobacillus Acidocaldarius

Thermophilic and acidophilic bacteria have great potential for production of useful chemicals in industrial processes. However, most systems for promoting genetic recombination for the purposes of introducing nucleic acids of interest are not well-suited for such bacteria. Embodiments of this invention relate to isolated and purified Alicyclobacillus acidocaldarius polypeptides, nucleic acid sequences encoding them and methods for their use.

Patent No. 9,567,595 granted 2/14/2017 to Brady D. Lee, Deborah T. Newby, Jeffrey A. Lacey, David N. Thompson, Vicki S. Thompson, William A. Apel, Francisco F. Roberto and David W. Reed

Vaporization Chambers and Associated Methods

Liquefied natural gas is produced via a refrigeration process that changes the gas to a liquid state. Carbon dioxide has a freezing temperature that is higher than the liquefaction temperature of methane, which results in solid crystal formation as the natural gas cools. Because of this, conventional liquefaction systems utilize a costly process to separate CO_2 from other natural gas components prior to the liquefaction process. This invention eliminates the need for gas phase CO_2 separation with a vaporization chamber that enables effective separation of solid CO_2 to a sublimation device.

Patent No. 9,574,713 granted 2/21/2017 to Terry D. Turner, Bruce M. Wilding, Michael G. McKellar and Lee P. Shunn

Improved Antibody Profiling Sensitivity Through Increased Reporter Antibody Layering

Antibody profiling is based on the discovery that every individual has a unique set of antibodies found in many bodily fluids and tissues. A method for analyzing biological samples by antibody profiling in a biochip format would make analysis amenable to automation. In this invention, the method is used as a test for the presence of drugs and can also be used to test for identity.

Patent No. RE46351, granted 3/28/2017 to William A. Apel and Vicki S. Thompson

Method, System, and Computer-readable Medium for Estimating a Predicted Arbitrary Aging Condition of an Object

Over the service life of a battery, certain performance characteristics may experience losses. This invention describes systems and methods that provide a modeling capability to more accurately determine, track and diagnose performance losses due to degradation mechanisms. The system also predicts arbitrary aging conditions of an object, such as electrochemical cells and batteries.

Patent No. 9,625,532 granted 4/18/2017 to Kevin L. Gering

Monitoring Devices and Systems for Monitoring Frequency Hopping Wireless Communications, and Related Methods

Wireless technologies employing frequency, such as BLUETOOTH.RTM, are becoming more pervasive in industry and government environments. In undiscoverable mode, a device may communicate but will not be detectable to conventional monitoring devices, which may allow communications to occur in areas not necessarily desired. Various embodiments of this invention comprise monitoring devices and systems configured to monitor frequency hopping wireless communications without transmission by the device or system.

Patent No. 9,641,216 granted 5/2/2017 to Kurt W. Derr and John G. Richardson

Accident-Tolerant Oxide Fuel and Cladding

The events surrounding the loss of coolant accident caused by the tsunami at Fukushima have driven interest in developing more accident-tolerant fuels. Despite the success of today's oxide fuels, their thermal conductivity is a drawback. This patent describes an innovative fuel design that lowers the peak temperature of the fuel by approximately 640 degrees Celsius at peak power.

Patent No. 9,666,310 granted 5/30/17 to Robert D. Mariani

Thermophilic and Thermoacidophilic Glycosylation Genes and Enzymes from Alicyclobacillus Acidocaldarius and Related Organisms, Methods

Glycosylation (the addition of a carbohydrate molecule) has been shown to assist in protein stability, modulate physical properties such as solubility, protect against protein breakdown, modify activity profiles and target proteins to the outside of cells. Isolated and purified polypeptides and nucleic acid sequences encoding polypeptides from Alicyclobacillus acidocaldarius are described in this invention, with methods for glycosylating certain proteins.

Patent No. 9,677,054 granted 6/13/2017 to David N. Thompson, William A. Apel, Vicki S. Thompson, David W. Reed and Jeffrey A. Lacey

Containers and Systems for the Measurement of Radioactive Gases and Related Methods

Detection of radionuclides in the atmosphere involves sampling a very large volume of gas with a relatively small radioactive signal. Existing containers for detection generally cannot be used for low activity, low energy and high pressure gases. This patent describes containers that can maintain at least 1,000 psi so that a far larger sample volume may be concentrated, thus increasing the probability of detecting trace amounts of radionuclides.

Patent No. 9,683,976 granted 6/20/2017 to Nicholas R. Mann, Matthew G. Watrous, Christopher O. Oertel and Christopher McGrath

Chemical Detection System and Related Methods

The U.S. military has used neutron activation analysis techniques for nondestructive identification of suspect, sealed chemical munitions and containers for the past several decades. This patent includes an advanced chemical detection system and method for testing and identifying one or more chemicals of interest, such as chemical warfare agents and reactive or explosive materials not previously capable of detection.

Patent No. 9,689,814 granted 6/27/2017 to Augustine J. Caffrey, Kenneth M. Krebs, Edward H. Seabury, John M. Zabriskie, David L. Chichester, Clinton D. Van Siclen, Ann E. Egger and Carl J. Wharton

Methods of Combined Bioprocessing and Related Microorganisms, Thermophilic and/or Acidophilic Enzymes, and Nucleic Acids Encoding Said Enzymes

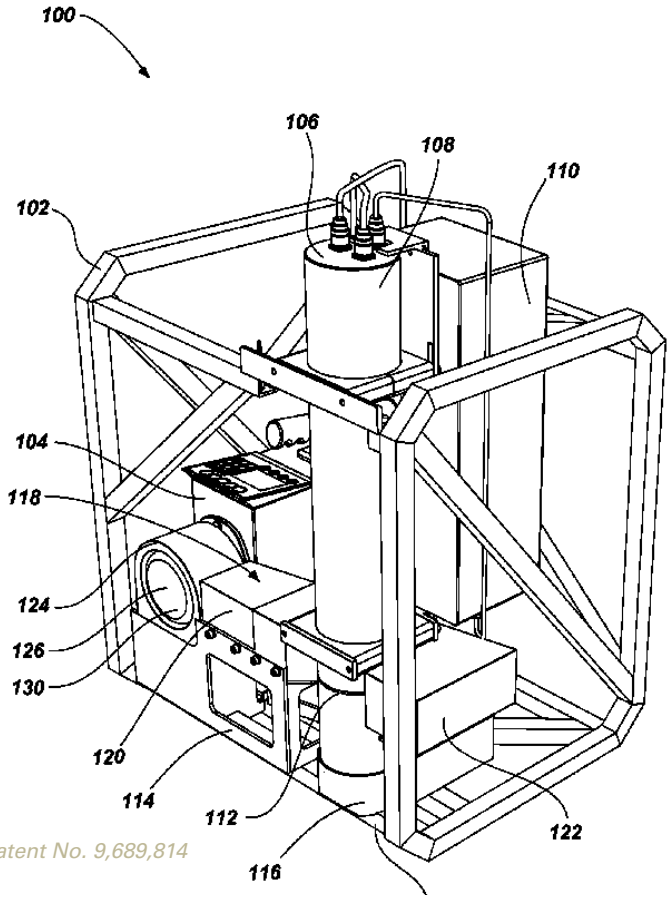
Dilute acid hydrolysis to remove hemicellulose from lignocellulosic materials is one of the most developed pretreatment techniques and is currently favored for converting biomass into liquid fuels. Embodiments of this invention relate to a genetically modified organism for use in dilute acid hydrolysis processes to convert biomass into products. Protein and cellular extracts isolated from a genetically modified organism are also described.

Patent No. 9,732,330 granted 8/15/2017 to David N. Thompson, William A. Apel, Vicki S. Thompson and Thomas E. Ward

Electrolyte Solutions Including a Phosphoranimine Compound, and Energy Storage Devices Including Same

Electrolyte solutions used in lithium-ion batteries are unstable at high temperatures and high voltages. Organophosphorus compounds have been investigated as an additive or co-solvent to reduce the flammability of these solutions. This invention describes improved electrolyte solutions that include phosphoranimine compounds and energy storage devices that include the phosphoranimine compounds.

