



**Federal Laboratories and
State and Local Governments**
Partners for technology transfer success

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The FLC's State and Local Government Committee strives to develop an awareness among state and local government organizations of the benefits of partnering with federal laboratories and the technology transfer opportunities that can develop from these partnerships. We are proud to deliver these fine examples of technology transfer partnership success that have proven valuable to local economies, communities, and individuals.

Letter of Introduction

In today's ever-changing technological landscape, cities and communities across the country are busy searching for new, innovative ways to enhance the well-being of their citizens and the infrastructure that supports them. To accelerate the handoff of new technologies to communities, the Federal Laboratory Consortium for Technology Transfer (FLC) works diligently to facilitate collaborative partnerships between economic development organizations, local government offices, and federal laboratories.

The articles in this publication highlight how federal laboratory partnerships with state and local governments and various business groups can improve coordination and planning of emergency response efforts, and lead to important developments for our society and economy. Whether focusing on advancements in infrastructure that protect California residents from flooding, or creating cutting-edge tools that can evaluate micro grid electricity usage, federal labs are eager to collaborate with regional entities to provide innovative solutions that meet public needs.

As you read through the State and Local Government (S&LG) publication, I hope that you will appreciate the critical technologies that these collaborations have produced, as well as the advancements they will provide in the areas of infrastructure; design and evaluation tools; partnerships; and human, animal and environmental health improvements.

The FLC's State and Local Government Committee strives to develop an awareness among state and local government organizations of the benefits of partnering with federal laboratories and the technology transfer opportunities that can develop from these partnerships. We are proud to deliver these fine examples of technology transfer partnership successes that have proven valuable to local economies, communities, and individuals.



Kathleen Graham

FLC State and Local Government Committee Chair

About the FLC

Promoting, educating and facilitating technology transfer

Formally chartered by the Federal Technology Transfer Act of 1986 (15 U.S.C. §3710), the Federal Laboratory Consortium for Technology Transfer (FLC) is a nationwide network of over 300 federal laboratories, agencies, and research centers. The FLC's mission is to promote, educate, and facilitate federal technology transfer (T2) among its member labs and institutions so they can easily reach their mission goals, and impact society and the economy with new, innovative technologies. Through easy-to-use cross-agency resources, education and training, tools and services, the FLC provides a hub of T2 information for our nation's laboratories and businesses at www.federallabs.org. Using FLC-created resources, federal labs are better able to create public-private partnerships, navigate the commercialization process, and help companies achieve market success.

The Mission of the FLC

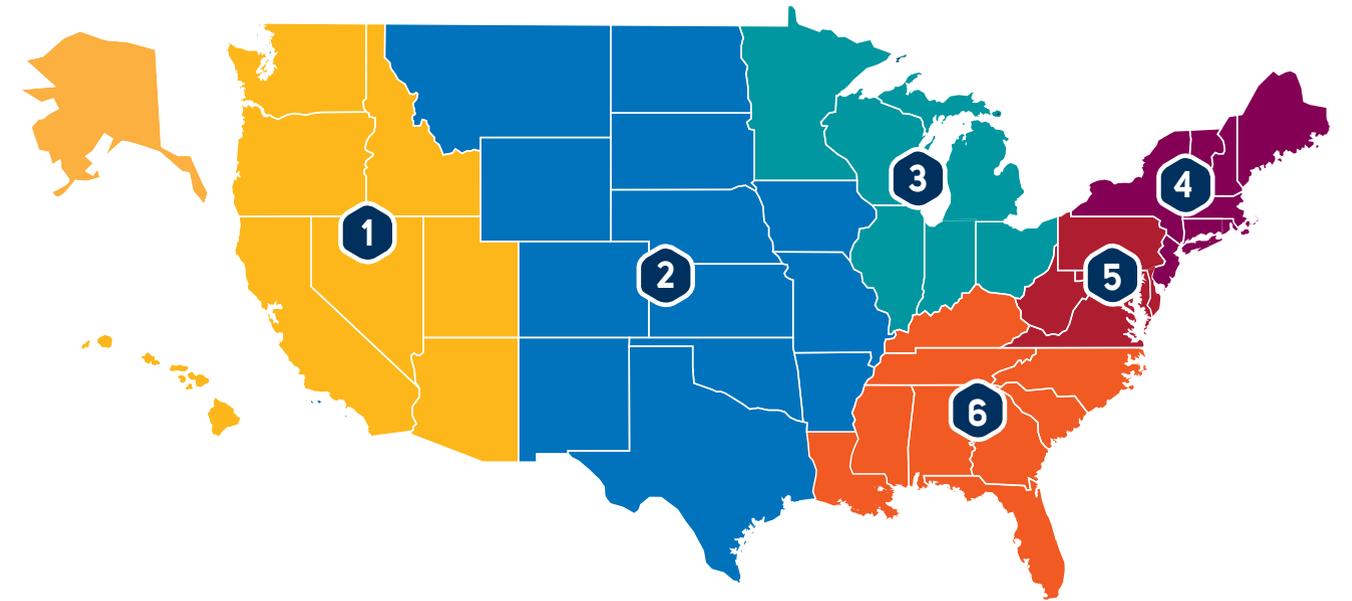
PROMOTE awareness and increase dialogue with state and local governments, industry, academia, and other external participants about the significance of T2, and the FLC tools and services available to support T2 missions. We achieve this goal by advocating T2 activities and successes through the FLC awards program, as well as print, online, and social media communications.

EDUCATE the FLC community, from newcomer to seasoned professional, on T2 best practice strategies and offer various in-person and online training opportunities for anyone to expand their T2 knowledge for improved understanding and easy navigation of the federal commercialization process.

FACILITATE federal laboratories' T2 goals and missions through FLC-created tools and services in order to provide lucrative connections between labs, businesses and academia so that collaborative research and lab to market innovation can occur.

To learn more about the FLC and the growing resources it provides to boost technology commercialization and connect laboratories with industry, visit www.federallabs.org.

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FLC Regions

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Technological Infrastructure Advancements

