

Reaching New Peaks With Technology Transfer



FLC National Awards Denver • April 29, 2015





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Organized in 1974, the Federal Laboratory Consortium for Technology Transfer (FLC) was formally chartered by the Federal Technology Transfer Act of 1986 to promote and strengthen technology transfer (T2) from lab to market nationwide. Today, approximately 300 federal laboratories, centers, agencies, industry and academia partners make up the diverse network of FLC members. The mission of the FLC is to support and provide value-added resources for its members to accomplish the rapid integration of researched and developed technologies into the mainstream of the U.S. marketplace.

From its outset, the FLC's vision has been to foster the environment for the active utilization of federal laboratory innovations through successful technology transfer. Through its mission mandates, the FLC remains steadfast in improving its ability to facilitate the transfer of technologies from federal labs by maximizing collaborative research and partnership opportunities, offering a plethora of up-to-date T2 education and training courses, and maintaining an extensive library of diverse resources for the FLC community to easily access.

The FLC'sT2 advocacy and history of success acting as a clearinghouse for technological and/or scientific agencies and businesses to enhance our socioeconomic landscape confirms that transferring new technologies from federal labs is critical to stimulating the economy and creating new high-tech jobs.

In order to achieve its ever-evolving T2 communication initiatives, the FLC offers a wide range of media and search engine tools for industry, government, and academia to take advantage of for all of their research and development needs. All FLC members can stay informed and connect with technologies throughout the country with the following FLC outlets: the FLC website, Technology Locator, T2 Mechanisms and database, Available Technologies search tool, FLCBusiness, FLC NewsLink, trade show exhibits, FLC awards program, education and training publications, and many other tools to assist with

The FLC community is, above all, driven by the dedicated people who make up the federal laboratory system. Consisting of federal and industry T2 professionals, patent attorneys, licensing professionals, scientists, and agency representatives, to name a few, these individuals are committed to helping the U.S. continue to be the world leader in scientific and technological innovation. Their service advancing the FLC's mission improves the nation's business and supports economic growth.



Message From the Awards Committee Chair

It has been my privilege to chair the Awards Committee for the past four years. No chair succeeds without the support of committee members; and so, I wish to thank committee members for their dedication, advice, and professional reviews. I will step down as chair after today's event, and I wish that my successor enjoys the same respect and support I have received.

Since before my tenure, and for over 30 years, the Federal Laboratory Consortium for Technology Transfer (FLC) has chosen to highlight the technology transfer (T2) efforts of federal department and agency scientists and

technology transfer professionals who work with commercial (or public) partners to move federal innovations into our daily lives. These technologies and products include airplane deicers, life-saving vaccines, antibiotics, digital mammography, environmentally friendly solvents, and materials and metals that protect the warfighter or those of us behind a wheel. These transfers of technology to the public sector are the result of successful partnerships between our laboratories and the private sector.

Continuing in this proud tradition, the FLC honors its newest technology transfer champions with the presentation of the 2015 FLC awards. Echoing the theme of this year's national meeting, "Reaching New Peaks With Technology Transfer," these winners used their creativity and determination to collaborate with forward-thinking partners to elevate their ideas from the benches to the rarefied arena of commercialization. Well done!

The 2015 winners will be recognized in the following categories:

Interagency Partnership Award – presented jointly to agency and laboratory employees from at least two different agencies, who have collaboratively accomplished outstanding work in transferring a technology.

Outstanding Technology Transfer Professional Award - for an FLC laboratory technology transfer professional who has demonstrated outstanding work transferring a technology in a manner significantly over and above what was called for in the normal course of their position.

Rookie of the Year Award – recognizes an FLC laboratory professional with three years (or less) experience in a technology transfer position who has demonstrated outstanding work in the field of technology transfer over and above what was called for in the normal course of their duties. FLC Service Award/Harold Metcalf Award – presented to an FLC laboratory employee for sustained significant service to the FLC as an organization.

State and Local Economic Development Award – for successful initiatives that involve partnership between state or local economic development groups and federal laboratories for economic benefit.

Laboratory Director of the Year Award – honors laboratory directors who have made outstanding contributions to support T2 activities in their organizations and the communities they

Awards for Excellence in Technology Transfer – for employees of FLC member laboratories and technology transfer staff who have accomplished outstanding work in the process of transferring federally developed technology.

In the following pages you will find out more about the remarkable partnerships that these talented and dedicated individuals were a part of. These outstanding efforts are already making an impact; and before long, they will become integral to the way we use technology in our daily work—to grow more delicious produce, protect ourselves from disease, and secure our nation, to name only a few examples.

Congratulations to the winners of the 2015 FLC awards

James A. Poulos, III Awards Committee Chair



Ultra-Scale Visualization Climate Data Analysis Tools (UV-CDAT)













Department of Commerce

National Oceanic and Atmospheric Administration, Earth System Research Laboratory

Department of Energy

Lawrence Berkeley National Laboratory Lawrence Livermore National Laboratory Los Alamos National Laboratory Oak Ridge National Laboratory

National Aeronautics and Space Administration

Goddard Space Flight Center

The Department of Energy's (DOE) Biological and Environmental Research Program supports climate change research on a global scale, and seeks to generate the scientific knowledge base needed to inform public discussion, evaluate energy policy options, and provide tools for planning, adapting, and mitigating climate change. The ultra-scale visualization climate data analysis tools (UV-CDAT) were established to help address these needs.

UV-CDAT accomplishes a task that has never before been attempted for or by the climate community: the integration of more than 70 disparate scientific software packages and libraries for large-scale data analysis and visualization. Team members worked across institutional boundaries to develop and integrate software packages under a single framework that facilitates climate research and enables scientists to use them with little or no effort. The result is a powerful toolset that aids climate researchers with solving their most complex data analysis and visualization challenges.

The integrated, cross-institutional partnership responsible for developing and refining UV-CDAT is unique in its breadth and depth of expertise. Four DOE national laboratories—

Lawrence Berkeley (LBNL), Lawrence Livermore (LLNL), Los Alamos (LANL), and Oak Ridge (ORNL)—focused on the development of large-scale parallel analytics and the diagnosis of climate model simulation and observational post-processing. Two universities—Polytechnic Institute of New York University and the University of Utah—handled provenance and workflow, and streaming visualization. From the private sector, Kitware worked on software processes, cross-platform build and test suites, back-end visualization capabilities, and development of a spatiotemporal parallel pipeline; and Tech-X supplied reprojection libraries. The National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center provided three-dimensional (3D) data visualization and UV-CDAT tutorials, while the National Oceanic and Atmospheric Administration (NOAA) provided temporal and spatial regridding tools.

UV-CDAT version 1.0 was officially released in early 2013. UV-CDAT version 2.0.0, released in October 2014, is in production use for DOE and NASA projects, most notably DOE's Accelerated Climate Modeling for Energy (ACME) project and NASA's Climate Model Data Services. The UV-CDAT software source code



is open source under the Berkeley Software Distribution license agreement to allow for community development and partnership.

Today, UV-CDAT provides users with access to more analysis and visualization products than any other single source. The tool offers unparalleled capabilities for climate scientists to address big data analytics, sensitivity analyses, heterogeneous data sources, and multiple disciplinary domains; and it incorporates existing software components in combinations that were previously difficult or even impossible.



Top: UV-CDAT team: Bottom: Dean Williams

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Franklin Hoke, Jr. Air Force Research Laboratory, Information Directorate

Kimberly Dalgleish-Miller NASA Glenn Research Center

Rookie of the Year Award





Franklin Hoke, Jr. is the Air Force Research Laboratory Information Directorate's Chief of the Office of Research and Technology Applications (ORTA). He has guided his Directorate, which has a long and rich legacy

in communications, intelligence, command and control, cyber assurance and many other groundbreaking technologies, on new and innovative initiatives in technology transfer.

Due to aggressive and innovative transfer and transition efforts established by Hoke, a robust information assurance and cyber operations community of developers has grown more than 400 local jobs supporting cyber research and cyber tool development and deployment around the Directorate, servicing the commercial and military markets. In addition, Hoke encouraged local/regional academic institutions to create a pool of cyber professionals in the area. As a result, Syracuse and Clarkson universities, Utica College, and two local community colleges were early adopters in establishing information assurance and cyber defense programs as part of their graduate and undergraduate curricula.