Patent No. 9,761,910 granted 9/12/2017 to John R. Klaehn, Eric J. Dufek, Harry W. Rollins, Mason K. Harrup and Kevin L. Gering



Patent No. 9,689,814

Copyright Assertion Highlights

Copyright is a legal right that grants the creators of original work, such as software, exclusive rights for its use and distribution. INL employees assign such rights to the company as a condition of employment. In accordance with BEA's contract with DOE, all copyright rights are assigned to DOE unless BEA specifically requests authority to assert copyright. BEA requests the permission to assert copyright on software it intends to license via open source and traditional agreements.

During FY 2017, INL received permission to assert copyright on six software programs. Since 2005, INL has been authorized by DOE to assert copyright protection on more than 91 pieces of software.

MARMOT Mesoscale Simulation Code

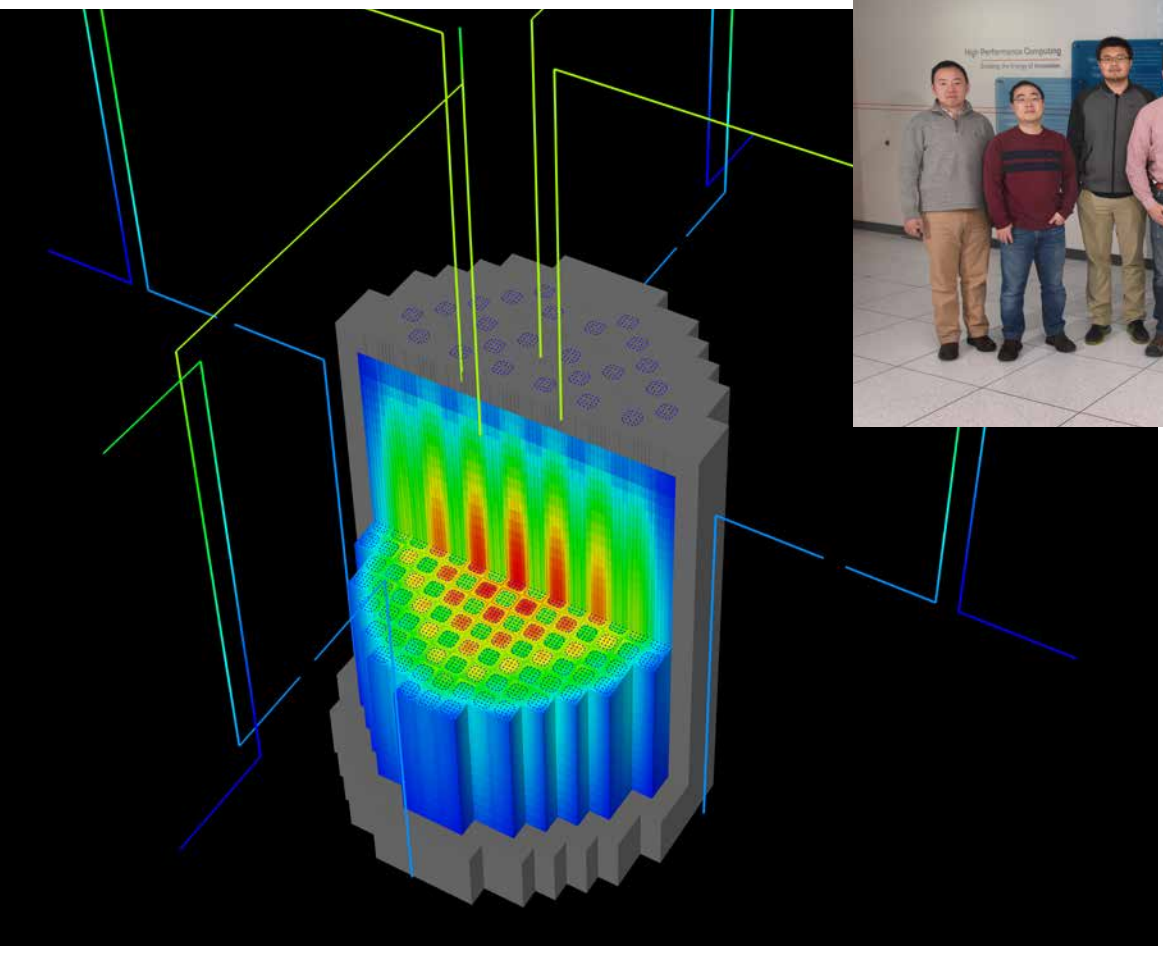
MARMOT is a thermo-mechanical code that models nuclear fuel performance at the engineering scale, specifically microscopic fuel changes during irradiation. Its purpose is to predict changes in the microstructure and material properties of nuclear fuels and claddings from stress, temperature, and irradiation damage. Using the finite element method, MARMOT solves the phase field equations coupled to solid mechanics and heat conduction. The MARMOT repository contains export-controlled code such as nuclear-specific material models.

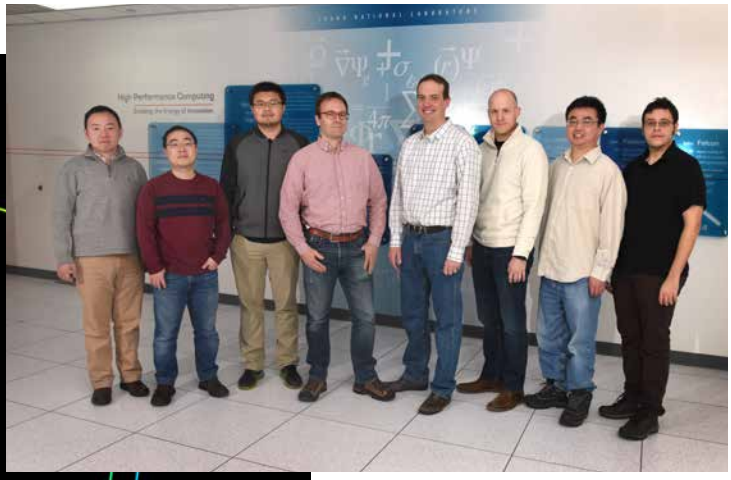
RATTLESNAKE Multi-level, Multi-scale Radiation Transport Software

Modeling radiation transport with accuracy is essential to designing safe nuclear reactors and facilities. Rattlesnake is a radiation transport solver that can model neutron, photon and thermal radiation interactions with background materials. It describes how radiation particles interact with background media and field variables such as temperature and material density to compute various quantities of interest, including the radiation flux distribution, variable reaction rate, and radiation-induced power profile.

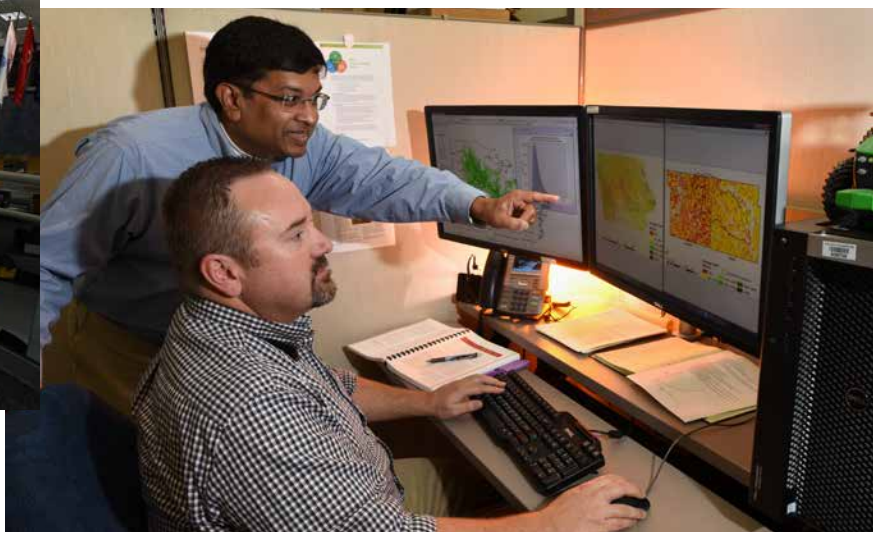
CellRAD

CellRAD is a radiation detection application that can be run on an off-the-shelf unmodified Android cellphone. It uses the phone's camera to detect gamma radiation from unexpected or illicit radioactive material. While the lens is covered to keep out visible light, gamma rays interact with the phone's camera system to produce small traces of activated pixels. INL has developed algorithms that use this information to calculate approximate gamma ray energy levels and more accurate radiation exposure levels.