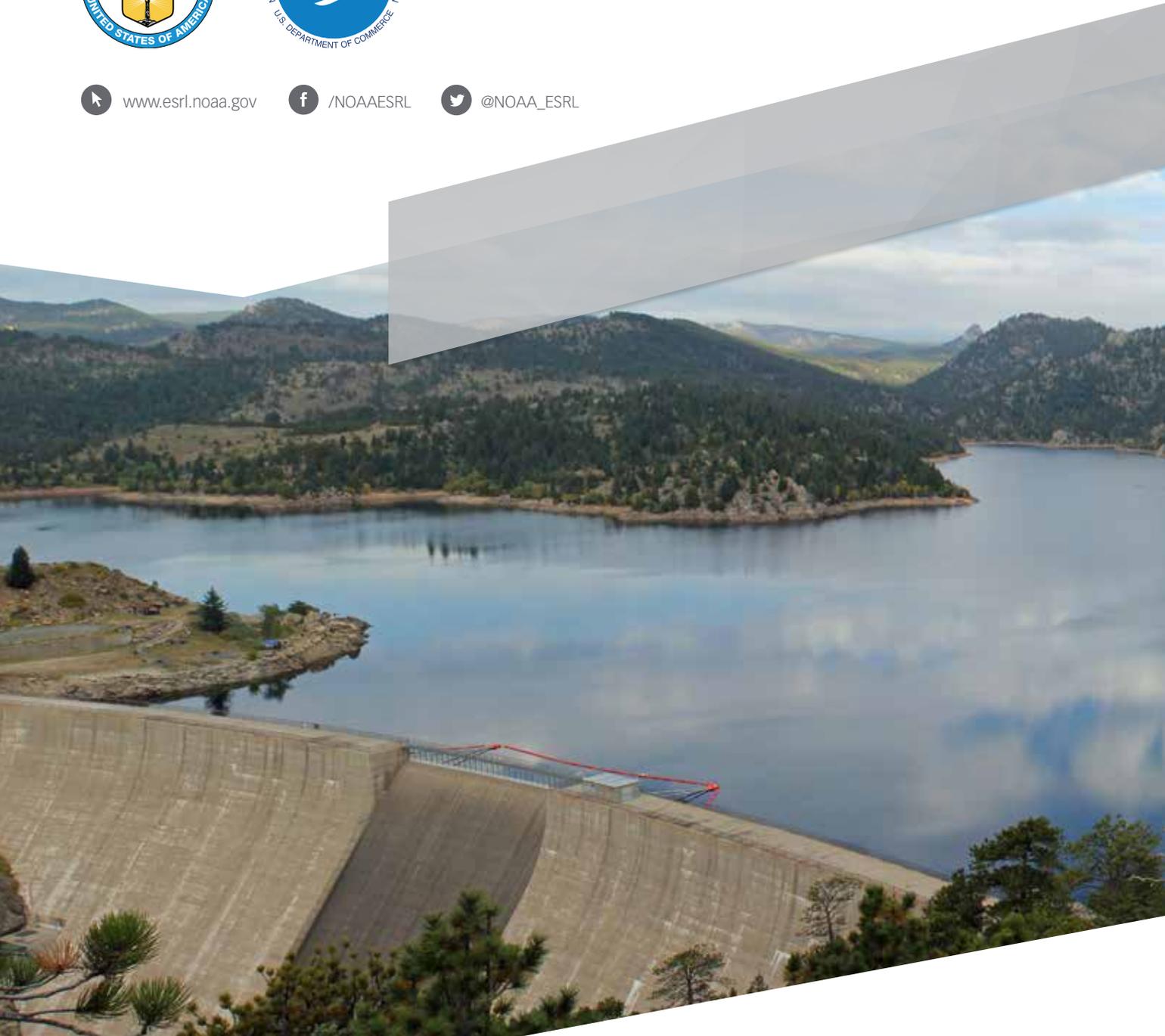
Keeping America's infrastructure systems operating at full capacity requires extremely important, and often overlooked, work that takes place every day across every state in our nation. Thanks to the partnerships forged between federal and state agencies, federal laboratories and academic institutions, regions have been working together to create cost-effective technologies and building methods that address infrastructure deterioration, improve waterway systems in real time, and provide reliable communication techniques that keep our country moving forward safely.



www.esrl.noaa.gov

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Colorado-New Mexico Regional Extreme Precipitation Study

Photo credit: Jeffrey Beall via Wikimedia Commons

National Oceanic and Atmospheric Administration

Earth System Research Laboratory

The Colorado–New Mexico Regional Extreme Precipitation Study: Improving Extreme Precipitation Estimates to Enhance Dam Safety and Community Resilience



Dams are essential for storing water for household use, irrigation, energy, and recreation. However, a dam failure that results in the release of stored water poses a risk to populations living downstream. Because of potentially devastating consequences, all practical methods must be applied to prevent such failures, ensure public safety, and maximize water storage.

The Challenge—All dams have spillways to safely route flows from extreme runoff events and prevent overtopping. In the last 100 years, overtopping due to inadequate or improperly designed spillways is the leading cause of dam failure and the resulting loss of life.

Estimating extreme rainfall amounts is a critical component of building safe dams. However, the data and methods currently used to calculate these quantities are dated, and studies have shown that current methods can both over- and under-estimate rainfall, depending on location. A tenuous balance exists between the safety provided by conservatively designed spillways to protect dams against extreme events and the cost of that construction.

The Need—Modern meteorological methods of estimating probable maximum precipitation can reduce the likelihood of over- or underestimating rainfall. New approaches aim to produce more realistic estimates of maximum precipitation to strike an appropriate balance between the protection of public health and safety, and the required level of construction infrastructure.

The Colorado Division of Water Resources and the New Mexico Office of the State Engineer have identified and set as a priority the need to update their extreme precipitation estimates for use when evaluating dam

spillway adequacy based on the most modern methods and scientific understanding available.

Innovation—Due to geographical and meteorological similarities between Colorado and New Mexico, a cooperative regional study has been undertaken. The project began in June 2016 and is scheduled to be completed in June 2018. Of particular concern in both states are questions about the physical limits on high elevation rainfall amounts and the annual exceedance probability (AEP) of the extreme rainfall amounts used for spillway design. This reality has led to using an innovative ensemble approach and methods to update extreme precipitation estimates.

NOAA Contributions—The National Oceanic and Atmospheric Administration (NOAA) is providing innovative solutions to meet this project’s unique challenges through its expertise in modeling and understanding of the physical processes that affect extreme precipitation. Experience from related stakeholder-driven research also allows NOAA scientists to critically consider limitations of past methods to estimate extreme precipitation and to design updated alternative options. Research scientists in NOAA’s Earth System Research Laboratory (ESRL) are leading this effort, with critical input from members of the Project Review Board (PRB), which includes NOAA representation from the National Weather Service and the Office of Water Prediction/National Water Center.

Partners—In order to accomplish the project goals with the highest degree of scientific and engineering credibility, the project sponsors have assembled a PRB comprised of subject-matter experts from multiple state and federal organizations.



Real-time Stormwater Sensor Demonstrates Benefits in Northern Kentucky Study



The U.S. Environmental Protection Agency's (EPA) National Homeland Security Research Center, located in Cincinnati, Ohio, jointly collaborated with the Urbanalta Company, also of Cincinnati, to develop novel measurement methods and technology for detecting and monitoring surface water, stormwater, and wastewater flow, depth, velocity, and/or water quality in sewers, gutters and open channels, and in pipe network manholes. The novel and innovative technologies and methods are aimed to achieve: higher efficiency; faster detection, identification, and quantitation of flow using economically viable methods; quantification of urban drainage system performance and maintenance needs; and actuation of control structures to manage drainage operations. The technologies have been co-developed. The EPA and Urbanalta are collectively evaluating the performance of the monitoring and measurement methods and technologies.

Through their collaboration, the EPA and Urbanalta have redesigned methods and technologies to optimize performance of the sensor network/platform. EPA and Urbanalta received a patent on the technology in 2017.

Urbanalta is applying for an exclusive license to use the technology, which helps further develop its business plan. This project has been very successful in promoting co-developed federal sensor technology, and that technology has been transferred to Urbanalta. The technology being developed, demonstrated and transferred to the private sector under this collaboration will be a benefit to utilities responsible

for stormwater, combined sewer, and wastewater monitoring. The application of the technology is anticipated to revolutionize the monitoring and management of municipal and commercial utilities. Potential applications are in municipal and commercial areas of stormwater, water and wastewater, and combined systems for flow detection and water security. The novelty is the low cost of the sensor system, enabling highly networked sensor systems to better understand, evaluate and manage stormwater, combined sewer, and wastewater systems using the power of cloud computing. The flow monitoring and measurement methods and technology being designed and developed by Urbanalta as part of its business plan are anticipated to provide a competitive edge as it offers the management and monitoring technology to various utilities.