Hoke was also responsible for piloting, in conjunction with Arizona State University, a new, innovative startup accelerator, called NY Furnace, to form new companies. An intensive nine-month accelerator experience, NY Furnace provides seed funding, office space, and access to top industry mentors to commercialize

discoveries made at the Directorate. This process helps entrepreneurs to create new startup companies, while offering technologies to existing companies in the NY region to help them grow and develop. The program attracted the support of a wide range of local, regional, and statewide economic development organizations, colleges, universities, startup incubators, accelerators, angel investors, and venture capitalists. Over \$400,000 of funding has been generated.

To raise the visibility of the patent process at the Directorate, Hoke developed a Patent Wall to recognize the historical legacy of the laboratory in innovative scientific achievements. The Wall consists of over 300 patents and 34 licenses, giving recognition to the inventors and the technology transfer capabilities of the laboratory. Additionally, Hoke created a new environment that champions the protection of intellectual property by encouraging Directorate staff to use all available technology transfer assistance.

Hoke was also instrumental in establishing the Directorate's comprehensive science, technology, engineering and mathematics (STEM) program that includes robotics, cyber, and engineering summer camps with 11 local middle schools for over 140 students. In addition, it distributed 300 robotics kits and trained 300 students per year. Recently, Hoke's program hosted its fifth Air Force Research Laboratory Challenge Competition, and to date 50 local high school teams competed for 22 paid summer internships.



Since assuming the role of Chief of the Technology Transfer Office (TTO) at NASA's Glenn Research Center (GRC) less than three years ago, Kimberly Dalgleish-Miller has shown time and again that she has

the strategic vision to take GRC and NASA to great heights in terms of technology transfer; the insight and determination to implement new processes and cultural changes that are essential to achieving major improvements; and the personal dedication to make the agency's goals a top priority.

Dalgleish-Miller transformed and revitalized a TTO that had stagnated and lost focus by establishing an overall strategy where previously no strategy existed, and developing systematic and streamlined processes to implement that strategy. She implemented a process to proactively manage the TTO's portfolio of innovations, ensuring that every invention that comes in is evaluated to determine the best path forward. Dalgleish-Miller also focused on achieving licensing success, populating the agreement pipeline with high potential technologies and pursuing prospects proactively. In addition, she costefficiently published two new trifold brochures designed to secure the interest of potential industry partners by summarizing the impact of GRC technology transfer and providing a highlevel overview of how industry can work with the Center.



According to Daniel Lockney of NASA's Office of the Chief Technologist, "Kim has really dug into the content and become one of our strongest center leads. I rely on her a great deal. As an example, her willingness to apply her knowledge of NASA procurement has helped us solve reporting issues that have plagued us for years. Kim is making significant progress in an area where others have routinely failed. She has gone from being the 'new kid' to being the agency expert on new technology reporting."

simplify the process of finding the NASA

innovations that meet their needs.



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Belinda Snyder Los Alamos National Laboratory

Environmental Protection Agency, Environmental Technology Innovations Clusters Program

State and Local Economic Development Award







For 20 years, Belinda Snyder led the way in developing and implementing a variety of innovative and successful technology transfer methods that also stimulated collaboration, fostered community

involvement, and helped small businesses succeed not only in New Mexico, but across the United States. As a program manager at Los Alamos National Laboratory (LANL), she worked tirelessly to ensure that LANL technologies, technical expertise, and technical assistance always found their way to other government agencies, academia and, of course, industry.

Snyder was also a strong advocate of the Federal Laboratory Consortium for Technology Transfer's (FLC) efforts to increase the awareness and availability of FLC technology and technical assistance resources to the benefit of state and local governments. As chair of the FLC's State and Local Government (S&LG) Committee, she established longterm collaborations and partnerships with key national organizations, all of which were focused on promoting innovation, high-technology economic growth, and technology-based economic development. These partnerships included the State Science and Technology Institute, the Association of University Research Parks, the National Business Incubation Association, the International Economic Development Council, and the National Association of Seed and Venture Funds.

To further promote FLC S&LG Committee activities, Snyder oversaw the development of a "success story" publication that highlighted significant examples of where the technology transfer efforts of the federal laboratories benefited economic development and other initiatives for local and state governments. Another resource developed under Snyder's leadership was an interactive state-map website that highlighted examples of federal laboratory technology transfer from across the United States, along with pertinent federal research and development funding and other key statistics. This resource has proven to be particularly useful to policymakers and legislators.

Most recently, Snyder implemented several key economic development pilot projects focused on identifying various state economic development entities in each state within a given FLC region. One such project documents the network of Midwestern federal laboratories and different types of technology-based economic-development (TBED) entities. The FLC's Midwest Region commissioned the Indiana Business Research Center (IBRC) to collect data on entities that either have facilitated or are interested in facilitating the transfer and commercialization of technologies developed at federal laboratories. Collected in the database were data on nearly 250 TBED entities with a presence in the Midwest. The IBRC research team also conducted more than 50 interviews with TBED staff to gather information and recommendations on how to strengthen the relationships between federal laboratories and TBED entities pursuant to expanding the commercialization of technologies developed in federal labs

Regional technology innovation clusters are geographic concentrations of interconnected firms—businesses, suppliers, service providers and supporting institutions, local government, business chambers, universities, investors, and others—that work together in an organized manner to promote technological innovation and economic growth. In 2010, the Environmental Protection Agency (EPA) took the initiative to design and develop a water-related technology innovation cluster in the Greater Cincinnati region.

The following year, the EPA and the Small Business Administration announced the launch of a Cincinnati-based organization called "Confluence, a Water Technology Innovation Cluster (WTIC)." Confluence was designed to cover a 100-mile regional radius comprising Southwest Ohio, Northern Kentucky, and Southeast Indiana.

Since its formation, Confluence has made an impact on the region it serves. In 2012 the EPA began a collaboration with Urbanalta, a Cincinnati-based small business, to develop novel measurement methods and technology for detecting and monitoring combined sewer overflows. The company agreed to let the EPA take the lead on a joint patent for which Urbanalta will be granted an exclusive license to use the technology. Urbanalta is currently adding design engineers to its research and development team and building preproduction prototypes of a Flowing Water ScopeTM.

Confluence also provided technical and professional support for local small business startup CitiLogics, including technology in the lab, inclusion in local business accelerator UpTech, testing at the Northern Kentucky Water District, and signing its first contract with a local water utility, Greater Cincinnati Water Works, allowing the company to hire its first employee in only two years. CitiLogics is bringing research dollars into the region, generating \$300,000 in research grants in 2013, \$500,000 in 2014, and an expected \$2.5 million in 2015.

Confluence worked with Bacterial Robots in Cincinnati and its subsidiary, Pilus Energy, to successfully develop genetically enhanced bacteria with the specific function of remediating wastewater while creating energy. Tauriga Science, Inc. in Danbury, Connecticut, acquired Pilus Energy in January 2014 for \$2,000,000. Tauriga is currently launching product performance trials in Cincinnati in cooperation with the EPA and the Cincinnati Metropolitan Sewer District.

As a direct result of the establishment of Confluence, the University of Cincinnati is moving forward with "Water Clusters" as one of its five focus research areas over the next five years and is investing between \$12 and \$15 million. This will provide the University with the opportunity to hire six new faculty members and help in creating a fertile future workforce around water in support of Confluence.

















Left to right: Confluence team leaders Alan Vicory, Sally Gutierrez, and Melinda Kruyel.

Alan Vicory, Melinda Kruyer, Michele Simmons, Reese Johnson, Roy Haught, Teresa Harten, Tina Odum Not pictured: Evelyn Hartzel, Abby Waits, Julius Enriquez, William Ball

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Laboratory Director of the Year Award

George Duchak Air Force Research Laboratory, Information Directorate

Sevim Erhan, Ph.D.
USDA, ARS Eastern Regional Research Center

Laboratory Director of the Year Award







The Air Force
Research Laboratory's
Information Directorate
(AFRL/RI) has a long
and rich legacy in
radar, communications,
intelligence, command
and control, information
technologies, and many
other groundbreaking

technologies that date back to the 1950s. As Director, George Duchak leads basic research and advanced development activities in information exploitation, information fusion, information understanding and management, cyber operations, connectivity and networks, command and control, and advanced computing architectures.

Duchak has had an enormous impact on the Directorate's technology transfer program in the short time he has been Director. He has revolutionized its processes and culture by tripling the technical staff dedicated to technology transfer, establishing a vigorous culture within the Directorate to protect its intellectual property, encouraging the staff to enter into new Cooperative Research and Development Agreements and Education Partnership Agreements to enhance their programs, and visibly strengthening the Directorate's Office of Research and Technology Applications.