The Rattlesnake application (left) can simulate radiation transport. The MARMOT application (development team above) models nuclear fuel performance on the microscopic scale.



RAVEN (development team above) and LEAF (right) are two tools released as OSS in FY 2017.

Open Source Software Release Highlights

INL has expanded efforts to release open source software (OSS), which is freely available to the public and open to collaboration directly with researchers and engineers outside of the laboratory. Fostering widespread distribution of this software can accelerate adoption within industry and fuel innovation in other research organizations. INL's Technology Deployment group is defining and refining an overarching strategy around open source and commercial releases to capitalize on the strengths of each. INL's open-source software can be acquired cost-free at https://github.com/idaholab.

MASTODON (Multi-hazard Analysis for STOchastic time-DOmaiN phenomena)

This code helps scientists and engineers design buildings and other structures to better withstand seismic events. MASTODON is a finite element application that calculates the realistic response of soil and structures to earthquakes in three dimensions. With capabilities to simulate "source-to-site" earthquake energy release, the software tool enables detailed analyses of earthquake fault rupture, nonlinear seismic wave propagation, and nonlinear soil-structure interactions. MASTODON is also the MOOSE-based master application for dynamic probabilistic risk assessment of external hazards.

Continuous Integration, Verification, Enhancement and Testing tool (CIVET)

Each step in software development is time-consuming and error-prone, which keeps software developers from doing what they are particularly good at: solving problems and authoring solutions. Civet automates the process of making changes to software, allowing developers to work on less menial tasks and supporting quality at every stage. Originally designed to be used with INL's MOOSE modeling and simulation platform, the tool can be used for any software development.

Risk Analysis and Virtual Environment (RAVEN) framework

RAVEN is a unique and powerful tool for risk analysis, offering capabilities not currently available in other software. It provides a graphical user interface for the pre- and post-processing of input and output from INL's Reactor Excursion and Leak Analysis Program-7 (RELAP-7). RAVEN offers a fully integrated working environment, providing everything engineers and scientists need to tackle challenging problems in an efficient and user-friendly fashion. The flexible and multipurpose statistical analysis framework allows users to conveniently perform a variety of analysis, data mining and model optimization tasks.

Water Energy Simulation Toolset (WEST)

WEST is a computer modeling platform that tracks water availability throughout a system to estimate ecological and economic impacts from power generation, agriculture, flood control, and environmental protection. The "drag and drop" software enables a user to create and test customized basin configurations. Data sets from different times of the year can be used to analyze alternative management strategies and suggest changes in the distribution of resources.

Landscape Environmental Assessment Framework (LEAF)

LEAF is a software program designed to estimate soil, soil carbon, and nitrogen losses from wind and water erosion and other environmental factors. It offers site-specific landscape performance assessments that allow land managers to decide which plants to grow on what land for food, feed, fiber and fuel. It can be used to evaluate how much stover and other crop residue farmers can remove from a specific field without harming soil health or the environment.

Decision-support for Digester-Algae IntegRation for Improved Environmental and Economic Sustainability (DAIRIEES)

DAIRIEES was developed in collaboration with the University of Idaho and Boise State University to create value-added products from manure, including bioplastics, electricity, fertilizer and animal bedding. This novel treatment system mitigates many current environmental concerns of manure management. DAIRIEES allows users to enter characteristics about a dairy farm's manure, manure management plan and regional market. Based on these inputs, the options are analyzed in detail using data from laboratory research to determine the most efficient use of this material.

Agreement Management

Who are we?

The Agreement Management organization is responsible for a number of functions including:

- Preparation, negotiation and execution of all research funds coming to INL and research collaboration agreements with industry, academia and other government agencies,
- Leading the process to determine appropriate research and development (R&D) agreement mechanisms, and
- Managing expectations of technical leads, principal investigators, managerial staff and sponsors relative to the implementation of sound contracting practices.

Goals

INL, like all federal laboratories, has a statutory technology-transfer mission to make its capabilities and technologies available to federal agencies, state and local governments, universities, and industry. To fulfill this mission, INL encourages its scientific, engineering and technical staff to disclose new inventions and creations to ensure the resulting intellectual property is made available to others who may benefit.

INL has long leveraged its distinctive technical resources through industrial partnerships. The lab uses a variety of flexible partnership mechanisms to establish industrial partnerships that benefit INL, the DOE and the participating partner, including:

- Increased technical breadth and depth of laboratory staff available to national missions,
- Reduced costs to taxpayers by using funding from other sources, and
- Enhanced competitiveness for U.S. companies.

The Agreement Management team includes (left to right) Agreement Specialists Rachel Taow, Elise Miller, Agreement Administrator Karalee Holubar, Agreement Specialist Lisa Nate, Manager Don Stevens and Agreement Specialist Tara Justesen.

2017 Agreement Mechanisms

Agreement	Purpose	Funding	Benefits	Requirements
Cooperative Research and Development Agreement (CRADA)	Collaborate and share results of a jointly conducted R&D project	Private and/or Federal	**Collaborate:** Leverages research efforts and funding by INL and Partner. **Inventions:** INL and Partner may own their respective inventions. **Confidentiality:** Generated information can be protected for up to five years; Partner's proprietary information can be protected. **License:** Partner has option to negotiate license to INL inventions.	• Substantial U.S. manufacturing requirements (or benefit to U.S.) for products embodying CRADA-generated intellectual property • 90-day advance payment for privately funded • Government-use license to generated IP • Approval by DOE
Strategic Partnership Project (SPP)	Allows INL to perform mission-related, reimbursable work	Private or Federal (federal sponsor terms negotiated by DOE.)	**Access:** Highly specialized or unique DOE facilities, services or technical expertise; Helps non-DOE entities accomplish technology goals that may otherwise be unattainable; Avoids duplication of effort. **Inventions:** IP ownership subject to project parameters; Transfer INL technologies to marketplace for further development or commercialization. **Confidentiality:** Generated information treated as proprietary when marked; Partner's proprietary information can be protected. **Strategic:** Maintain core competencies and enhance INL science and technology base.	• U.S. Preference: No exclusive 3rd-party license to project-generated IP unless manufactured substantially in the U.S. • 90-day advance payment • Government-use license to generated IP • Approval by DOE
		Federal	**Access:** Highly specialized or unique DOE facilities, services or technical expertise **Inventions:** Terms of government funding agreement apply **Confidentiality:** In accordance with government funding agreement	• U.S. Preference: see above • 90-day advance payment • Government-use license to generated IP • Approval by DOE

INL's Core Capabilities

- Advanced computer science, visualization and data
- Applied materials science and engineering
- Biological and bioprocess engineering
- Chemical and molecular science
- Chemical engineering
- Condensed matter physics and materials science
- Cyber and information sciences
- Decision sciences
- Environmental subsurface science and analysis
- Large-scale user facilities and advanced instrumentation
- Mechanical design and engineering
- Nuclear and radiochemistry
- Nuclear engineering
- Power systems and electrical engineering
- Systems engineering and integration

Agrmt Type	Party	Topic	Core Capabilities
SPP	Orbital ATK	Electrochemical pilot plant	
SPP	TerraPower, LLC	Test pins fabrication development	
SPP	Pacific Gas & Electric	California Energy Systems	
SPP	University of Utah	Finding spectrum offenders	
SPP	Renault Group	Advanced Electrolyte Model license	
SPP	Nippon Fuel Development Co., Ltd.	Irradiated weld specimen analysis	
SPP	Montana Department of Environmental Quality	Electric vehicle corridor study	
SPP	U.S. Army PEO for Simulation, Training and Instrumentation	Nuclear fuel pricing-plate configuration	
SPP	U.S. Department of Homeland Security	Electronic Jamming Exercise 2017	
SPP	Office of Naval Research	Anomaly detection of cyber-physical systems	
SPP	NASA-Goddard Space Flight Center	Technical support	
SPP	Air Force Research Laboratory/Power & Control Division	Emulate aircraft power system	
SPP	Air Force Life Cycle Management Center	Vault Door Test 2017	
SPP	Tri-Guard Risk Solutions	High-level software evaluation	
SPP	R.J. Reynolds Tobacco Company	Tobacco plant residue supply chain	
SPP	Ultramet	Deuterium adsorption and desorption testing	
SPP	LGS Innovations, Inc.	Project Laser Raptor	
SPP	R.C. Hunt Electric, Inc.	Stirling Solar Array Improvement Project	
SPP	University of Utah	Milford, Utah, FORGE Project	
SPP	Electric Power Research Institute	Analysis of harvested core shroud material	