Urbanalta has successfully demonstrated the flowing water station at six different sewer districts. Northern Kentucky Sewer District #1 is the latest demonstration site. The state of Kentucky has approved the use of Urbanalta's technology, and will be one of the first clients when the company begins selling its commercial units in late 2017. This collaboration with Urbanalta contributes to the mission of the EPA, primarily relative to sustainable stormwater and wastewater management. This work will also contribute to the advancement of stormwater and wastewater flow monitoring, and real-time management and operation of collection systems for various state and local governments.



 www.epa.gov

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Installing Urbanalta's drop-in retrofitted flowing water station

Photo credit: Michael Bolan

Atmospheric River Observatory at
Pt. Sur, California

Photo credit: Tom Ayers, NOAA



National Oceanic and
Atmospheric Administration

Earth System Research Laboratory

21st Century Observations and Modeling in California Helping to Address Water Resource and Flood Protection Issues



California/Colorado

Since 2008, the National Oceanic and Atmospheric Administration's (NOAA) Earth System Research Laboratory (ESRL) has partnered with the California Department of Water Resources (CA-DWR) to address water resource and flood protection issues. As part of CA-DWR's Enhanced Flood Response and Emergency Preparedness (EFREP) Program, ESRL and CA-DWR are working with the Scripps Institution of Oceanography to improve precipitation monitoring and prediction, especially for extreme events. The statewide deployment of observation systems and a suite of highly detailed weather forecast models builds on lessons learned in NOAA's Hydrometeorology Testbed (HMT).

The Problem

During Northern Hemisphere winters, the western coast of North America is battered by land-falling storms. The impact of these storms is of paramount concern to California, where water supply and flood protection infrastructure are being challenged by the effects of age, increased standards for urban flood protection, and projected climate change impacts. In addition, a built-in conflict exists between providing flood protection and the other functions of major water storage facilities in California: water supply, water quality, hydropower generation, water temperature and flow for at-risk species, and recreation. To improve reservoir management and meet the increasing demands on water, improved precipitation forecasts, especially during extreme weather events, will be required.

Working Toward a Solution

- Antecedent soil moisture can determine whether an extreme rainfall event produces a flood, so soil moisture sensors with other associated

meteorological equipment are being placed at 43 new sites across California.

- Water vapor fuels precipitation, and GPS technology provides a viable method of measuring vertically integrated water vapor (IWV). The HMT is partnering with UNAVCO, the operators of the Plate Boundary Observatory, where many GPS receivers already exist for geodetic purposes, to provide IWV measurements from over 50 locations in or near California.
- The snow level is important with respect to flooding in mountainous watersheds because it determines the surface area throughout the watershed that is exposed to snow versus rain. ESRL engineers have invented a new, compact radar designed to measure the snow level at a much reduced cost compared to other radars used for this purpose. These "snow-level radars" are being installed in ten key watersheds across California.
- A major finding from the HMT is the role that atmospheric rivers, which are narrow regions of enhanced water-vapor transport, have in creating heavy precipitation that can lead to flooding. A picket fence of atmospheric river observatories (AROs) is being deployed along the California coast to provide critical information on water vapor transport aloft and the snow level.
- Taking full advantage of the new measurements requires a complementary effort in data assimilation and weather forecast modeling.
- Decision support tools also are being developed to integrate the new information provided by the observations and models into flood forecasts, and to inform water management decisions and minimize water shortages due to drought.



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Improving Reliability for Droughts and Floods: Forecast-Informed Reservoir Operations (FIRO)



Background

Created in 1958, Lake Mendocino, in California, provides flood control, water supply, recreation and stream flow regulation. The U.S. Army Corps of Engineers (USACE) operates the dam in accordance with the Lake Mendocino Water Control Manual. This manual specifies elevations for an upper volume of reservoir storage that must be kept available for capturing storm runoff and reducing flood risk, and a lower volume of storage that may be used for water supply. During a flood event, runoff is captured by the reservoir and released soon after to create storage space for the next potential storm. The manual is based on typical historical weather patterns—wet during the winter, dry otherwise.

The Challenge

The manual utilizes estimates of flood potential to establish reservoir storage and release requirements. It does not account for changing conditions in the watershed—for example, increased variation in dry and wet weather patterns and reductions to imported flows into the lake that have occurred since 1986. Also, the manual’s reservoir operations procedures were developed decades ago, without the benefit of current science that more accurately predicts weather and streamflow.

Given reduced supplies, changed hydrologic conditions, and technological advances, some adjustments to the current reservoir operating procedures may be possible to optimize the goals of maintaining flood control while bolstering water supply reliability for downstream users and the environment (e.g., to support recovery of endangered and threatened fish).

For example, following an atmospheric river-type storm in December 2012, water was released to create flood space according to the manual, dropping reservoir

levels by more than 35 percent. 2013 was the driest year on record, resulting in little inflow to refill the reservoir. By December 2013 lake levels were extremely low and remained low through 2014. Ideally, water from the December 2012 event could have been retained based on longer-term precipitation forecasts, lessening the impact of drought.

The Potential Solution

An interagency steering committee, consisting of state and federal agencies, the Center for Western Water and Weather Extremes (CW3E) at University of California San Diego and Sonoma County Water Agency, was formed to explore methods for better balancing flood control and water supply needs. The committee has developed a Lake Mendocino Forecast Informed Reservoir Operations (FIRO) work plan that describes an approach for using modeling, forecasting tools and improved information to assess whether deviations from the Lake Mendocino Water Control Manual can maintain flood risk reduction while improving water supply and achieving additional ecosystem benefits. Implementation of the Lake Mendocino FIRO pilot project is anticipated to demonstrate ways in which improved weather forecasts can aid the decisions made by USACE and other water-resource managers to balance flood and drought risks, maximize reservoir storage potential, and minimize conflict among competing water users.

FIRO is a management strategy using data from watershed monitoring and modern weather and water forecasting to help water managers selectively retain or release water from reservoirs in a manner reflecting current and forecasted conditions. The Lake Mendocino FIRO pilot project is envisioned as a model for the management of other reservoirs.

21st Century Tools

In today's digital technology-driven age, federal laboratories are constantly developing new and innovative technologies in order to stay at the forefront of the digital frontier. From software development projects with regional incubators that support the warfighter to developing and deploying city transit system applications, some of our nation's top energy, transportation and defense labs have both fulfilled their technology research and development (R&D) missions as well as boosted regional economies. The stories you will read throughout this section demonstrate how resource sharing and collaborative digital efforts can vastly improve our nation's quality of life on many levels.



Warfighters use the ATAK app to plan and collaborate operations, increasing situational awareness and contributing to mission success.

Photo credit: Air Force Research Laboratory Information Directorate

New York Partnership Key to Air Force App's Success



New York

New York's Griffiss Institute is connecting private-sector entrepreneurs with software that increases situational awareness for military and government security forces. The Team Awareness Kit was developed by the Air Force Research Laboratory Information Directorate (AFRL/RI) in Rome, New York, for use on Google's Android mobile operating system.