Duchak was instrumental in developing a technical culture around the Directorate to take advantage of its nanotechnology program. As a result, New York State has established a new nanotechnology hub located near the

Directorate that will create 1000 high tech jobs in the area, opened a \$125 million facility to support chip manufacturing, and realigned its State University campus as a Polytechnic University focusing on nanotechnology. In addition, Duchak actively sponsored his partnership intermediary, the Griffiss Institute, in obtaining special incubator status within New York State. As a result, the Institute was designated as the region's official state incubator and granted \$120,000 from New York State to initiate its first year of efforts. Additionally, the State is making available "hotspot" status, which will confer tax advantages on the participants of its incubator.

Most recently Duchak piloted a new, innovative startup accelerator, called NY Furnace, designed to form, fund, incubate, and launch new companies. An intensive, nine-month accelerator experience for startups, Furnace provides seed funding, office space, and access to top industry mentors to commercialize discoveries made in Air Force laboratories. This new process helps entrepreneurs create new startup companies, while also offering some technologies to existing companies in the region to help them grow and develop. Through Duchak's initiatives, the program attracted the support of a wide range of local, regional, and statewide economic development organizations, colleges and universities, startup incubators, accelerators, angel investors, and venture capitalists. State and local economic development organizations pledged \$200,000, and venture capitalists offered the potential of \$1.5 million in seed funds.



The Eastern Regional Research Center (ERRC) is one of four Agricultural Research Service (ARS) Research Centers. The Center has 90 senior scientists/engineers (including post-docs), 110 support scientists,

15-20 students, over 35 foreign collaborating scientists, and 18 administrative staff that support 27 research projects. Through her leadership and vision, Dr. Sevim Erhan has refocused and transformed the laboratory into a Center with national and international prominence, as well as one that is viewed as the "go-to" facility for research in food safety, sustainable biofuels, dairy and food processing innovations, and biobased products.

Dr. Erhan's entire career with the ARS has been directed toward finding and transferring solutions to agricultural problems. She successfully increased productivity, funding, and facilities in each leadership assignment by motivating the scientists and research leaders, and ensuring that their research was always focused on American agriculture's highest priority problems.

She also initiated and coordinated with the Office of International Research Programs to ship surplus reference books and journals from the ERRC library to the Institute of Agricultural Research for Development (IRAD) in Cameroon, Africa, as well as supporting a

senior scientist's month-long visit to collaborate in the development of bioenergy technology. Additionally, she is working with Tajikistan and through the Foreign Agricultural Service in Afghanistan to transfer knowledge to countries where there is a critical need for sustainability in agriculture.



One example of a successful transfer under Dr. Erhan's leadership involves instantized corn soy blend (ICSB), a ready-to-eat emergency aid meal. ICSB was developed at ERRC using modern food processing technology, and Dr. Erhan worked to overcome hurdles in its transfer by setting new policy, developing networks, and collaborating with a company that hires the severely handicapped to manufacture the ICSB products in the U.S. From there, a team of USDA scientists, program managers, policy administrators, and international aid agencies worked together to distribute ICSB in Haiti and other parts of the world.





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Laboratory Director of the Year Award

Sally Gutierrez EPA, Environmental Technology Innovation Clusters Program





In her then-position as Director of the EPA's National Risk Management Research Laboratory (NRMRL), Sally Gutierrez began developing a more defined and deliberate technology transfer organization in the

Cincinnati, Ohio, area as early as 2008. The new technology transfer strategy would focus around a water technology cluster, a regional network of researchers, businesses, utilities, and others involved in water technology.

Under her supervision, the Cincinnati Cluster team supported the movement of EPA technologies into the marketplace by promoting technology transfer and assisting EPA researchers with protecting intellectual property. The Cluster team also promoted and supported innovation in the water technology sector through RD&D collaboration among internal and external partners in the region, particularly through the use of Cooperative Research and Development Agreements (CRADAs) that focused on environmental technology innovation and commercialization while supporting regional economic development efforts. These efforts created much clearer pathways for collaboration and the commercialization of EPA and private industry technology.

In 2012, Gutierrez leveraged the early successes of the Cincinnati Cluster team into the creation of the Clusters Program, which

she now leads. The program supports the development of water technology clusters across the U.S. as a way to facilitate the transfer of federally and academically developed water technologies into the market.

EPA researchers are currently collaborating with Urbanalta Company of Cincinnati, Ohio, to develop novel flow monitoring methods and sensors. These low-cost networked sensors have the potential to revolutionize flow monitoring and management for municipal and commercial utilities. Under Gutierrez's direction, the Cincinnati Cluster team developed a CRADA between the EPA and Urbanalta. Under the CRADA, both parties contribute to cost sharing for the research, development, and demonstration of the flow monitoring technology. The EPA will retain intellectual property rights for the technology, and Urbanalta will receive an exclusive first commercial license for the technology. Royalties from the license will be returned to the EPA laboratory and researchers involved in the technology, thereby providing an incentive for future technology transfer.

After several prototypes, Urbanalta is currently developing and designing a final, commercially viable sensor platform in collaboration with the EPA. Urbanalta is currently expanding its business footprint and positioning itself as a sensor company.



Department of Agriculture • Agricultural Research Service Apple Rootstock Breeding Laboratory

Department of Agriculture • Agricultural Research Service Coastal Plains Soil, Water, and Plant Research Center

Excellence in Technology Transfer Award

New Productive, Disease-Resistant Apple Trees





In 2014, apple growers across the United States planted about 1.8 million apple trees (10% of the national total) that feature fire blight-resistant, replant-tolerant, highly productive apple rootstocks. The number is expected to increase over the next 5 years to 5 million trees. This is thanks to the efforts of a Cooperative Research and Development Agreement partnership between the U.S. Department of Agriculture's Agricultural Research Service (ARS) and Cornell University scientists who developed the rootstocks, and the Cornell Center for Technology, Enterprise and Commercialization, which manages the technology transfer to stakeholders.

ARS and Cornell have a longstanding excellent collaborative project on breeding apple rootstocks that possess economically important traits such as dwarfing, precocity, high productivity and fruit quality, good coldhardiness, and propagability. In addition, the rootstocks are resistant to key apple diseases such as fire blight and collar rot, insects, and components of replant disease. Many apple growers in the Northwest, Midwest, and Eastern regions of the U.S. had stopped planting new orchards because they lacked apple rootstocks resistant to fire blight. In 2006, the ARS-Cornell program patented and

Gennaro Fazio evaluates trees developed from different rootstocks in an apple rootstock breeding project. The tree in the foreground is smaller and more productive than the one in the background and represents a good candidate for high-density orchards being planted today.

Photo by Peggy Greb

released two apple rootstocks that had proven to be resistant and more productive than the commercially available materials at the time. In 2010 and 2014, the program released five additional rootstocks that were targeted to mitigate replant disease, another problem faced by the industry.

More than 50 testing agreements were established with nurseries representing 95% of the U.S. production of apple rootstocks to assure market penetration and impact in the orchards. More than 40 demonstration sites at farms and research institutions nationwide were planted to bring in potential customers, along with the coordination of numerous field days and field visits where growers could witness the positive aspects firsthand. Over 100 presentations delineating salient characteristics about the technologies were delivered to grower and industry organizations, and more than 50 scientific and trade publications introduced the new technologies to decision makers in fruit companies. These efforts resulted in the production of 3 million apple rootstocks in 2014 worth about \$3.5 million, and estimated to be worth about \$19 million in 2015 when sold to farmers as finished apple trees. These new rootstocks are being adopted by farm operations ranging from small "pick-yourown" operations to large fruit farms.





Gennaro Fazio. Jessica Lyga

Vot pictured.

Quick Wash Process for Removing and Recovering Phosphorus From Wastes

A new treatment process, called "quick wash," was originally developed to extract and recover phosphorus from poultry litter and animal manure solids, but research has shown that the approach is equally effective with municipal biosolids. Nutrient pollution, caused by too much nitrogen and phosphorus in the environment, is one of America's most widespread, costly and challenging environmental problems, impacting many sectors of the American economy that depend on clean water. These environmental problems can be mitigated with the quick wash process, which selectively extracts phosphorus from solid manure or municipal biosolids prior to land application. The guick wash process selectively recovers more than 80% of the phosphorus from solid waste while leaving most of the nitrogen in the washed solid residue. Consequently, the washed solid residue has a more balanced nutrient composition for crop production, and is safe for land application. The concentrated phosphorus materials contain more than 90% of its phosphorus in plant available form that provides a recycled phosphorus source for use as crop fertilizer.