Agrmt Type	Party	Topic	Core Capabilities
SPP	Radiation Detection Technologies	Micro Pocket Fission Detector (MPFD)	
SPP	Dalhousie University	Advanced Electrolyte Model license	
SPP	Emirates Nuclear Energy Corporation (ENEC)	Cybersecurity assessment	
SPP	Commission for the Comprehensive Nuclear Test-Ban Treaty Organization	Xenon Isotope Standards	
SPP	Belgian Nuclear Research Centre SCK-CEN	Quality Assurance Support	
SPP	Automated Surface Observing System	CRD Training Phase I	
SPP	Energy Division, U.S. Army Engineering and Support Center	ECIP Program Support	
SPP	Johnson Space Center	NASA PRA procedure guide update	
CRADA	Pebble Bed Modular Reactor (Pty), Ltd. - South Africa	Testing of TRISO particle fuel	
CRADA	Belgium Nuclear Research Centre SCK-CEN	Post-irradiation examination projects	
CRADA	Environmental Systems Research Institute, ESRI	Geo-enabling critical infrastructure protection	
CRADA	Oklo, Inc.	Legacy Metal Fuel Data Exploration	
CRADA	Cornerstone Capital Resources, Inc.	Feedstock assessment of treated trash	
CRADA	Westinghouse Electric Company	Testing of a Thermal Acoustic Sensor	
CRADA	Xcel Energy, Inc.	Automated work packages	
CRADA	Honeywell International, Inc.	Create a Virtual Research Park to Address Control System Threats	
CRADA	ThermoChem Recovery International, Inc.	Compressibility of sorted trash	
CRADA	Beijing Research Institute of Uranium Geology	Radionuclide Transport Model	
CRADA	ESCAL Institute of Advanced Technologies, Inc./dba SANS Institute (SANS)	Development of Information Security Training Courses	
CRADA	Central Research Institute of Electric Power Industry	Metal fuel fast reactor technologies	
CRADA	Antares Group, Inc.	Biomass Process Testing	
CRADA	TerraPower, LLC	Transient test reactor experiments	
CRADA	U.S. Geothermal, Inc.	Integrating solar at geothermal power plant	
CRADA	Analysis and Measurement Services Corporation	Wireless valve position indicator prototype	
CRADA	NextAxiom Technology	Computer-based procedure for fieldworkers	
CRADA	Westinghouse	Fabricating uranium silicide fuel	

Cooperative Research & Development Agreement (CRADA) Highlights

Pebble Bed Modular Reactor Ltd. (PBMR)

Safety testing and destructive examination will be completed for four PBMR nuclear fuel compacts containing Tristructural Isotropic (TRISO) coated particle fuel that was irradiated in INL's Advanced Test Reactor (ATR). The testing and examination will help assess fuel performance during high-temperature reactor accident conditions.

Belgian Nuclear Research Centre SCK-CEN

SCK-CEN, a Belgian nuclear research center, and the DOE will develop an international collaboration with INL to expand irradiation testing and post-irradiation examination (PIE) capabilities at their facilities.

Central Research Institute of Electric Power Industry (CRIEPI)

CRIEPI, a Japanese nonprofit foundation that studies fission reactor concepts, seeks to collaborate with INL under DOE's Fuel Cycle Research and Development (FCRD) program. The R&D will support development of metallic fast reactor systems.

Westinghouse Electric Company

DOE is supporting research to develop nuclear fuels and claddings that can withstand loss of active cooling in a reactor core for a considerably longer time while maintaining or improving the fuel performance during a range of operating conditions. Under this agreement, a Westinghouse testing facility will validate that experiment sensors can withstand irradiation conditions inside INL's ATR.

Beijing Research Institute of Uranium Geology (BRIUG)

INL scientists will collaborate with BRIUG on the design of field hydraulic and tracer tests monitoring groundwater flow and radionuclide transport through fractured granite in the Beishan area of northwestern China.

U.S. Geothermal, Inc.

U.S. Geothermal will collaborate with INL to evaluate a hybrid plant configuration that will enable high efficiency conversion of solar heat to electrical power while increasing the power output of the geothermal cycle. Such a design has the potential to reduce the cost of electrical power from concentrating solar power (CSP) and geothermal plants.

PBMR fuel compacts for testing

ESCAL Institute of Advanced Technologies, Inc., dba SANS Institute

INL's Mission Support Center (MSC) team and SANS, a global institution that focuses on computer and information security training, will create multiple cybersecurity course training opportunities for a wide range of U.S. government agencies and industry, focusing on engineering, industrial control systems and security analysis.

Esri

Esri, a world leader in geospatial analysis and critical infrastructure visualization, will collaborate with INL on R&D related to the creation and use of cyber/physical and cyber/GIS solutions to protect critical infrastructure and critical missions. They will explore emerging cybersecurity and cyber-geospatial concepts and technologies to identify cyber vulnerabilities and protect against targeted attacks.

Bioenergy feedstock from tobacco crop residue

Strategic Partnership Project (SPP) Highlights

Nippon Fuel Development Co., Ltd.

Irradiation can cause aging and embrittlement of stainless steel welds in nuclear reactor vessels. Nippon Fuel Development Co., Ltd. is collaborating with INL on three-dimensional atom probe analysis of irradiated weld specimens to understand how irradiation may accelerate a phenomenon known as spinodal decomposition.

Belgian Nuclear Research Centre SCK-CEN

INL will provide quality assurance oversight inspections on uranium aluminide fuel plates for the Belgian Nuclear Research Centre SCK-CEN's Nuclear Materials Science Institute Belgian Reactor 2. The fuel plates will be fabricated by BWX Technologies, Inc., where INL has a quality assurance inspector on permanent outplant assignment.

Preparatory Commission for the Comprehensive Nuclear-test-Ban Treaty (CTBT) Organization

Under the CTBT, a global International Monitoring System has been established to detect radioisotopes released into the atmosphere. INL will provide xenon isotope reference samples to be used for intercomparison exercises and full-system tests of noble gas monitoring systems.

Montana Department of Environmental Quality (DEQ)

The Montana DEQ requested analysis of ideal electric vehicle charging routes and locations for EV charging infrastructure to encourage electrified travel between Yellowstone and Glacier national parks. INL's Advanced Vehicles group will analyze three travel routes and identify ideal locations for Level II and DC fast charging stations.

R.J. Reynolds Tobacco Company

R.J. Reynolds Tobacco Co. is trying to develop a biomass feedstock from tobacco crop residue. Collecting both stalk and root materials, and separating tobacco root fibers from the soil matrix is a difficult task that root crop harvesters and high pressure washing operations have not been able to achieve. INL's expertise, facilities and partnerships make it uniquely qualified to address the challenges.

Emirates Nuclear Energy Corporation (ENEC)

ENEC and INL are establishing a cybersecurity assessment project for the Barakah Nuclear Power Plant in western Abu Dhabi. This assessment will identify potential security gaps (vulnerabilities) and recommend mitigation strategies for ENEC industrial control systems (ICS) operations.

INL partners with Cascadia CleanTech to launch Lab Accelerator training

DOE's Office of Energy Efficiency and Renewable Energy (EERE) launched National Lab Accelerator programs at several national laboratories in 2016 to help scientists understand and interact with industry. National Lab Accelerator is one of several EERE projects collectively called "Lab-Bridge," which provides support for laboratories to experiment with new approaches to partnership and tech transfer.

National laboratories participating in the Lab Accelerator program partner with local universities and business development networks to present concepts for commercialization. This also serves as a precursor to DOE's two-month intensive Energy I-Corps program (also part of Lab-Bridge).

In spring 2017, INL partnered with Cascadia CleanTech, a Seattle-based business development organization, to initiate its pilot National Lab Accelerator training program.