Known as ATAK, the app delivers advanced mapping, navigation, and real-time location and photo sharing on mobile devices, plus voice and text communications. Ralph Kohler, the AFRL/RI principal ATAK engineer, cited the 1993 battle of Mogadishu, Somalia, as his inspiration. "'Black Hawk Down' was the motivational scenario for me," he stated.

After its 2010 launch, ATAK was offered at no cost to other Department of Defense organizations that adopted its use and built on it rather than developing their own mobile platform from scratch. To avoid competing with other Android-based apps, which would threaten future interoperability and increase taxpayer costs, AFRL/RI partnered with the Griffiss Institute to transfer the software to approximately 50 companies that expanded its use to civilian applications.

Avwatch, a service-disabled veteran-owned small business in Massachusetts, adapted ATAK for its fleet of networked observation aircraft and also offers a civilian version, known as TAK-C, to niche customer groups like civilian first responders. "We can stream situational awareness to people on the ground," said Chris Kluckhun, Avwatch's president. "We did it for the Deepwater Horizon/BP oil spill. We did it for Mississippi River flooding, multiple fires, Hurricane Irene, Hurricane Sandy, the Boston Marathon, and other scheduled events."

The Griffiss Institute was established by the State of New York in 2002. By partnering AFRL/RI with private industry, the Griffiss Institute can facilitate and grow the technology base in upstate New York. Its successful transfer of ATAK technology was recognized with an award from the Federal Laboratory Consortium for Technology Transfer (FLC) in 2015 and continues to result in new license agreements.





Safer Roads Through Better Design: Using the Interactive Highway Safety Design Model

Improving roadway safety continues to be at the forefront of all stages of project development, including planning, alternatives analysis, design, construction, and operations. Advanced analysis methods and tools have been developed to help practitioners improve safety. One tool available now to estimate a project's substantive safety is the Interactive Highway Safety Design Model (IHSDM). IHSDM supports performance-based practical design (PBPD) via the implementation of Highway Safety Manual (HSM) Part C predictive methods and can be an integral part of the Road Safety Audit (RSA) process.

The IHSDM contains six modules: Crash Prediction, Design Consistency, Intersection Review, Policy Review, Traffic Analysis, and Driver/Vehicle. This free software package helps users identify areas of safety concern in a given facility, and IHSDM outputs assist agencies with determining how to best invest limited resources to improve safety performance. Results from the model help project developers identify and justify safety-related design decisions. In recent years, agencies have established increasingly flexible project design criteria. The Federal Highway Administration (FHWA) has encouraged PBPD in an effort to ground cost-saving design decisions in a performance-management framework.

Several agencies have used the IHSDM to evaluate and optimize their design decisions as they address a project's purpose and need. The IHSDM helps engineers balance short- and long-term project goals while considering operational and safety performance. For example, a designer determines that eliminating shoulders and reducing lane widths from 12 feet to 10 feet will add space for a needed turn lane without the need to acquire a right-of-way. Using the IHSDM Crash Prediction Module, the designer can weigh the overall safety impacts of reducing lane and shoulder widths (which may increase lane departure crashes),

and adding a turn lane (which may reduce crashes for turning vehicles).

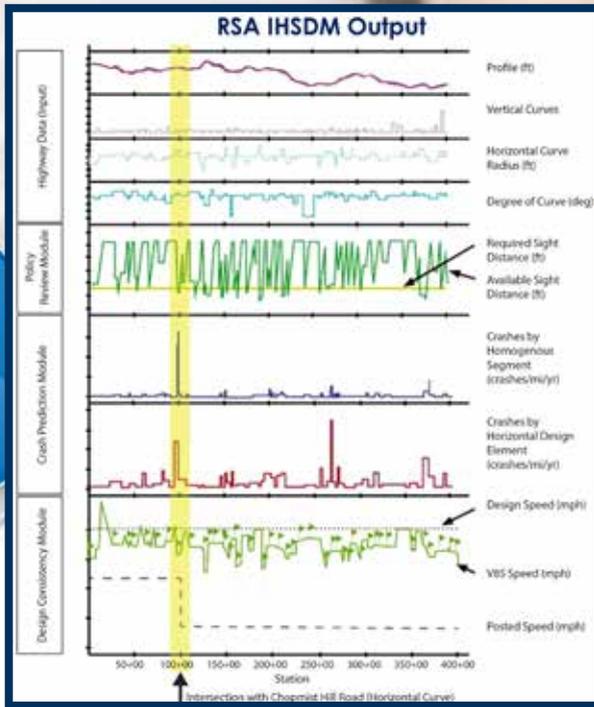
In addition to agencies using the IHSDM to improve highway design safety, practitioners have found that it is a useful tool during the Road Safety Audit (RSA) process. When RSA teams use the IHSDM modules before their assessment, the outputs can help practitioners flag potential problems for detailed field investigation and point them to measures that may mitigate safety issues identified during the RSA. The IHSDM can also help focus an RSA team's efforts, maximizing the efficiency and productivity of the audit process.

Since its first public release in 2003, over 9000 individuals have registered to download the IHSDM software. The IHSDM 2015 release (September 2015 and March 2016 update) has been downloaded by more than 1000 users representing most state Departments of Transportation, as well as the FHWA (division offices, Federal Lands Highway Division, Resource Center, etc.), local agencies, consulting firms, universities, and many other countries. Over 600 registered users have downloaded the IHSDM 2016 release in the first 4 months after its public release (version 12.0.0; September 29, 2016), including approximately 100 users representing at least 36 state agencies.

<p>LESS TIME & MONEY</p> <p>Automates the evaluation process for the user</p>	<p>BETTER TARGETED INVESTMENTS</p> <p>Allows agencies to make more informed design decisions</p>	<p>FEWER FATALITIES & SERIOUS INJURIES</p> <p>Uses current analytical methods, offering robust reporting</p>
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The IHSDM automates the evaluation process for the user, allows agencies to make more informed decisions, and offers robust reporting using current analytical methods.

Photo credit: FHWA



A visual of an IHSDM output flagging potential problem locations for further investigation by practitioners.

Photo credit: FHWA





**Sandia
National
Laboratories**

The New Jersey Transit Rail Operations Center will benefit from the planned NJ TRANSITGRID, a first-of-its-kind electric microgrid for transportation that can supply highly reliable power during storms or other times when the centralized power grid is compromised.

Photo credit: New Jersey Transit

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U.S. Department of Energy

Sandia National Laboratories

New Jersey Transit Microgrid Research, Development and Deployment/ TRANSITGRID Project



New Jersey/
New Mexico

After a number of serious storms, culminating in Superstorm Sandy in 2012, which caused billions of dollars in damage and closed parts of the transit system, New Jersey Transit Corporation (NJTC), the state-owned public transportation system, wanted to reduce its vulnerability to the loss of electric power caused by natural or manmade disasters. Maintaining power to the transit system would minimize disruptions to the regional workforce and economy. A Memorandum of Understanding (MOU) between the Department of Energy (DOE), NJTC, the New Jersey Board of Public Utilities, and Sandia National Laboratories was announced after the Hurricane Sandy Rebuilding Task Force was charged by President Obama with identifying and working to remove obstacles to resilient rebuilding while considering existing and future risks.