The guick wash process was invented by a team of scientists at the Coastal Plains, Soil, Water and Plant Research Center. The U.S. Department of Agriculture granted an exclusive license to Renewable Nutrients LLC, of Pinehurst, North Carolina, for commercial use of the process. The Center worked closely with Renewable Nutrients to develop approaches for commercializing the new technology for municipal biosolids and the poultry markets.

A pilot plant is under construction for the Borough of Ephrata, Pennsylvania, wastewater treatment plant, which annually produces 370 dry tons of biosolids, most of which are landfilled. While most technologies for phosphorus removal are not profitable, the recovery of phosphorus from biosolids using the quick wash process results in an annual revenue per plant of \$70,000 to \$500,000. Renewable Nutrients' business model consists of sublicensing the technology to each municipal treatment plant. In addition, the company will participate in the value of the phosphorus recovered as fertilizer material and nutrient credits.

"While most technologies for phosphorus removal are not profitable, the recovery of phosphorus from biosolids using the quick wash process results in an annual revenue per plant of \$70.000 to \$500,000."

For the agricultural market, a sublicense agreement with Triea Systems of Frederick, Maryland, has already secured \$250,000 from Maryland Industrial Partnerships (MIPS) to accelerate efforts to introduce to the market the quick wash process for recovering phosphorus from animal and poultry waste. The commercial partner's expectations to reach the market with a reliable and proven technology to recover phosphorus that has competitive advantages for commercialization were exceeded. For the first time, a technology developed for agricultural waste crossed discipline boundaries and is being adopted by the municipal wastewater treatment industry.





Top to bottom Ariel Szogi, Jeff Dawson, Matias Vanotti. Patrick Hunt









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Department of Agriculture • Agricultural Research Service Environmental Microbial and Food Safety Laboratory

Department of Agriculture • Agricultural Research Service Genetic Improvement of Fruits and Vegetables Laboratory

Excellence in Technology Transfer Award

Online Imaging for Real-Time Wholesomeness Inspection in Poultry Processing





Food safety is a public concern and a priority of the U.S. Department of Agriculture. A cumulative team effort in the Environmental Microbial and Food Safety Laboratory (EMFSL) has resulted in the licensing of an imaging technology with the potential to make food consumed by the public more wholesome and safer to eat. This technology is a method and system that allows automated wholesomeness inspection of chicken carcasses during processing.

"The work involved numerous collaborators and post-doctoral researchers, and resulted in one Cooperative Research and Development Agreement and two issued patents."

Currently, chicken carcasses are processed at a rate of 140 per minute, and every carcass must be examined by a human inspector. Up to 4 inspectors may work on a single processing line since inspectors work at a maximum speed of 35 birds per minute. The licensed technology has the potential to reduce and redistribute the



human workload, and has been demonstrated effectively at 140 birds per minute. The company that licensed this technology, Headwall Photonics, Inc., has developed a commercial imaging platform that has been used for poultry wholesomeness classification. This platform supports real-time, hyperspectral, line-scan imaging of any commodity transported by a conveyor system, and can be used to address other food and agricultural processing problems, including grading of fruits and vegetables.

The EMFSL team initially focused on developing the technology—including system design and integration, algorithm development, and implementation for real-time inspection—as an application of their pioneering hyperspectral imaging research for food safety. However, their efforts grew to include outreach and networking to kindle interest in the new system as well as business connections between food processors and imaging technology companies. Collaborations with processors and equipment providers in the poultry industry helped them to assess the poultry industry's needs, limitations and interest, and to conduct in-plant tests of the technology. Collaborations with spectral imaging technology partner Headwall Photonics, Inc., tailored system adaptation for industrial use in poultry processing.

The work involved numerous collaborators and post-doctoral researchers, and resulted in one Cooperative Research and Development Agreement and two issued patents. In April 2014, the patent was licensed by Headwall Photonics, Inc., which is now negotiating with poultry processors for commercial use of the technology.

'Flavorfest' Strawberry Cultivar

Scientists from the Beltsville Agricultural Research Center's Genetic Improvement of Fruits and Vegetables Laboratory developed a novel mid-season strawberry variety released as Flavorfest. Named for its superior fruit flavor, Flavorfest strawberries are large, bright red, and appear distinctively plump. The cultivar is expected to best adapt to the Mid-Atlantic and northeastern U.S. and adjacent areas. In particular, Flavorfest is well-suited to replace Chandler, the current bestselling strawberry in the Mid-Atlantic region, because it is highly resistant to a fungal disease advancing in the region and shows some resistance to other less problematic species.

"By the end of February 2013, as a result of marketing activities by the Laboratory team, Lassen had received orders from nurserymen for 36,000 plants."

The Laboratory team actively promoted the new strawberry by first executing a material transfer/propagation agreement with Lassen Canyon Nursery, the dominant strawberry nursery in California. Thereafter, plant test agreements were executed with reputable American and Canadian nurseries and producers for testing the cultivar. Upon obtaining positive feedback from Lassen and other growers testing Flavorfest, and from results at the lab in Beltsville, Maryland, a plant invention disclosure was filed along with a request for public release.



ARS geneticist Kim Lewers and ARS horticulturist John Enns are testing the idea of growing strawberries under low row covers to extend the berry's growing season in the northern and eastern United States.

In January 2013, Lassen had approximately 13,500 plants on hand to distribute. By the end of February 2013, as a result of marketing activities by the Laboratory team, Lassen had received orders from nurserymen for 36,000 plants. There was so much demand that sales were limited to nurseries only, and sales depleted the entire stock available for sale.

In 2014, sales to growers were 20 times greater than sales in 2013. A March 2014 Lassen email to the USDA-ARS team stated, "It was a combined effort; you also did a great job passing the word around, so Thank You! Total sales were ¼ of a million plants."

All other nurseries carrying Flavorfest had such demand that they restricted sales by limiting the number of plants sold to individual customers. They sold out well before the 2014 spring planting season (approximately 100,000 plants combined), and have reported that they will be "ramping up production" for 2015. The plant numbers from all nurseries reporting sales equate to around 350 growers producing plants on 21 acres.





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Department of Agriculture • Agricultural Research Service National Center for Cool and Cold Water Aquaculture

Department of Agriculture • National Wildlife Research Center Animal and Plant Health Inspection Service

Excellence in Technology Transfer Award

Development and Release of a Disease-Resistant Rainbow Trout Line





Demand for aquaculture products, such as rainbow trout, is rising because of increased recognition of the health benefits from consuming seafood, as well as the limits to harvesting wild-caught seafood. Bacterial cold water disease is a common problem for rainbow trout growers and a frequent cause of antibiotic use in aquaculture. Since 2005, scientists at the National Center for Cool and Cold Water Aquaculture have demonstrated how selective breeding can be used to develop a line of rainbow trout with increased resistance to the disease.

The new line of rainbow trout, designated ARS-Fp-R, represents the first line of rainbow trout with specific disease resistance that has been made publicly available. Advantages of the ARS-Fp-R line include stable disease resistance that. unlike vaccination and antibiotics, requires no application or treatment by farmers. The innate disease resistance is particularly advantageous in young fish that are too small to be vaccinated and most susceptible to the disease.

Recipients of the ARS-Fp-R line include Troutlodge, Inc.; Clear Springs Foods, Inc.; and the Utah Division of Wildlife Resources. Troutlodge is the world's largest producer of rainbow trout eggs and annually distributes approximately 500 million eggs to customers in more than 50 countries. Clear Springs Foods, a vertically integrated breeder, producer, processor, and distributor of fresh and frozen rainbow trout products to food service and retail markets in the United States and Canada, is

> Scott LaPatra, Ph.D. Tim Leeds, Ph.D.





responsible for approximately 60% of domestic rainbow trout food fish production. The Utah Division of Wildlife Resources operates ten production hatcheries and annually stocks the state's streams, rivers, lakes, and reservoirs with approximately 12 million sport fish.

In addition, the ARS-Fp-R line and associated control and susceptible lines have been provided as a resource to understand the genetic basis of disease resistance to university and government researchers, including the Virginia Institute of Marine Science; College of William and Mary; U.S. Fish and Wildlife Service in Bozeman, Montana; and the University of Pennsylvania. These fish have also been utilized in research reported in more than 20 scientific and trade publications.