Thirteen INL teams, all partnered with industry mentors (IMs), met April 13 to learn about innovation-to-market techniques and how to create technology value propositions through customer discovery — a practice based on the notion that entrepreneurs must "test sell" at every stage and run pass/fail tests to determine the existence of a viable market for a product or service.

From that event, six teams were selected to participate in a "pitch competition," making presentations to and answering questions from a six-judge panel.

"This program is the best program in all the years of working with the lab I've ever seen," said David Noack, one of the judges and director of the Idaho Small Business Development Center regional office in Idaho Falls.

Pitch competition teams, composed of INL researchers and entrepreneurial partners, were:

Industrial Electrification (Ting He, Dong Ding, Norris Krueger-IM): A new electrolysis cell technology that makes use of a novel electrolyte and catalyst to upgrade ethane into higher-value chemicals.

WEX (Kurt Derr, Samuel Ramirez, Kaz Lawler-IM): A wireless communication appliance that automatically scans the radiofrequency spectrum in real time, allowing analysts to discover all the waveforms present in an area of interest.

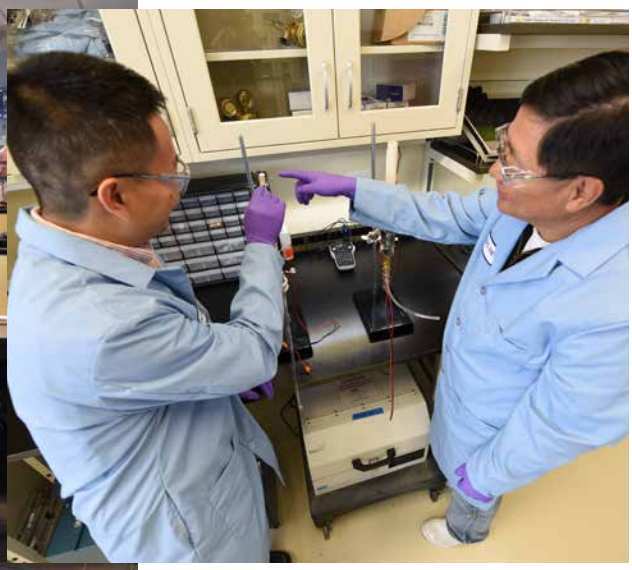
AHA (Ryan Hruska, Shane Cherry, Richard Newman-IM): Software that can create "regional dependency" models for facilities and resources based on information from subject matter experts, technical manuals and open sources for use in emergencies such as natural or man-made disasters.

4Cs (Vivek Agarwal, John Buttles, Jessica Whiting-IM): Wireless valve position sensors for nuclear plant configuration management with applications in oil and gas, and many other manufacturing industries.

The Fog (Steve Reese, Jada Williams, Bob Brown, Jon Duval-IM): Application for the abatement of mercury contamination.

Pitching Pros (Johanna Oxstrand, Roya Gordon, David Cohen-IM): Highly scalable computer-based procedure system for fieldworkers.

Left: Lab Accelerator training at INL.
Right: Industrial electrification project.



Energy I-Corps

Nine INL teams participated in Energy I-Corps cohorts during fall of 2016 and spring of 2017. Formerly known as Lab-Corps, Energy I-Corps is a DOE program aimed at strengthening entrepreneurial culture at national labs. It focuses on cultivating small-team collaboration between researchers and private entrepreneurs.

INL and the Center for Advanced Energy Studies have been sending people to the program since it started in 2015. During seven weeks of training provided by the National Renewable Energy Laboratory in Golden, Colorado, each team visits or calls company representatives in their specific market sectors, engaging directly with potential customers with a goal of 100 Customer Discovery Interviews. At the same time, they also meet with and are scored by panels of industry experts.

A laboratory setup for the E-RECOV technology

The participating teams from INL are below.

COHORT 4

OPTIBLEND

Team members: Allison Ray (principal investigator), Hongqiang Hu (entrepreneurial lead) and Ryan Bills (industry mentor). This technology allows researchers to produce high-quality bioenergy feedstock from grass, wood and agricultural residues.

CELLSAGE

Team members: Kevin Gering (principal investigator), Josh McNally (entrepreneurial lead) and Frank Meijers (industry mentor). CellSage deploys software to support battery performance and life-cycle determinations in diverse applications.

E-RECOV

Team members: Tedd Lister (principal investigator), Luis Diaz Aldana and Leslie Ovard (entrepreneurial leads), and Jonathan Cook (industry mentor). This electrochemical recovery process retrieves critical and rare earth materials from such devices as cellphones and computers.

CHANGE DETECTION SYSTEMS FOR NUCLEAR APPLICATIONS

Troy Unruh (principal investigator), Gregory Lancaster (entrepreneurial lead) and Sontra Yim (industry mentor). This computer software program aligns digital images to detect changes over time for nuclear facility and national security applications.

DRY CASK VITAL SIGNS

Ahmad Al Rashdan (principal investigator), Carson McNair (entrepreneurial lead) and John Kessler (industry mentor). Noninvasive determination of the status and integrity of vented dry nuclear fuel casks is possible with this technology.

COHORT 5

ELECTROPLATE

Team Members: Prabhat Tripathy (principal investigator), Jordan Argyle (entrepreneurial lead) and Steve Herring (industry mentor). This team developed an electroplating process that enables formation of a multilayered surface coating that is thick and uniformly pore-free, adhering to an object's substrate level. By operating at much lower temperatures than traditional plating methods, it also saves energy.

AMAFT

Team Members: Isabella van Rooyen (principal investigator), George Griffith (entrepreneurial lead) and Ed Lahoda (industry mentor). This additive manufacturing technology provides a direct route to fabrication of dense uranium silicide using a novel hybrid laser-engineered net shaping process. By creating a small, localized melt pool from multiple powder sources, pellets can be uniformly fabricated to exact microstructure and chemistry specifications.

EMRLD

Team Members: Steven Prescott (principal investigator), Ram Sampath (entrepreneurial lead) and Rob Sewell (industry mentor). EMRLD is a probabilistic risk assessment (PRA) model based on three-phase discrete event simulation, which makes it ideal for dynamic time-dependent models and also makes coupling possible with other time-dependent physics-based simulation models.

RE-LIGHT

Team Members: Donna Baek (principal investigator), Devin Imholte (entrepreneurial lead), and Robert Fox and James Hedrick (industry mentors). RE-LIGHT's technology safely removes and separates mercury and rare earth elements from fluorescent lamps. Phosphor powders contain rare earth elements, which are considered critical elements worldwide based on their ubiquitous application in clean energy technologies and microelectronic devices.

Licensing Highlights

100th licensing agreement for RELAP5-3D

In April, INL signed its 100th active license agreement for the Reactor Excursion and Leak Analysis Program 5-3D (RELAP5-3D) program, making it one of the most widely licensed, royalty-producing products within the DOE. RELAP dates back to the 1960s, when the Nuclear Regulatory Commission identified a need for reactor safety analysis software. While primarily used for water-cooled nuclear power plants, it is also used for modeling of jet aircraft engines and fossil power plant components. RELAP5-3D sustains itself primarily with membership fees from the International RELAP Users Group (IRUG), which provides funding to continually upgrade and maintain this safety analysis code.

On-Site Inspection RadioIsotopic Spectroscopy (OSIRIS)

INL and Advanced Measurement Technology, Inc., entered into a licensing agreement in March 2017 for On-Site Inspection Radio Isotopic Spectroscopy (OSIRIS), a gamma-ray spectrometer designed to detect specific radionuclides whose presence is certain evidence of nuclear explosions, in support of the provisions of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The OSIRIS equipment is designed in a manner that precludes its diversion to proliferating uses and thus can be deployed to more countries.