NJTC is the largest statewide public transit system and the third largest provider of bus, rail, and light rail transit by ridership in the United States, linking major points in New Jersey, New York, and Pennsylvania. Sandia was brought in by the DOE based on prior work in microgrid research and development for more than 20 military bases. Its partnership with NJTC uses a measurable risk-assessment approach called the Energy Surety Microgrid™ (ESM), a design methodology developed at Sandia. Under the MOU, Sandia conducted a feasibility study. After completing the initial design, New Jersey was awarded \$410 million from the Department of Transportation (DOT) to develop NJ TRANSITGRID, a first-of-its-kind electric microgrid for transportation capable of supplying highly reliable power.

With the DOT funding in place, an umbrella Cooperative Research and Development Agreement (CRADA) with

a value of over \$1 million was signed so Sandia could continue working with the state on further development of NJ TRANSITGRID. Sandia's technical expertise in microgrids and experience executing contracts with nonfederal entities made this partnership possible.

The NJ TRANSITGRID is groundbreaking for several reasons. It is the first critical civilian application of a design methodology originally developed for military installations. Also, the project will be the largest microgrid by capacity and geographical footprint in the U.S. It will help identify and address gaps that challenge the widespread deployment of microgrids, including regulatory implementation. When successfully completed, the NJ TRANSITGRID project will be a model to guide the application of resilient microgrids to other critical infrastructure.

One of the greatest successes of this project and collaboration is bringing resilient energy to the forefront of discussions about improving infrastructure. For the first time, a smart microgrid is being designed for a core segment of a large-scale transportation system involving multiple states, jurisdictions, agencies, and complex legal issues. The threats to public transportation and other public services due to both natural and manmade disasters are ever-present, and the NJ TRANSITGRID represents a real, achievable solution to preparing for these high-consequence events. Additionally, the size of this project has attracted the interest of other major cities and organizations, and its success may well mean more resilient energy projects in the future.

GlobalFlyte's technology (shown below) provides a tool for better incident response management.

Photo credit: GlobalFlyte



U.S. Department of Defense

Air Force Research Laboratory,
711th Human Performance Wing



The Potential to Dramatically Improve Civilian Emergency Management Operations

A few years ago, the Air Force Research Laboratory (AFRL) turned its eye to a major concern of air combat commanders—the confusion generated by large amounts of radio traffic.

While studying how the human mind processes information and why voice communications become garbled in a headset, AFRL researchers developed a software tool to capture and organize voice communications. This tool has since been patented by AFRL as multi-modal communication (MMC) spatial audio separation and visual transcription.

While still being evaluated for Air Force use, MMC is now positioned to improve emergency management operations in the civilian world through Dayton-based GlobalFlyte. As a technology startup, GlobalFlyte is building a business around MMC by combining it with other technologies to provide a tool for better incident response management by state and local emergency management operations.

Those who make lifesaving tactical decisions in the field on federal, state and local levels may soon have access

to a significantly improved process to sort the flurry of information heard over their radios.

GlobalFlyte secured specific rights to the technology through a Patent License Agreement, which is used by the Air Force Technology Transfer (T2) Program to ensure that Air Force science and technology is shared with state and local governments, academia and industry. In addition, the AFRL secured a Cooperative Research and Development Agreement (CRADA) with GlobalFlyte, allowing both parties to leverage future developments and accelerate the advancement of MMC technologies. Wright Brothers Institute, an AFRL partnership intermediary designed to support collaboration and technology transfer, played a pivotal role in getting GlobalFlyte off the ground.

The launch of GlobalFlyte is just one example of how a growing collaboration between AFRL, the Air Force T2 Program, and Wright Brothers Institute is providing benefits to the Air Force and boosting the regional economy.

The installation of the new air compressors at NIST consists of two (2) 150 HP oil-free rotary screw air compressors rated for 674 CFM @ 125 PSIG and two 200HP VSD oil-free rotary screw air compressors.

Photo credit: Sparks Dynamics



The ReMASTER system uses the Tridium (Honeywell) Niagara AX data acquisition system at the plant level where all sensor data is collected in a Java Application Control Engine (JACE) processor.

Photo credit: Sparks Dynamics



NIST

TEDCO
LEADING INNOVATION TO MARKET

U.S. Department of Commerce

National Institute of Standards and Technology



State-of-the-Art Energy Monitoring Technology

Compressed air is often the most expensive utility in manufacturing processes due to its energy consumption. In an effort to reduce the costs of compressed air systems, researchers from the National Institute of Standards and Technology (NIST) collaborated with Sparks Dynamics to develop an air pattern analysis and fault detection system during operations to enhance the efficiency and reliability of electromechanical equipment. The commercial result is a cost-effective solution to identifying faults in the operation of compressed air plants, allowing more efficient processes to take place.

The project is a result of collaboration across several local and state organizations. In addition to the invaluable cooperative work from NIST and Sparks Dynamics, project assistance came from the Maryland Technology Development Corporation (TEDCO) and funding assistance from a Potomac Electric Power Company (PEPCO) rebate.

Following a NIST/TEDCO technology showcase, an entrepreneur approached a NIST researcher about adapting a NIST algorithm for rule-based analysis and fault detection from HVAC systems. NIST and Sparks Dynamics entered into a Cooperative Research and Development Agreement (CRADA) to further develop NIST's fault detection algorithms.

With the help of Sparks Dynamics and TEDCO, the team solved the challenge of validating the technology, since most industry stakeholders are unwilling to test or adopt untested advancements in fault detection. The team tested the technology using NIST's own industrial-level compressed air plant. The staff at NIST's facilities management and laboratories came together in an unprecedented effort to test the technology with Sparks Dynamics.

The CRADA team also bridged the gap between basic research and commercial applications by creating a link between the research and industry mentality in a manner that avoided typical conflicts.

While the collaboration between Sparks Dynamics and NIST focused on optimizing the performance of a specific compressed air system, the fault detection technology resulting from this collaboration has broader commercial applications in industrial electromechanical systems. Thanks to this collaboration, the increased efficiency of the compressed air plants reduces energy consumption and commercial manufacturing costs.

The Results

This technology transfer success resulted in a technology with the potential to majorly advance the industry. Sparks Dynamics, a startup company based on the fault detection technology, is now commercializing a monitoring and analytics solution brand named ReMASTER. The state-of-the-art compressed air plant system was completed on time and on budget with seamless integration to ensure compressed air service throughout the installation and testing. As a result, Sparks Dynamics' role has expanded to include a remote monitoring contract utilizing its ReMASTER cloud-based monitoring and analytics solution.

A standard government procurement and a PEPCO rebate funded the project for Sparks Dynamics, paying half of the total compressed air system equipment costs.

Benefits include 1,000 cubic feet per minute (cfm) of additional compressed air, an energy cost savings of \$140,000 per year, and a PEPCO energy rebate of \$370,000.