Because of the ARS-Fp-R line, commercial rainbow trout producers have access to the first publically available bacterial cold water disease-resistant line, and are continuing to propagate the line in their own selective breeding programs. The line has been tested on farms in Idaho, Utah, North Carolina, and West Virginia where the pathogen was known to be present, and has not exhibited signs of bacterial cold water disease. The line continues to be tested in large-scale farm trials and evaluated for resistance against different pathogens and bacterial cold water disease strain variants. To date, the release of the new germplasm has led to healthier animals, improved product quality, and reduced antibiotic use on-farm.







Peter Savarie, Ph.D., William Pitt, Ph.D.,

Automated Bait Cartridge and Delivery System for Controlling Brown Treesnakes

The invasive brown treesnake (BTS) was introduced to Guam nearly 70 years ago, likely through post-World War II cargo shipments. Since its introduction, the snake has colonized the entire island, at densities of up to 33 snakes per acre. These venomous snakes have caused the extinction of most of Guam's native birds, bats, and lizards; and they feed on young poultry and other small livestock, and threaten human health and safety. They also cause power outages throughout Guam, resulting in millions of dollars in structural damages and lost revenue.

Federal, state, and territorial governments are committed to preventing the spread of the BTS from Guam and mitigating their day-today impacts on the island. The unintentional movement of snakes as a result of shipping or travel is a very real danger to all islands in the western Pacific basin and sections of the U.S. mainland. The economic costs of the potential BTS colonization to the Hawaiian Islands alone are estimated to be as high as \$2 billion annually.

To prevent the spread of the BTS and reduce the snake's impacts on Guam, the USDA Wildlife Services program has partnered with the Government of Guam's Department of Agriculture, the U.S. Department of Defense, Office of Insular Affairs, and the U.S. Fish and Wildlife Service. The prevention program uses a variety of control tools and strategies, including the use of traps, fumigants, hand capture, snake-detector dogs, public education, and an oral toxicant. In 2003, the toxicant

acetaminophen was granted a registration by the U.S. Environmental Protection Agency based on research conducted by National Wildlife Research Center (NWRC) scientists. The toxicant is currently used in bait stations around ports, the airport, and other easily accessible areas of the island.

In 2009, the NWRC and Applied Design Corporation (ADC) entered into a series of cooperative agreements to design a bait cartridge, automated manufacturing system, and aerial bait delivery system for the distribution of acetaminophen to the BTS in remote and inaccessible areas on Guam. The NWRC provided information on BTS ecology and behavior, and guidance regarding EPA's pesticide regulation and early prototype concepts. Working together, NWRC scientists and experts at ADC designed a biodegradable bait cartridge and delivery system that can disperse a bait cartridge every 15 meters (4 bait cartridges/second at a flight speed of 125

In 2014, ADC and the NWRC jointly filed for a U.S. patent for the bait cartridge; and ADC plans to file two additional patents related to its automated bait delivery system and bait manufacturing process. ADC plans to commercialize this technology for use in wildlife damage management. The new technology provides large-scale control of BTS populations on Guam, and invasive species management worldwide.

knots) via helicopter or fixed wing aircraft.

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Department of Commerce National Institute of Standards and Technology

Department of Defense • U.S. Army U.S. Army Medical Research and Materiel Command

Excellence in Technology Transfer Award

Temperature-Controlled Spherical Magnetic Resonance Imaging Phantom





Winners:

Ph.D.

Michael Boss, Ph.D.,

Elizabeth Mirowski,

Image-calibration technology designed and developed by Michael Boss at the National Institute of Standards and Technology (NIST) and commercialized by Elizabeth Mirowski at High Precision Devices, Inc. (HPD) has been adopted for use in multi-site clinical trials in the United States and Europe to study the effects of traumatic brain injury (TBI). About two dozen of the units, which were brought from conceptualization to commercialization in only a year, will be distributed to trial participants in an effort to bring uniform quality control to a critically important brain imaging technique.

Magnetic resonance imaging (MRI) is the principal diagnostic tool for detecting and monitoring microscopic changes caused by TBI. But MRI scanners are made by several manufacturers, operated in a variety of clinical settings, and generate images using different values for key parameters. To ensure that brain and other scans are not only accurate but also comparable to images of the same patient taken at different times or to images made on other scanners, physicians need a quantitatively consistent standard against which to calibrate their instruments.

In response to requests from clinicians, NIST conceptualized and made prototypes of a head "phantom" (calibration standard), a spherical plastic shell the size of a volleyball. It is filled with containers of polymer solutions at various, carefully prepared concentrations. These serve as standard surrogates for water having different rates of diffusion in the brain. Water diffusion is a major indicator of injury in TBI, and it can be used to reveal conditions that otherwise would be invisible. The phantoms are cooled by an icewater bath system so different users will all make measurements of the same property of interest at the same temperature, 0°C, eliminating the

measurement variability caused by temperature differences across MRI scanners.

The technology also has utility beyond TBI, and is adaptable to various kinds of imaging in cancer and neurotrauma, as well as the study of neurodegenerative diseases. Initial prototypes of the phantoms were developed in collaboration with the National Cancer Institute and the Radiological Society of North America's Quantitative Imaging Biomarker Alliance. The prototypes were then circulated for testing and evaluation to European Union collaborators in the Innovative Medicines Initiative Quantitative Imaging in Cancer: Connecting Cellular Processes with Therapy (IMI-QuICConCePT) initiative, who expressed interest in using the phantom for quality control in clinical trials for cancer. In 2014, an American TBI clinical trial called TRACK-TBI, supported by the National Institutes of Health, received its prototype copy, leading to an order of phantoms for each site in the trial. This technology transfer has led to tremendous consumer demand, which is being met by an American manufacturer, High Precision Devices, Inc. The use of the phantom will facilitate quantitative MRI data acquisition, and ultimately lead to more cost-effective healthcare and improved quality of life for Americans.



NIST-developed diffusion phantom placed in a "head coil" used for magnetic resonance imaging of the human brain.

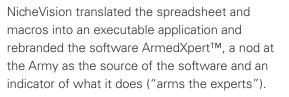
ArmedXpert™: DNA Deconvolution Software

A nearly unsolvable rape case was one of the earliest applications of software technology developed by a scientist at the Defense Forensic Science Center (DFSC), home of the U.S. Army Criminal Investigation Laboratory (USACIL).

"Today, more labs use ArmedXpert than any other non-hardware-tied DNA mixture software on the market. It has been implemented at forensics labs from coast-to-coast at city, county and federal levels."

DNA "fingerprinting" has been used since the 1980s to identify individuals in criminal investigations. In humans, the DNA structure of every individual is unique and cannot be forged, faked, or altered. However, DNA testing has one limitation: it is difficult, if not impossible, to separate individual DNA in biological samples that contain DNA from multiple sources. This presents a problem for samples in assault cases, which often contain DNA from both the victims and the assailants. To address this problem, DFSC scientist Tom Overson created an Excel® spreadsheet and a series of macros to "deconvolute" mixed DNA data. His algorithm and methods proved so useful in the USACIL that other labs began asking for their own copies of this tool.

The USACIL did not have an Office of Research and Technology Applications (ORTA) to implement a transfer of the technology, so it reached out to the U.S. Army Medical Research and Materiel Command (USAMRMC) ORTA for help. Through that assistance, a patent was filed on the DNA deconvolution algorithm and methods of use, and a licensing agreement was established with NicheVision Forensics. LLC. which was selected as the licensee.



The Navy rape case was solved when ArmedXpert software was used to definitively link the DNA in the crime scene samples with the perpetrator and the victim (and rule out other residual DNA). The perpetrator was unerringly identified and brought to justice.

Today, more labs use ArmedXpert than any other non-hardware-tied DNA mixture software on the market. It has been implemented at forensics labs from coast-to-coast at city, county and federal levels. This transfer has been a success story for the Army crime lab as well. Not only did the lab prevent the loss of a very important piece of software that scientists were using in the crime lab daily, but commercialization has led to an even better product for them to use.

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Winners:

Barry Datlof, Tim Kalafut, Ph.D., Luigi Armogida

Contact: Michael Boss, Ph.D., 303-497-7854, michael.boss@nist.gov

Department of Defense • U.S. Navy Space and Naval Warfare Systems Center Pacific

Department of Defense • National Security Agency

Excellence in Technology Transfer Award



Solid-State Integrated Crowbar/Circuit Breaker System

Thanks to the outstanding efforts of Dr. Dave Phillips, an electrical engineer for Space and Naval Warfare (SPAWAR) Systems Center Pacific (SSC Pacific), a new U.S. Government-developed spin-on technology is making submarine communication more reliable, even as it removes hazardous materials from transmission sites with savings of millions of dollars annually.