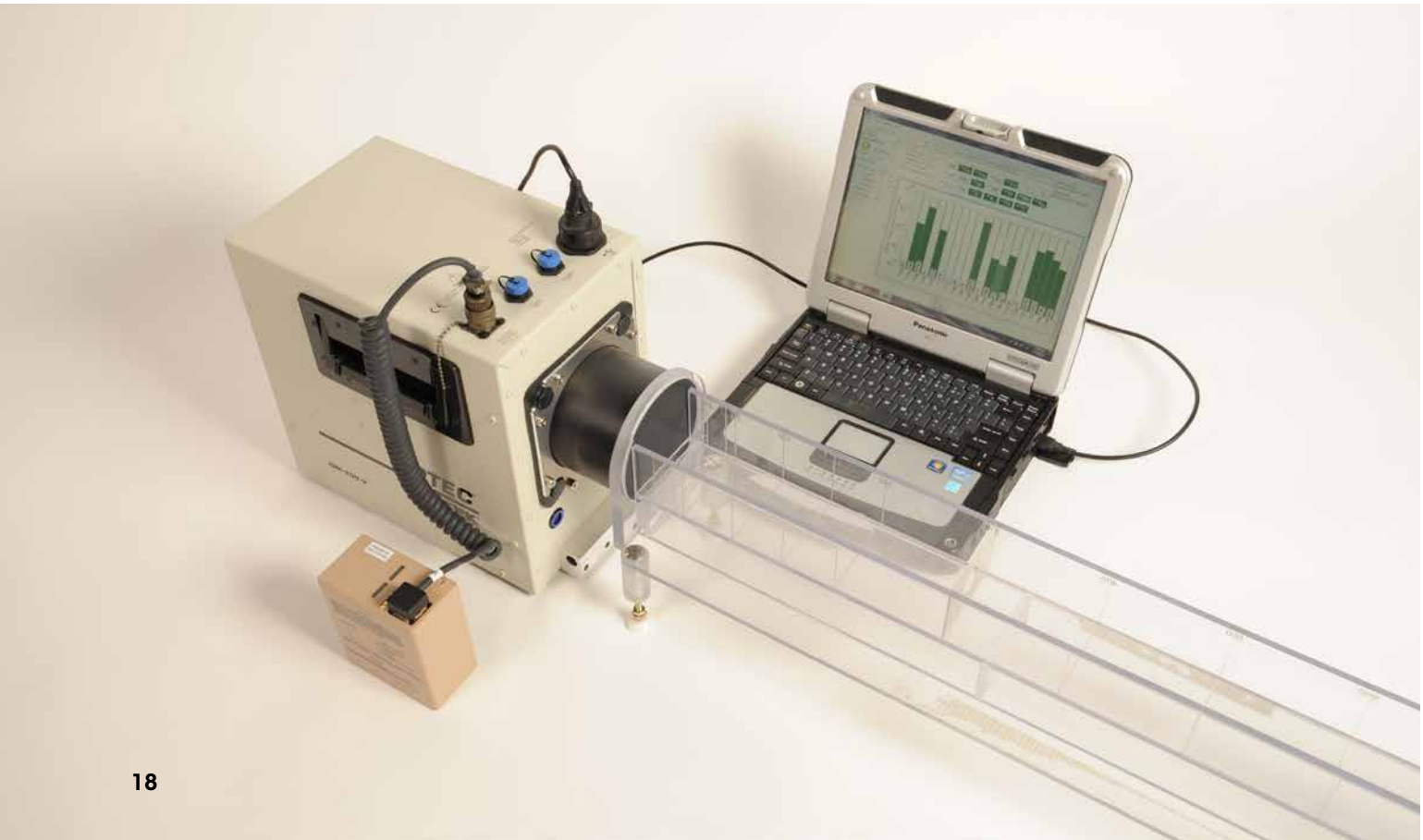
Advanced Electrolyte Model

INL signed four licensing agreements in 2017 for the Advanced Electrolyte Model (AEM), a software modeling program that quickly and accurately assesses interactions of electrolytic solutions in batteries. Offering data and reporting on more than 35 key parameters, its modeled predictions have been experimentally verified to be within a 5- to 10-percent deviation of lab data, often less. The technology won an R&D 100 Award in 2014, has been utilized by Dow Chemical Co., Xalt Energy and others, and was licensed by Canada's Dalhousie University, a leading battery development research center.

Hydrothermal Liquefication of Brown Grease from Waste Water Treatment Plants

CF Technologies, Inc., signed a licensing agreement with INL in conjunction with a Phase I Small Business Innovation Research (SBIR) award for development of ASTM-certified B-100 biofuel production from brown grease collected by wastewater treatment plants. The process invented at INL uses "supercritical" CO_2 – part gas, part liquid — to convert waste greases from homes and restaurants into biodiesel that can be used in unmodified diesel engines. The Massachusetts pressure vessel manufacturer plans to provide commercial-scale systems to wastewater treatment plants and consolidation facilities all across the country.

On-Site Inspection RadioIsotopic Spectroscopy (OSIRIS)



Impedance Measurement Technology

INL entered a licensing agreement in December 2016 with Dynexus Technology of Boulder, Colorado, for the company to commercialize INL's Impedance Measurement Box, a technology for analyzing and forecasting the health and safety characteristics of advanced energy storage devices. As battery users' expectations increase, there is a pressing need for real-time battery health data to ensure predictable performance and personal safety. INL's rapid impedance measurement technology enables continuous monitoring of a battery's health and remaining life throughout its life cycle. Dynexus plans to explore commercial applications across a broad range of markets including electric vehicles, utility energy storage, medical devices and military systems.

"It's like having an onboard 'smart meter' for your electric vehicle battery, providing the owner and the dealership with immediate and easily accessible factual information about battery health throughout its useful life." — David Lung, Dynexus Technology chief technology officer

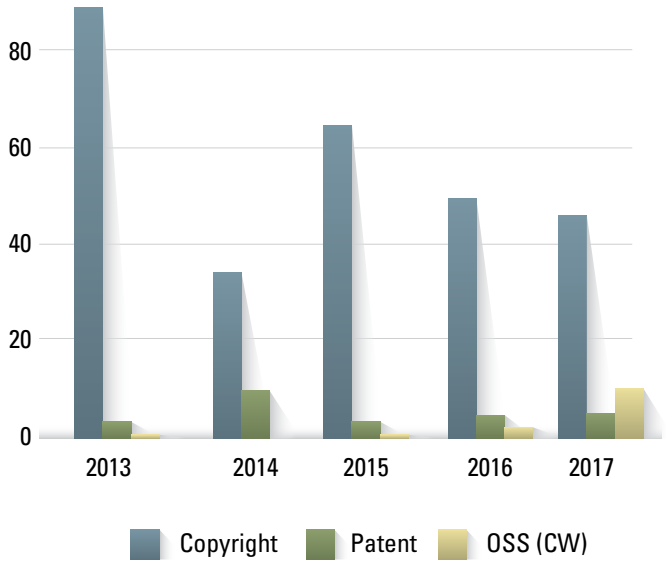
MAMMOTH

INL concluded four licensing agreements in 2017 for MAMMOTH, a general reactor physics software application that leverages existing applications to solve complex multiphysics problems. Based on the MOOSE framework, MAMMOTH links the applications for radiation transport (Rattlesnake), thermal fluids (RELAP-7) and fuel performance (BISON) into a single simulation framework. Licensing agreements were executed with the United Kingdom's Defense Academy, the U.S. Nuclear Regulatory Commission, University of Florida and OKLO, Inc.

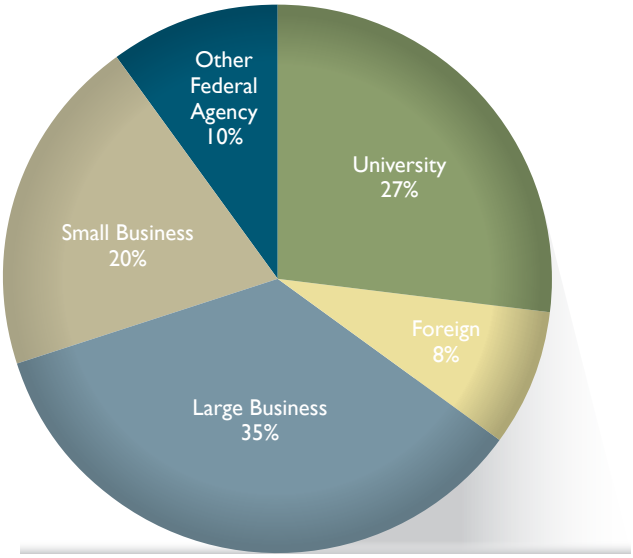
Novel Engineered Form Physisorption Material

INL and Rocky Mountain Scientific Inc. (RMS), an Idaho Falls-based small business, executed an exclusive patent license for removing phosphates, arsenic, fluoride or selenium from water. Although phosphates are great for crops, excessive amounts can cause toxic algae blooms that are bad for water resources. INL's technology, coupled with a compound developed by RMS, has the potential to remove excess phosphate nutrients from water and reduce such blooms. RMS's product, the APR Phosphate Sponge, received the Federal Laboratory Consortium's Far West "Outstanding Technology Development" award.