Partnering to Move Technologies Into the Market

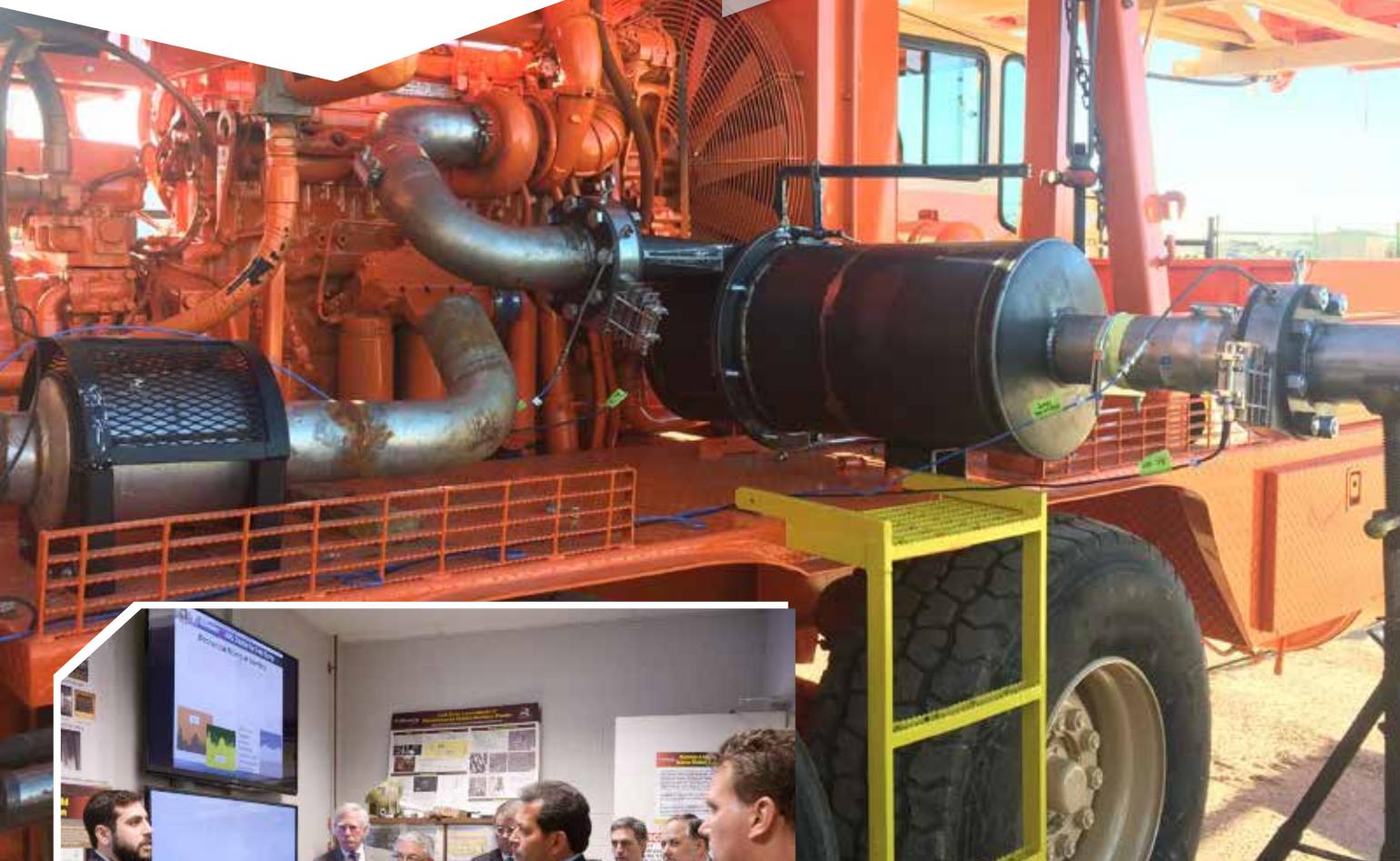
Technology transfer is often referred to as a “contact sport,” meaning it requires persistent outreach, networking and follow-up between laboratory, state and local government, and industry professionals to achieve technology-to-market success. To make the commercialization process easier, agencies have set up programs for researchers and entrepreneurs alike to work directly with federal laboratories to further their R&D. As you will read in this section, several partnerships between federal labs and diverse regional private-sector groups have been formed to spur regional innovation.



ARL

ARL is working with the New Horizons Foundation and Lea County to develop a new muffler technology that can be used on all types of engines and equipment to better suppress sound and protect hearing.

Photo credit: ARL



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U.S. Department of Defense

U.S. Army Research Laboratory

U.S. Army Research Laboratory Engagement With New Mexico State and Local Governments



Maryland/
New Mexico

The U.S. Army Research Laboratory (ARL) is the nation's premier laboratory for land forces whose mission is to discover, innovate, and transition science and technology to ensure dominant strategic land power.

In 2013, ARL was approached by the New Horizons Foundation (NHF), an organization formed and funded in 2011 by the Lea County, New Mexico, Commission and New Mexico Junior College as a new strategic initiative to use research and technology to diversify and expand the county's longstanding oil and gas economy. NHF serves as a technology intermediary, connecting regional innovators with a wide range of research resources such as ARL. Its goal is to provide entrepreneurs with access to technology adaptation, engineering, prototyping, testing capabilities, design expertise, manufacturing, and field testing capabilities through the federal labs.

Currently, the following two applications of ARL technologies are being developed in Lea County with the involvement of state and local government partners as well as local businesses in Hobbs, New Mexico.

Vorticity Sound Suppression Muffler—ARL is working with NHF/Lea County to develop a new muffler technology based on a weapon suppressor invention developed at ARL. The goal is to develop a muffler that can be used on all types of engines and equipment to better suppress sound and protect hearing. A Cooperative Research and Development Agreement (CRADA) was established to adapt the muffler technology for use with oil and gas industry equipment. An exclusive license agreement has been prenegotiated for any subject invention emerging from the CRADA that can be commercialized. Additionally, a separate

nonexclusive license agreement has been secured for the background Army patent (U.S. Patent #7,854,297).

Cold Spray Technology—ARL is a nationally recognized leader in the research, development and application of cold spray technology. ARL and NHF are working with PEMCO (a New Mexico company) to develop a cold spray coating and repair business model that could be replicated by small manufacturing companies across New Mexico and the U.S., especially those that cater to the oil and gas industry. Cold spray technology will increase the lifespan and reduce operating costs for oil industry equipment that operates in harsh corrosive environments.

Cold spray is a coating deposition technique that involves accelerating micrometer-sized solid powders in a supersonic gas jet. The particles, entrained within the gas, are directed toward a substrate upon which they embed on impact, forming a strong bond with the surface.

The term "cold spray" has been used to describe this process due to the relatively low temperatures (100-500°C) of the gas stream that exits the nozzle. Cold spray technology has numerous applications in the private sector, including repairing and refurbishing equipment in the oil and gas industry.

NHF entered into a Test Services Agreement with ARL to test the output of the prototype facility being developed by PEMCO and to leverage ARL's well-established cold spray knowledge. ARL's expertise in the field could lead to a new fabrication and repair capability that can be employed by small manufacturing companies nationwide.



Department of Health and
Human Services

Centers for Disease Control
and Prevention

Jumpstarting Innovation @CDC: The Office of Innovation and Technology Explores Entrepreneurship Training for Public Health



Georgia

The Centers for Disease Control and Prevention (CDC) faces an increasingly complex mission amidst rapid technological changes and continued threats to our nation's health. Innovation should be considered a key component of addressing public health problems to improve service efficiency and minimize costs. Solutions to enhance innovative programs and policies must be multifaceted, including collaborative efforts among different sectors and partnerships to substantially impact public health.