Because of the nature of seawater, very low frequency transmissions are the only way to communicate with submarines at speed and depth. The Navy has several Fixed Submarine Broadcast System (FSBS) transmitter sites, which are largely powered by onsite diesel generators and use equipment put into service in the 1960s that utilize technology dating from the 1930s. This includes large vacuum tubes, each of which costs \$17,000. Since a single 2-megawatt transmitter utilizes \$680,000 worth of tubes, protecting them from power surges or fluctuations is a clear priority.

"Once fully in place at all of the tube-type FSBS sites, the Navy expects to save about \$20 million annually in reduced energy and maintenance costs..."

Until recently, this protection came in the form of the "ignitron crowbar circuit," a device that would have looked at home in Frankenstein's lab. The ignitron is basically a pool of mercury kept warm by standard floodlights. Ignitrons

consume large amounts of power, interrupt submarine communications when they fire, and can be the source of frequent and disruptive stress in the power supply system. Although they do protect the tubes, their dramatic circuit breaking causes wear-and-tear on equipment, and has made commercial utilities leery of connecting the broadcast sites to their power grids.

In 2010, Dr. Phillips began working with Diversified Technologies, Incorporated (DTI) of Bedford, Massachusetts, on a possible replacement for the ignitron. Dr. Phillips' familiarity with the problem and his exceptional expertise in high-voltage electronics, dovetailed with DTI's existing component parts, capabilities, and facilities, sparked the new solid-state crowbar technology to life. The new technology eliminates the use of mercury, protects the expensive vacuum tubes, and virtually eliminates loss of communication with submarines. The new crowbar system also makes circuit interruptions essentially invisible to the power system so local utilities can now allow connection to their power grids.

The solid-state circuit breakers have been tested, proven, and are in production. Once fully in place at all of the tube-type FSBS sites, the Navy expects to save about \$20 million annually in reduced energy and maintenance costs—a very impressive return on investment, considering the entire project cost about \$325,000. Jettisoning the ignitron and adopting the new-style crowbar circuit is a definite blockbuster story, produced on a shoestring budget.

Winner: Dave Phillips, Ph.D.

Wireless Intrusion Detection System (WIDS)

The transfer of the National Security Agency's (NSA) patented Wireless Intrusion Detection System (WIDS) to Integrata Security stands as an excellent example of how disparate parts and value propositions can converge to not only move intellectual property from the lab to market, but also launch a company and commercialize technology from the best possible position.

The NSA WIDS technology is the world's most advanced cybersecurity solution for wireless local area networks (LANs). Unlike traditional WIDS, which channel-hop, leaving networks periodically exposed to undetected attack, NSA's technology continuously monitors all Wi-Fi channels. Its anomaly detection and alerting capabilities also exceed competing solutions, ensuring that security breaches are reported and can be acted on immediately to prevent or minimize harm.

"Just a year after signing an exclusive Patent License Agreement (PLA) with NSA, Integrata has secured \$1.5 million in commercial preorders, fully establishing itself as a market leader in wireless network security."

This unparalleled level of wireless network protection is critical given the increasing numbers of sophisticated cyberattacks, particularly for the nation's defense as well as for financial, energy, health care and other high-risk industries. Many industry sectors have avoided any use of wireless networks due to risk exposure.

Patented in 2011, NSA's WIDS was invented by Kristen Matlock, a computer systems researcher in Secure Wireless Research, in response to a Department of Defense directive. It was transferred to Integrata in September 2013, just months after Integrata CEO Mike Geppi and his management team approached the NSA Technology Transfer Program (TTP) in search of federal cybersecurity intellectual property to commercialize.

Integrata was an ideal commercialization partner. Determined to launch a cybersecurity product-based company, the founders had the tenacity and expertise needed to succeed. A former banker, Geppi knew firsthand the strong resistance to use of wireless LANs in the financial market, while other team members had deep experience in systems architecture and large-scale project management. With the assistance of Linda Burger, then a TTP agent and now director of the NSATTP, Integrata has leveraged its strengths to tap the numerous entrepreneurial resources within Maryland's "Innovation Ecosystem." For example, Integrata participated in two area business incubators and connected with the Maryland Technology Corp. (TEDCO), ultimately receiving \$100,000 of seed funding from the organization.

Just a year after signing an exclusive Patent License Agreement (PLA) with NSA, Integrata has secured \$1.5 million in commercial preorders, fully establishing itself as a market leader in wireless network security. The company has also created 10 new jobs, with the expectation of adding additional high-paying positions before year-end, and strengthened state and regional economies through partnerships with area manufacturing companies.





Winners:
Alexis Henderson,
Linda Burger,
Kristen Matlock,
Mike Geppi

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Department of Defense Uniformed Services University of the Health Sciences

Department of Energy • Argonne National Laboratory

Excellence in Technology Transfer Award

Development of a Rapid Shiga Toxin Diagnostic Array





Several strains of Shiga toxin-producing Escherichia coli (STEC) are responsible for 265,000 intestinal infections per year in the United States. Multiple food-borne outbreaks have resulted from the consumption of undercooked meat, raw milk and milk products, unpasteurized juices, and vegetables such as lettuce, spinach, and chili peppers. Infection can result in acute diarrhea, hemorrhagic colitis and, in 5% to 15% of cases, life-threatening hemolytic uremic syndrome (HUS). HUS is marked by kidney failure, hemolytic anemia, and clotting disorders, which can result in long-term vascular and neurological damage or death, with children and the elderly the most susceptible.

Two immunologically distinct types of Shiga toxin, Stx1 and Stx2, are responsible for all of these disease manifestations. The timely diagnosis of STEC has been held back by the slowness of culture methods (growing the bacteria) and the difficulty diagnosing certain strains by culturing. Existing toxin detection kits did not provide the sensitivity necessary for rapid same-day testing of fecal samples or for point-of-care diagnosis (physician's office, clinics).

The technology developed and transferred by the Uniformed Services University of the Health Sciences (USU) addresses these issues in two assay formats that can detect Shiga toxin

produced by multiple strains of E. coli. The Shiga toxin detection technology is protected by an issued U.S. patent for the direct detection of Stx1 and Stx2 in food and clinical samples. The diagnostic assay protected by the patent utilizes monoclonal antibodies to both Stx1 and Stx2, and provides a method to detect the Shiga toxins produced by STEC.

The Shiga toxin diagnostic technology was successfully licensed to Alere, a company with a focus on innovative diagnostic products. To further the development of the Shiga toxin technology into a commercial product, a Cooperative Research and Development Agreement with Alere and TechLab® (sublicensee of Alere) was executed.

The development of two Shiga toxin diagnostic assays, SHIGA TOXIN CHEK and SHIGA TOXIN QUIK CHEK, provides rapid tests that are able to detect and differentiate Stx1 and Stx2 toxins from STEC, allowing for the timely diagnosis of STEC and the implementation of an appropriate treatment plan.

Alison O'Brien, Ph.D., Louise Teel, Ph.D., Mark Scher, Ph.D.,











High Performance Computing Enabling Predictive **Engine Simulations for Engine Manufacturers**

Environmental and natural resource pressures are driving the design of more efficient vehicles and internal combustion engines powered by alternative fuels. The large number of design parameters, combined with new combustion chemistries, is so complex that much more engine development must be done via computer simulation (modeling). In addition, engine combustion concepts and fuels are evolving rapidly, which creates a demand for highly predictive engine-fuel simulation software for both research and industrial design.

Industry seeks the most effective, least costly, and most timely means to conduct research, engineering, and product development. Experimental research and prototyping have become expensive and often time-consuming; hence, there is strong incentive for industry to substitute less expensive modeling and simulation where possible.

Argonne National Laboratory transferred a two-part technology involving vehicle engine cylinder computer simulations: a unique engine fuel spray software model, and advanced computer load-balancing algorithm software technology and best practices that enabled high performance computing (HPC) simulations of combustion occurring in internal combustion engines. The technology enables engine modelers to perform more predictive engine simulations to determine what occurs when fuel enters the cylinder of an engine and is burned.