New licensing activities during FY 2013-2017



Licenses executed in FY 2017



Royalties

During FY 2017, U.S. businesses sold roughly $26 million in products, processes, and innovations based on INL patented technologies. From FY 2005 to FY 2017, INL signed 63 new licenses to commercialize technologies developed within the laboratory. License agreements generate royalties, and INL has earned more than $18.6 million in royalties since the inception of BEA's contract in FY 2005. During FY 2017, INL received more than $1 million in royalty receipts.

Royalties are one of the important signals that INL innovations are meeting market needs. INL continues to encourage innovation and to reinvest a significant portion of royalty revenues to promote development of promising early-stage technologies.

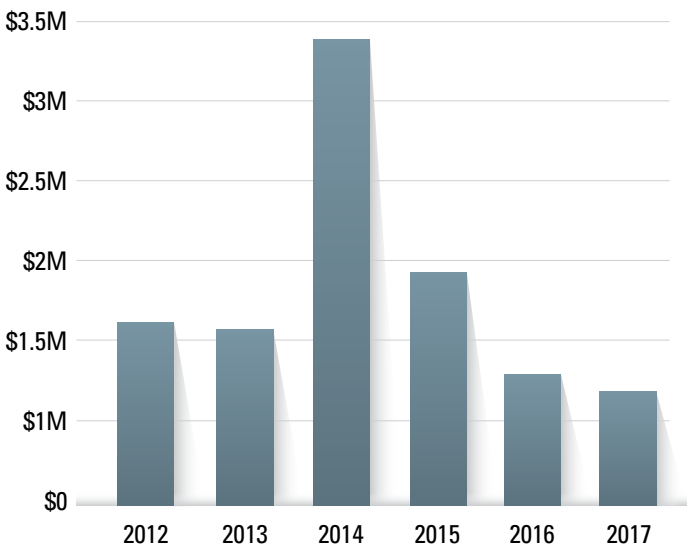
Expenditure of royalty funds is governed by federal regulations and must support technology transfer activities. Roughly 30 percent of INL royalty funds are shared with inventors of royalty-generating technologies.

Additional money is spent to reward employees who have supported laboratory technology transfer activities, independent of a specific technology having commercial application. The remaining royalties are reinvested via two funds, the Science and Technology Strategic Investments Fund (SIF) and the Innovation Development Fund (IDF).

SIF supports R&D capabilities that will lead to new technology development and increase the potential for INL to generate new business. A key to the success of these investments will be INL's ability to attract industry partners that are essential for advancing future INL technologies.

INL created the IDF to support technology maturation projects through proof of concept and prototype development. Last year DOE's Office of Technology Transfer introduced the Technology Commercialization Fund (TCF) aimed at helping businesses move promising energy technologies from DOE's national laboratories to the marketplace. TCF awards require matching funds from either the laboratory (Topic 1 awards) or from industry (Topic 2). In FY 2017 INL directed much of its IDF money to support TCF projects, which allowed the lab to leverage its funding with matching DOE funds.

Royalties received FY 2012-2017



FY 2017 IDF & TCF Projects

In FY 2017, $563,906 was reinvested into laboratory technology deployment activities. A selected summary of projects is provided here.

Project	PI(s)	IDF Funding	TCF Funding	Industry
Event Model Risk Assessment using Linked Diagrams (EMRALD)	Steve Prescott	$61,906	$61,096	n/a
Integration of PHISICS into the AREVA reactor design suite for commercial application to High Temperature Reactors (Private Partner: AREVA NP Inc., Lynchburg, Va.)	Hans Gougar	n/a	$300,000	$300,000
Highly Scalable Computer-Based Procedure System for Field Workers (Private Partner: NextAxiom Technology, San Francisco, Calif.)	Johanna Oxstrand	n/a	$750,000	$818,128
RAVEN Code Commercial Deployment for Industrial Related Applications (Private Partner: FPoli Solutions, Pittsburgh, Pa.)	Andrea Alfonsi	n/a	$250,000	$250,000
Seismic Isolation of Major Advanced Reactor Systems for Economic Improvement and Safety Assurance (Private Partners: Southern Company Services Inc., Birmingham, Ala.; TerraPower, Bellevue, Wash.; X-energy, Greenbelt, Md.)	Justin Coleman	n/a	$710,000	$710,000
Produced Water Treatment using Switchable Polarity Solvent Forward Osmosis (SPS FO) Process	Dan Wendt	$150,000	$150,000	n/a
Pathway to Commercialization of Weather Based Dynamic Line Rating with CFD using INL's General Line Ampacity State Solver (GLASS, Private Partners: Schneider Electric, Burnsville, Minn.; WindSim Americas Inc., Westlake Village, Calif.)	Tim McJunkin	n/a	$300,000	$387,650
Advanced Electrolyte Model Ver. 2.0	Kevin Gering	$5,000	n/a	n/a
Change Detection System (TCF, Energy I-Corps)	Troy Unruh, Gregory Lancaster	n/a	$17,500	n/a
Electronic Jamming Exercise	Lynda Brighton	$40,000	n/a	n/a
Resilient Control Systems Laboratory	Craig Rieger	$290,000	n/a	n/a
ODH Catalyst Validation	Dayna Daubaras	$17,000	n/a	n/a
Total FY 2017 investments		**$563,906**	**$2,538,596**	**$2,465,778**

Technology-Based Economic Development Highlights

INL's Technology-Based Economic Development program stimulates the regional and local economy by supporting innovative ventures, nurturing relationships with local businesses and attracting talent.

INL strengthens the region as Idaho's sixth largest private employer, employing **4,256 workers** in 2016. Other important impacts include the following:

When combined with indirect and induced impacts, INL operations add **$1.9** billion to Idaho's total output.

INL's total output impact increased by nearly **$324** million between FY 2015 and FY 2016, a 20.4 percent increase.

Combined with secondary impacts, INL accounted for nearly **11,280** Idaho jobs.

More than **$874** million of economic output was generated through INL suppliers and employee household spending.

BEA subcontracted more than **$136** million to Idaho companies.

DID YOU KNOW?

The SBIR tour stopped in six Idaho cities throughout the year: Salmon, Idaho Falls, Pocatello, Twin Falls, Lewiston and Coeur d'Alene.

DID YOU KNOW?

During FY17, INL was instrumental in establishing the newly formed Regional Economic Development Eastern Idaho (REDI) Science, Technology and Research (STAR) industry cluster.

Small Business Innovation Research Idaho Road Tour

The Idaho Small Business Development Center (SBDC), headquartered in the College of Business and Economics at Boise State University, teamed up with INL and the Idaho Department of Commerce to bring a series of small business funding workshops to communities across Idaho. The Idaho Small Business Innovation Research (SBIR) road tour highlighted state and national grant programs, as well as local business resources for Idaho's technology entrepreneurs and small business owners.

Connecting with Community

"Partnering with INL: Powering Discovery" events in Boise and Idaho Falls (below) drew more than 400 business and community leaders. Attendees learned about INL's mission, and how to partner with the laboratory in a variety of ways related to economic development, technology deployment, contracting and education.

Increasing Prosperity Through Economic Opportunity

The State Science and Technology Institute (SSTI), a national nonprofit organization dedicated to improving initiatives that support prosperity through science, technology, innovation and entrepreneurship, honored INL for its support of the Idaho Rural Partnership's Community Review program, which promotes economic opportunities in rural areas. The Community Review program builds momentum in rural communities by working with IRP economic development experts to attract available funding and resources.

Supporting Electric Vehicle Adoption

INL awarded a $15,000 Technology Based Economic Development grant to Rev Up Blaine, which focuses on promoting and supporting electric vehicle adoption in Blaine County, Idaho, and expanding charging infrastructure. INL also offered the expertise of its researchers, who have participated in the world's largest plug-in electric vehicle and charging infrastructure experiment.