The CDC's Office of Technology and Innovation (OTI) (<https://www.cdc.gov/od/science/technology/>), established within the Office of the Associate Director for Science, has partnered with Georgia Tech's VentureLab (<http://venturelab.gatech.about-us/>) to offer evidence-based entrepreneurship training, the CDC Ideation Catalyst (I-Catalyst), for agency staff. OTI was established to foster and develop innovative science, technologies, and processes that support CDC. OTI provides strategic leadership, coordination, and support for technology transfer and innovation to enhance the agency's ability to protect and promote the health of Americans. OTI established the I-Catalyst program to help staff gain skills in entrepreneurship and foster innovation within the agency.

Exploring entrepreneurship training to help CDC deliver on its public health mission

In early 2016, OTI established a partnership with Georgia Institute of Technology's (Georgia Tech) VentureLab. Part of Georgia Tech's Enterprise Innovation Institute, was founded in 2001 to collaborate with faculty and students to create startups based on Georgia Tech research. One of eight sites funded by the National Science Foundation to deliver the Innovation Corps (I-Corps) program, VentureLab prepares scientists and engineers to extend their focus beyond the university laboratory, and accelerate the economic and societal benefits of basic-research projects that are ready to move toward commercialization.

Following the basic tenets of the I-Corps program, CDC I-Catalyst helps teams identify valuable solution opportunities and gain skills in entrepreneurship through training in customer discovery and guidance from experienced entrepreneurs. Now in its second year, I-Catalyst teams have explored a variety of public health topics and solutions.

Public-private partnerships offer new and exciting opportunities to advance the capabilities and mission success of federal agencies like the CDC. OTI's partnership with Georgia Tech's VentureLab is one way government and academia are working together to develop solutions and training to promote innovation.

Pictured at the first I-Catalyst cohort closing session in May 2016 are OTI Director Juliana Cyril (front) and (left to right) Georgia Tech VentureLab partners Colin Ake, Julie Collins, and Melissa Heffner.

Photo credit: CDC



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Collaboration Between Montgomery County, Maryland, and Various Federal R&D Entities



Montgomery County, Maryland, is home to 18 federal agencies or installations, one of the highest concentrations of federal labs in a single jurisdiction. Since 2008, the Montgomery County Department of Economic Development (MONTCO) (now a 501(c)(3) entity and renamed the Montgomery County Economic Development Corporation, or MCEDC) has engaged with these laboratories through the Federal Laboratory Consortium for Technology Transfer Mid-Atlantic Region (FLC-MAR) to bring businesses and federal labs together using many different tools.

laboratories, academia, investors, and national associations and foundations. The Gateway featured an interactive portal that provided an innovative pathway to tech transfer services and resources available in the County. It also provided brochures and related tech transfer materials from the County's 18 federal labs.

- MONTCO served on the planning committees of regional networking initiatives bringing federal laboratories together with businesses in the county. Two of these initiatives centered on bioinformatics and nanotechnology were hosted at the Universities at Shady Grove and the National Institute of Standards and Technology (NIST), respectively.
- MONTCO collaborated with the FLC-MAR to sponsor the attendance of postdocs from federal laboratories at the FLC national meeting.
- MONTCO launched the Gateway for Innovation: Federal and Academic Technology Transfer and Commercialization. The Gateway was housed at the Shady Grove Innovation Center in Rockville, Maryland. The goals of the Gateway were to:
 - Centralize available federal and academic resources to enhance the promotion and access of these resources to the business community
 - Establish and promote new locally based education and training programs targeting technology transfer and commercialization
 - Facilitate greater networking and connectivity among proponents of the tech transfer community
 - Provide matchmaking and partnering opportunities among interested business entrepreneurs, federal civilian and military

- In conjunction with the FLC-MAR, MONTCO designed and launched an Innovation to Commercialization (I2C) conference, a major networking venue for federal labs and industry. The conference was a full-day event featuring three in-depth panels on innovation, commercialization and financing, that included speakers from industry and federal labs. The format enabled MONTCO to showcase its successful technology-based businesses, as well as the efforts of the federal labs. During lunch, small businesses could discuss issues affecting their business with subject-matter experts from a federal lab, university or federal tech transfer office; venture capitalists; business service organizations; and others. In addition, there was an exhibit area where many federal labs showcased their technologies, facilities and research capacities. MONTCO launched a T2 Speaker Series for federal labs and universities to visit incubators or other county venues to discuss their capabilities, features, and possible collaboration opportunities. The result of this monthly forum was the successful and direct connection of more than 300 entrepreneurs to federal labs and universities. Some of the previous programs with federal labs included: Successfully Team With a Tech Transfer; Partnering With DISA Through Cooperative Research and Development Agreements (CRADAs); Leveraging USDA-ARS Partnerships; 10 Shortcuts to Licensing With the NIH; Sparking New Ideas – Tech Transfer at DOE; and Partnering With the Frederick National Laboratory for Cancer Research.

The Montgomery County Department of Economic Development (MONTCO), served on the planning committees of regional networking initiatives bringing federal laboratories together with businesses in the county. Pictured left to right: Rachel King (CEO, Glycomimetics), Fizie Haleem (MONTCO), Steve Silverman (MONTCO), Ike Leggett (Montgomery County Executive), and Paul Zielinski (NIST).



Electronics Engineer William Neeley and Chief Technology Officer Greg Walker of Silent Falcon install a battery into their Silent Falcon unmanned aircraft. The Smart Battery Manager Leveraged Project received the Honorable Speaker Ben Lujan Award for Small Business Excellence, which is given annually to NMSBA projects that demonstrate the most economic impact.

Photo credit: Norman Johnson, Johnson Photography



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U.S. Department of Energy

Los Alamos National Laboratory

New Mexico Small Business Assistance (NMSBA) Program



New Mexico

The New Mexico Small Business Assistance (NMSBA) Program is an effective partnership among small businesses, the State of New Mexico, and Los Alamos and Sandia national laboratories. In addition, NMSBA currently contracts unique services with the New Mexico Manufacturing Extension Partnership, the University of New Mexico (UNM) Management of Technology Program, the UNM School of Engineering, the New Mexico State University Arrowhead Center, and the New Mexico Tech Department of Management. NMSBA has more than 16 years of success leveraging federal investment in world-class science and technology. Other states seek to replicate this results-oriented public-private partnership.

In an effort to stimulate economic development across the state, in 2016 the State of New Mexico and the two national laboratories invested \$4.8 million to aid 365 small businesses in 29 counties. NMSBA focuses on small businesses located in rural areas, which this year made up 61 percent of its customers. Since the inception of NMSBA in 2000, the two national laboratories and NMSBA contractors have provided \$53.3 million in technical assistance to 2648 businesses, enabling 5734 jobs to be created and retained statewide. For every \$1.00 of tax credit invested, the state received a return of \$1.26.

A Recent Success Story When NMSBA Helped Local Companies

Whether flying through the air, zipping along the ground, or sailing on the water, unmanned vehicles are part of a global market expected to reach \$4 billion by 2020. Many of these vehicles are powered by batteries, and in order to improve system reliability and plan complicated missions, operators need to know the batteries' state of charge and state of health.

Emerging Technology Ventures makes unmanned vehicles for land, air, and sea. Motion Picture Marine uses unmanned vehicles to create sequences for motion pictures like X-Men, Armageddon, and Star Trek. American Lithium Energy manufactures lithium-ion batteries that power unmanned vehicles, and Silent Falcon UAS Technologies is a developer of aerial unmanned vehicles. This group of small New Mexico businesses in the unmanned vehicles industry decided to work together to develop a "smart battery manager."