The technology was transferred to Convergent Science, Inc.; Cummins, Inc.; and Caterpillar, Inc. The fuel spray software model was integrated into Convergent Science's CONVERGE computational fluid dynamics (CFD) software, a commercial product highly accepted by industry and used for engine modeling. The integration was tested by Cummins, using its products in the model. Argonne, Convergent Science, and Caterpillar used the CFD software plus fuel spray model to conduct simulations of the Caterpillar C15 engine on high performance computing platforms at Argonne.

The technology transfer effort has benefitted all parties with improved engine simulations and best practices for performing these simulations in industry. In particular, the technology has allowed Caterpillar to shrink its development timescales, resulting in significant cost savings. Caterpillar engineers predict that these engine simulation developments will reduce the number of multi-cylinder test programs by at least a factor of two, resulting in hundreds of thousands of dollars in cost savings per year. A further benefit is that insights gained by these advanced simulations will be extended to inform important engine design considerations such as fuel consumption, heat release rate, and emissions (nitrogen oxides and soot), impacting the design of advanced transportation technologies worldwide.



Left to right: Sibendu Som, Ph.D., Terry Maynard,

Raymond Bair, Ph.D.

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Department of Energy Pacific Northwest National Laboratory

Department of Energy Pacific Northwest National Laboratory

Excellence in Technology Transfer Award

Algae-to-Biocrude Oil





In recent years, there has been a shift in the U.S. to use renewable energy as a way to reduce dependency on fossil fuels from other countries. Algae is considered an attractive source of renewable energy, but it has been challenging to bring to the marketplace because producers typically must first remove water from the algae, then extract oil from the dried algae. This is energy-intensive and costly, and it leaves behind residual material that is difficult to use

The algae-to-biocrude oil process developed at Pacific Northwest National Laboratory (PNNL) not only converts a slurry of wet algae into biocrude oil in less than an hour, it also takes advantage of the wastewater and residual organics left behind. With additional conventional refining, the crude algae oil is converted into aviation fuel, gasoline, or diesel fuel. The wastewater is processed further. yielding burnable gas for heat or energy use, and plant nutrients such as potassium and nitrogen which, along with the cleansed water, can be recycled to grow more algae. The process is similar to the way fossil fuels were formed, except that it does in less than an hour what would take nature millions of years to accomplish. The process reduces the cost of algae-based biocrude oil production by 86 percent compared to existing processes.

PNNL licensed the original technology to Genifuel Corporation and further developed the technology in response to the needs of the licensee. The two partners spent more than a year testing the technology on wet algae, and Genifuel licensed the process to gasify wet algae in 2009. The technology evolved from previously licensed catalytic hydrothermal gasification to include hydrothermal liquefaction, which was licensed to Genifuel in 2013. At each step of the way, licensing was amended and expanded to reflect the technology advancements, joint patents, and additional fields of use.

In 2014, Genifuel built a pilot plant for its first customer, Reliance Industries, Ltd. Constructed in Colorado, the plant has attracted significant attention from a variety of industries, including food processing and wastewater treatment companies. The pilot plant provides Genifuel with a potential client base of industries interested in converting not just algae, but various other wet waste materials into biofuels. As a result, Genifuel is actively pursuing additional customers interested in converting various bio-based materials.

The successful transfer of the algae-to-biocrude oil process has greatly benefitted both PNNL and its partner, Genifuel. PNNL benefitted from Genifuel's business sense, determination, and drive to find a technology to convert wet algae and bring that innovation to market. Genifuel benefitted from PNNL's expertise in hydrothermal chemistry, as well as PNNL staff and facilities to rapidly test different species of algae and other feedstocks.

Left to right:
Andrew Schmidt,
Dan Anderson,
Douglas Elliott,
Eric Lund, Ph.D.,
James Oyler,













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System for Analysis at the Liquid Vacuum Interface (SALVI)

Important scientific studies often require precise knowledge of the unique properties at the liquid-solid interface or at the liquid surface itself. Analyzing these interfacial or surface properties has proven difficult, if not impossible, because many key analytical instruments are vacuum-based. In such instruments, liquids normally evaporate before they can be analyzed. To overcome this problem, scientists have used sample holders to position liquids for analysis, but such holders are expensive and designed to fit a single instrument; and they also require specially designed cells. Scientists also tried freezing or drying samples for analysis in a static state, but always with concern about changing the liquid compared to its natural state.

Pacific Northwest National Laboratory (PNNL) developed the System for Analysis at the Liquid Vacuum Interface (SALVI), a unique, self-contained, portable analytical tool that, for the first time, enables vacuum-based scientific instruments such as time-of-flight secondary ion mass spectrometry (ToF-SIMS) to analyze liquid surfaces in their natural state at the molecular level. Using as few as two drops of liquid and requiring minimal sample preparation and no modifications to scientific instruments, SALVI allows scientists to understand complex liquids and develop advanced solutions to challenging problems, such as extending the life of batteries and eliminating biofilms that form resistance to antibiotics. R&D Magazine named SALVI among the top 100 technology innovations for 2014, granting it a prestigious R&D 100 Award.

Knowing the potential SALVI could have on the advancement of science if it could be developed into a product by a commercial partner, PNNL initiated the process of finding that partner before the patent application on the technology was even filed. PNNL partnered with SPI Supplies, a division of Structure Probe, Inc. (SPI), to commercialize SALVI in March 2011. By 2014 a license was issued to SPI, which is currently taking orders for its commercial embodiment of the device, called Wet Cell II, on its website and through direct contact with its customers.

PNNL continues to apply SALVI to new research projects, expanding its applicability and use to SPI's potential customers in the scientific community. For example, SALVI is being used in nuclear magnetic resonance, an application not previously envisioned, and has proven the tool can be used to support important biological applications such as cancer research.

If SALVI had not been commercialized, a few scientists might have attempted to build and use their own versions based on information provided in PNNL's scientific publications.

Instead, by transferring what was originally a new tool invented for PNNL's use into the broader scientific community via a commercial partner, PNNL and SPI dramatically expanded SALVI's potential impacts to science, enabling new research never before possible. SPI's new product line also contributes to the company's profitability and U.S. economic competitiveness





Bruce Harrer, Li Yang, Ph.D., Xiao-Ying Yu, Ph.D., Zihua Zhu, Ph.D.

Contact: Xiao-Ying Yu, Ph.D., 509-372-4524, xiaoying.yu@pnnl.gov

Department of Energy • Sandia National Laboratories

Department of Health and Human Services Centers for Disease Control and Prevention

Excellence in Technology Transfer Award

BaDx (Bacillus anthracis Diagnostics)





The world today is presented with many dangerous biological threats, both naturally occurring and nefariously concocted, with recent prime examples being *E. coli*, group A *Streptococcus*, Rift Valley fever virus, Ebola virus, and *Bacillus anthracis*. Homeland security and first responders can benefit when unique technology and unique technology transfer methodology combine to help effective products rapidly enter the market, allowing a quick reaction to new and emerging threats.

BaDx was created at Sandia National Laboratories as a lab-in-a-pocket device to sample, sense, and diagnose bacteria that cause anthrax in environments with no power, refrigerated storage, or laboratory equipment. At the same time, it was designed to be used with minimal or no training and to keep handlers safe. BaDx is the first product of its kind to meet all of these requirements, and with a target cost of less than \$10.

Developed at Sandia and with several key pieces of intellectual property secured, the technology was transferred to two companies: NIMA Ventures and Aquila. Working under nondisclosure and test and evaluation agreements, the technology was evaluated from the perspectives of manufacturing, commercialization, research and development, and intellectual property generation.





Left to right: David Wick, Ph.D., Yasmin Dennig Not pictured: Martha Talbott, Aquila

The first BaDx product order was delivered by Aquila, and four other projects involving Sandia, Aquila, and NIMA are currently in process. As the BaDx device technology can be modified to handle other dangerous biological threats such as Ebola, Rift Valley fever, group A *Streptococcus*, Salmonella, and *E. coli*, the technology transfer process has been streamlined to move the research from the labs to manufactured products quickly so the technology can be as useful as intended.





Top: Jason Harper, Ph.D., Melissa Finley, Ph.D., and Thayne Edwards, Ph.D.