Igniting Innovation in Rural Idaho

The Clearwater Economic Development Council (CEDC) recognized that entrepreneurs in remote and sparsely populated areas often possess ideas, businesses or products but are unsure of how to bring their ideas to the next level. The council invited like-minded individuals to a gathering where they could network, interview experts, and learn how to connect ideas and products with global marketplaces. To fund this innovative solution, INL granted $1,600 to CEDC to host the "Igniting Innovation" event.

Building Access to INL's Capabilities and Expertise

INL's Technical Assistance Program (TAP) is a federally mandated program authorizing the lab to share knowledge and specialized equipment to promote U.S. competitiveness. Through TAP, INL scientists and engineers can benefit a community or small business by providing limited-fee assistance that is not commercially available in the region.

9,407: Hours INL has dedicated to TAP projects since 2005

Select TAP projects from 2017 include:

- Inergy Solar of Pocatello, Idaho, requested support to evaluate an enhanced lithium-ion battery. Researchers at the lab's Battery Testing Center helped determine how the cells would perform under various conditions that mirror those seen in Inergy's products.
- The Divinia Water company of Idaho Falls, Idaho, requested assistance constructing a glass resonant chamber used in the water distillation process.
- Radiation Detection Technology requested assistance with a DOE Small Business Innovation Research grant funding announcement opportunity in advanced sensors and instrumentation technologies for nuclear energy.

Awards & Recognition

Federal Laboratory Consortium Far West Awards

INL won three Federal Laboratory Consortium (FLC) Far West Regional Awards in 2017 for excellence in technology development and deployment. Gary Smith was named Technology Transfer Professional of the Year. Troy Garn, Mitchell Greenhalgh and Jack Law, along with Rocky Mountain Scientific Corporation employees, won the Outstanding Technology Development award for developing the APR Phosphate Sponge, an innovative solution to decrease toxic algae blooms. INL also won the Outstanding Partnership Award for its ongoing collaboration with Montana Tech on the commercialization of the jointly developed Impedance Measurement Box technology.

R&D 100 Awards

The General Line Ampacity State Solver (GLASS) software package was selected as a 2017 R&D 100 Award finalist. GLASS is designed to help power line operators manage transmission for maximum efficiency and savings by calculating weather effects on lines. GLASS allows system planners and grid operators to better direct current over lines without the risk of overheating and enables utility companies to adjust power production and manage fluctuations in load more effectively.

Idaho Genius Awards

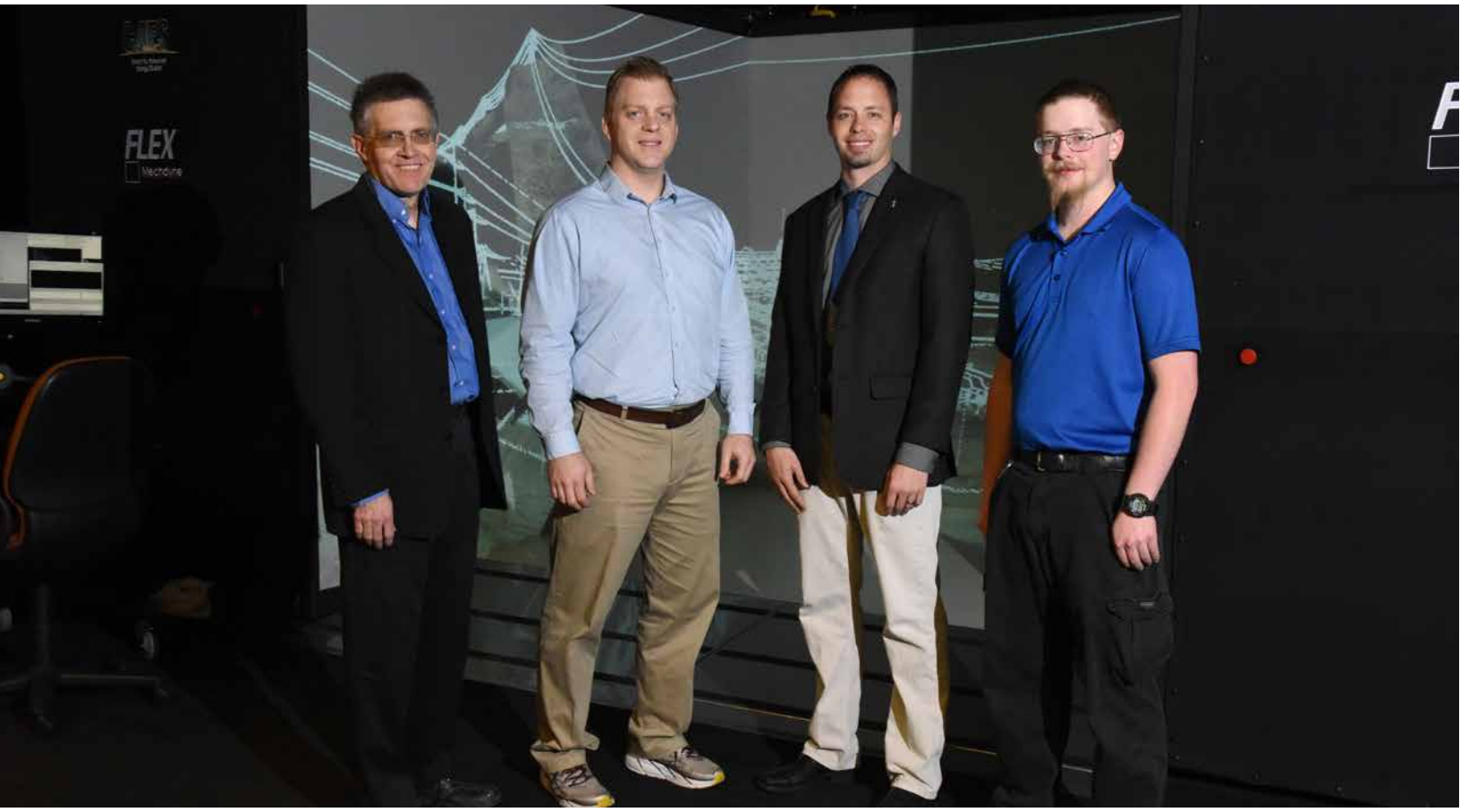
INL received honors at the Idaho Genius Awards, ranking in the top five Idaho companies by number of patents issued. Battelle Energy Alliance, which operates INL on behalf of the DOE, ranked fourth in the state for over two dozen issued patents. Joining BEA in the top five were Micron, Hewlett-Packard Development, Semiconductor Components and the Intel Corporation.

Idaho Innovation Awards

A newly developed method for detecting battery self-discharge was a finalist for the Early-Stage Innovation of the Year award at the Idaho Innovation Awards. This method provides researchers with a noninvasive way to identify manufacturing flaws and short circuits within batteries before they reach critical levels and enables faster detection than was previously possible. The patent-pending method was developed by Sergiy Sazhin, Eric Dufek and Kevin Gering.

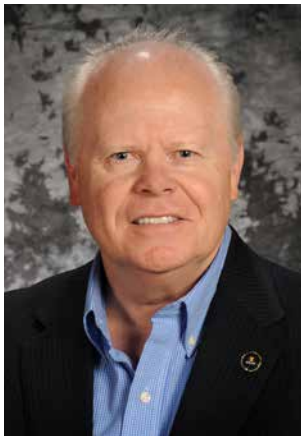
The APR Phosphate Sponge was a finalist for the Early-Stage Innovation of the Year award at the Idaho Innovation Awards. It is a composite product that can be used to treat water sources suffering from toxic algae blooms by removing excess levels of phosphates. Developed by INL's Troy Garn, Jack Law and Mitch Greenhalgh in collaboration with Rocky Mountain Scientific, the product has the potential to help solve a quickly growing environmental blight.

The GLASS development team includes (from left) Timothy McJunkin, Alexander Abboud, Jake Gentle and Jacob Lehmer.



Amy Lientz
Director of Partnerships, Engagement and Technology Deployment
(amy.lientz@inl.gov)

Jason Stolworthy
Director of Technology Deployment
(jason.stolworthy@inl.gov)



Don Stevens
Manager of Agreement Management
(donald.stevens@inl.gov)

INL is one of the U.S. Department of Energy's multiprogram national laboratories and is managed by Battelle Energy Alliance, LLC.

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