Bottom: Markku Koskelo, Ph.D., Thayne Edwards, Ph.D., Judy Beckes Talcott, and Luay Shawwa

Detection of H1N1/Swine and Other Types of Influenza Viruses

In April 2009, the first human cases of the 2009 H1N1 influenza virus in the U.S. were reported by the Centers for Disease Control and Prevention (CDC). This strain, which continues to circulate, is a unique combination of influenza genes not previously identified in humans. By April 2009, multiple countries reported an ongoing spread of the virus later confirmed to be H1N1. Hospitalizations and deaths associated with children and young adults infected with H1N1 were higher than known circulating influenzas. A means to rapidly identify, track, and treat emerging infections was critical to slow the epidemic.

The CDC influenza team sequenced the H1N1 strain, developed a real-time reverse transcription polymerase chain reaction (rRT-PCR) test by designing primer and probe sets for identifying and distinguishing the novel strain from other circulating influenzas, and then published the sequences and protocols for public health laboratory use on an influenza database. The CDC then manufactured diagnostic test kits to enable health care professionals to quickly identify the 2009 H1N1 virus in patient samples.

The rRT-PCR test developed by the CDC was authorized for use by the Food and Drug Administration (FDA) under an Emergency Use Authorization (EUA) on April 28, 2009, less than two weeks after the new pandemic virus was identified. Three days later, CDC test kits began shipping to domestic and international public

Left to right: Stephen Lindstrom, Ph.D., LaShondra Berman, Lakshmi Malapita, Ph.D., Bo Shu, Ph.D., Suzanne Seavello Shope, Francisco Candal, Ph.D.

Not pictured: Nancy Cox, Ph.D., Shannon Emery, Alexander Klimov, Ph.D., Lamorris Loftin, Ph.D. health laboratories. These transfer needs were immediate and critical as H1N1 virus infections were confirmed worldwide.

An increasing demand compelled the CDC to outsource purified primer and probe production. By November 2009, the first commercial license agreements were negotiated with Life Technologies, Inc. and Biosearch Technologies. The commercial agreements were for production of diagnostic oligonucleotide primer and probe sets for H1N1 and for patented influenza panel test kits for the universal detection of all influenza type A and B viruses, and the identification of strains with specificity to human H1 and H3, Asian avian H5, Eurasian H7, North American H7, and Asian H9 viruses.

To address the overwhelming volume of requests for testing procedures and technical support, the CDC Laboratory Support for Influenza Surveillance (CLSIS) website was created and eventually upgraded to a SharePoint site. The CLSIS SharePoint site was instrumental in facilitating rapid sharing of testing procedures for additional outbreaks of novel influenzas such as avian A/H7N9 in China in 2013. CLSIS currently supports over 200 domestic and international users by providing the latest information on CDC influenza rRT-PCR testing procedures.







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2014 FLC Regional Award Winners

Congratulations to the following recipients of FLC regional awards in 2014.



Far West Region

Outstanding Partnership Award

"H2FIRST: Accelerating Deployment of Zero Emission Vehicles"

Sandia National Laboratories
National Renewable Energy Laboratory
California Fuel Cell Partnership
California Governor's Office of
Business and Economic Development
California Air Resources Board

"Ultrascale Visualization Climate Data Analysis Tools"*

Lawrence Livermore National Laboratory
Lawrence Berkeley National Laboratory
Los Alamos National Laboratory
Oak Ridge National Laboratory
NASA Goddard Space Flight Center
NOAA Earth System Research Laboratory
New York University
University of Utah
Kitware, Inc.
Tech-X Corporation

Outstanding Technology Development Award

Idaho National Laboratory

"Advanced Electrolyte Model (AEM)"

NASA Armstrong Flight Research Center

"A Novel Peak-Seeking Algorithm to Optimize Performance of Dynamic Systems"

"Automatic Dependent Surveillance Broadcast (ADS-B) Technology"

Pacific Northwest National Laboratory

"Iron Vanadium Redox Flow Battery"

SPAWAR Systems Center Pacific

"Multiple Radios per Node Network Architecture"

"Multi-segmented Magnetic Robot"

USDA Agricultural Research Service, Pacific West Area

"Solution Blow Spinning"

Outstanding Commercialization Success Award

Idaho National Laboratory

"Multiphysics Object Oriented Simulation Environment (MOOSE)"

Lawrence Livermore National Laboratory

"Solution Grown Organic Scintillators"

Lawrence Livermore National Laboratory Field Forensics, Inc.

"microTLC™: For Fast and Easy Detection and Identification of Explosives and Drugs"

Naval Surface Warfare Center Corona Division

"METBENCH Calibration Automation to Market"

Technology Transfer Professional of the Year Award

Peter Christensen

Pacific Northwest National Laboratory

Laboratory Representative of the Year Award

Jennifer Stewart

Naval Surface Warfare Center Corona Division



Mid-Atlantic Region

Excellence in Technology Transfer Award

USDA ARS Environmental Microbial and Food Safety Laboratory*

"Online Imaging for Real-time Wholesomeness Inspection in Poultry Processing"

USDA ARS Genetic Improvement of Fruits and Vegetables Laboratory*

"'FLAVORFEST' Strawberry Cultivar"

USDA ARS Invasive Insects Biocontrol and Behavior Laboratory*

"Reduced Risk Vector Control Insecticides"

National Cancer Institute

"A Low-cost Tissue Microarrayer Instrument to Support Improved Cancer Diagnoses"

"The Breast Cancer Startup Challenge"

National Heart, Lung, and Blood Institute

"Interleukin-2 Receptor Gamma Deficient Mice, Widely Used Research Tools"

National Institute of Neurological Disorders and Stroke National Institute of Drug Abuse

"Deep Cranial Magnetic Simulation Coil and Therapy System"

Educational Institution and Federal Laboratory Partnership Award

National Institutes of Health,
U.S. Army Telemedicine and Advanced
Technology Research Center,
The Johns Hopkins Carey Business School

2014 FLC Regional Award Winners

USDA Agricultural Research Service, University of Maryland, Montgomery County Department of Economic Development

STEM Award

National Energy Technology Laboratory



Mid-Continent Region

Notable State and Local Government Collaboration Award

"New Mexico Small Business Assistance Program"

Los Alamos National Laboratory Sandia National Laboratories State of New Mexico

Outstanding STEM Mentorship Award

Linda Lung

National Renewable Energy Laboratory

Distinguished Service Award

Eric Payne, Sr.

National Renewable Energy Laboratory

Excellence in Technology Transfer Award

Joint Space Operations Center

"Joint Missions Systems (JMS)"

Los Alamos National Laboratory Alion Science and Technology

"CASA Grande Code for Nuclear Power Plant Safety"

Los Alamos National Laboratory Decision Sciences International Corp.

"Muon Scattering Tomography"

National Renewable Energy Laboratory NanoResearch, Inc.

SmartEnergi Corp.

"Binder-free Electrodes for Lithium-ion Batteries"

Sandia National Laboratories

"MANTEVO"

Notable Technology Development Award

Los Alamos National Laboratory

 $\hbox{``MiniMAX: A Revolutionary X-ray Imaging System''}\\$

NASA Johnson Space Center

"Road Barrier: Deceleration-Limiting Roadway Barrier"

Sandia National Laboratories

"Nano-Stabilized Enzymatic Membrane for CO2 Capture"

USDA Agricultural Research Service

"JournalMap"



Midwest Region

Excellence in Technology Transfer Award

EPA National Risk Management Laboratory

"Water Cluster Technology Team"

Regional Appreciation Award

Joseph King

NASA Glenn Research Center

Partnership Award

Environmental Protection Agency

Urbanalta Corporation

"Flow Sensor Monitor Development and Technology Transfer"



Northeast Region

Excellence in Technology Transfer Award

Naval Undersea Warfare Center Division Newport

"Inflatable Fabric Structures"

Volpe National Transportation Systems Center

"Safety Hazard Analysis Tool"

Regional Laboratory Award

Air Force Research Laboratory, Information Directorate



Southeast Region

Project of the Year

NASA Kennedy Space Center

"Business Students Accelerate NASA Technology to Market"

Excellence in Technology Transfer

Centers for Disease Control and Prevention*

"Detection of H1N1/Swine and Other Types of Influenza Viruses"

Oak Ridge National Laboratory

"ClimateMasterTrilogy 40 Q-Mode Geothermal Heat Pump" "SYMMETRIX® HPX-F Lithium-ion Battery Nanocomposite Separator"

USDA Agricultural Research Service, Mid South Region

"Hatchery Technology for Hybrid Catfish Fry Production"

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FLC Awards Committee

The FLC expresses its gratitude to the members of the Awards Committee for their tireless efforts in making the 2015 awards program a success.

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