In 2016 they completed their second NMSBA-leveraged project. A leveraged project enables the national laboratory to provide up to \$100K of assistance to multiple companies. Through access to Sandia National Laboratories' engineers and expertise, NMSBA's assistance advanced the battery-monitoring electronics and algorithms that could be embedded within the battery's hardware. These updates allow users to monitor battery condition and historical data, supporting the safe and reliable operations of autonomous and unmanned systems.

In addition to using the smart battery manager technology to give their companies a competitive advantage, this group is now looking at whether it can be turned into a commercially available system others in the industry could integrate into their products. So far, the companies have received \$2.5 million in new investments and added 12 new employees, including 3 engineers to focus on systems integration of the smart battery management system.



California

The i-GATE Innovation Hub

The i-GATE Innovation Hub, a high-technology start-up incubator located in Livermore, California, was originally founded through a collaboration between the city of Livermore, Sandia National Laboratories and Lawrence Livermore National Laboratory (LLNL) to achieve an "iHub" designation from the state of California. The i-Gate initiative has grown to also include the cities of Dublin, Danville, and Pleasanton, California but remains principally sponsored by Livermore, Sandia, and LLNL. i-GATE provides entrepreneurial training and resources to support the local entrepreneurial ecosystem, and has supported a number of high-tech startups that are commercializing technologies originally developed at LLNL.

One of the most successful of these start-ups is POC Medical Systems, a medical device company bringing low-cost cancer screening to the developing world, based on patented technology developed at and licensed from LLNL. i-GATE facilitated the initial connection between POC founder Sanjeev Saxena and LLNL's Innovation and Partnerships Office (IPO), and then provided the company with office and prototyping space as it developed its product. POC Medical Systems has raised over \$20 million in angel and venture capital financing, and now employs over 40 people in its new 24,000 square foot headquarters in Livermore.

The i-GATE facility serves as a common place for tech startups, innovators and investors to brainstorm technology development, commercialization and innovative research. The venture positions LLNL as a major factor in Tri-Valley technology innovation, and fosters initiatives such as the National Laboratory Entrepreneur Academy. These initiatives fulfill the need for rapid commercialization of technology that benefits society as a whole.

LLNL is now supporting aspiring entrepreneurs by providing expertise to help scientists make the transition from LLNL's research culture to the world of business and industry.

Commercializing an idea or technology is in most cases a long process, and the resources and expertise needed to succeed go well beyond the laboratory. The capital and business acumen of experienced venture capitalists, entrepreneurs and business development specialists from the private sector are essential to success. Incubators and accelerators such as i-GATE are helping new entrepreneurs navigate the potentially treacherous levels of technology readiness.



i-GATE Innovation Hub, a start-up incubator/accelerator in downtown Livermore, California and innovation partner with LLNL

Photo credit: Rich Rankin

The Louisiana Tech Transfer Office worked with NASA and one of its contractors, A2R, at the Stennis Space Center in Mississippi to help LTI, a Louisiana oil & gas technology start-up, get critical assistance. Pictured left to right: Vic Johnson, Mgr., LTTO at Stennis; Duane Armstrong, Chief, NASA Stennis Advanced Technology Branch; Brian King, Senior Metrologist, A2R; and Al Watkins, Program Mgr., A2R.



FLC T2 Partnership Success Story: The Louisiana T2 Office

Over two decades ago, a small group of individuals working to enhance the culture of technology and innovation in Louisiana approached the state with a then-unique concept—a state office located at a federal city located in a border state (Mississippi). From this idea came the Louisiana Technology Transfer Office (LTTO), a component of the Louisiana Business & Technology Center at the Innovation Park, Louisiana State University (LSU), Baton Rouge, Louisiana.

The LTTO has maintained a technology transfer office at the NASA John C. Stennis Space Center, Mississippi, for over 20 years. Through the LTTO, the state of Louisiana has enjoyed a unique and successful partnership with NASA/Stennis via a Memorandum of Understanding between the governor and the director of NASA Stennis. Although NASA is the primary tenant, Stennis is a federal city encompassing over 100,000 acres. Tenants include: U.S. Navy, Naval Research Lab, Department of Commerce (NOAA), Department of Homeland Security, Department of Interior (U.S. Geological Survey), and more.

Several Louisiana universities have a presence at Stennis. Besides technology transfer, the LTTO provides assistance to state universities and research institutions for collaborative R&D opportunities with federal labs through a unique multiyear task order type of procurement mechanism known as the Louisiana Research Consortium (LRC), which provides a much faster and simpler process for getting federal R&D dollars to Louisiana universities. The Louisiana Board of Regents is a signatory, and NASA is the single entity acting as fiscal agent for the universities. It has recently been renewed by NASA for five years at \$15,000,000.

Examples of success stories from the LTTO include the NASA Shared Services Center (NSSC), created by NASA to consolidate transactional/administrative activities previously done at NASA Centers and Headquarters. NASA held a competition among its Centers, and LTTO strengthened NASA's bid by securing a letter from the governor of Louisiana pledging \$1 million in workforce development training funds. This regional partnership component in the Stennis proposal was singled out by NASA Headquarters as a major reason Stennis was selected as the NSSC site.

The new NSSC at Stennis employs more than 450 people, nearly half of whom reside in Louisiana. Worldwinds, Inc., is a small disadvantaged, woman-owned company based in Louisiana that has transferred cutting-edge technology into state-of-the-art products/services that preserve/enhance the quality of life. The company's branch office at NASA Stennis provides access to federal labs such as NASA, the U.S. Navy, and the National Oceanic and Atmospheric Administration (NOAA). The primary business is forecasting/forensic analysis of hurricane-induced storm surge, processing thousands of simulated hurricanes for FEMA's Risk Mapping and Assessment Planning from the U.S. Department of Homeland Security. This has greatly enhanced the ability of local communities to prepare for and respond to storms—saving lives, protecting property, and reducing the cost of recovery and rebuilding. The LTTO worked with its partnering state university (University of Southern Mississippi) at Stennis to support the company with assistance, such as the Louisiana Phase 0 Program award for SBIR and identifying collaborative opportunities.

The UbiQD team at their new manufacturing facility in Los Alamos, New Mexico

Photo credit: Leslie Bucklin, Los Alamos County



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U.S. Department of Energy

Los Alamos National Laboratory

Venture Acceleration Fund (VAF)



New Mexico

In northern New Mexico, investments in high-growth companies—the region’s job creators—are being made through the Venture Acceleration Fund (VAF). VAF was established in 2006 by Los Alamos National Security, LLC (LANS), the company that manages Los Alamos National Laboratory. Today, the VAF is a collaborative investment tool that supports high-growth northern New Mexico companies. Partnerships with Los Alamos County, New Mexico Manufacturing Extension Partnership, Santa Fe County, and the city of Santa Fe have transformed the VAF into a multi-investor alliance to support economic growth in the region. The fund is administered by the Regional Development Corporation, and provides investments to high tech and manufacturing companies in every stage of development that are poised for long-term growth. In the more than ten years that VAF has been active, it has filled a unique funding niche by supporting companies that lack debt financing and are not ready for angel or venture capital investments.

Since its inception, VAF has made 53 awards and invested \$3.6M across 7 northern New Mexico counties. The awards have enabled 488 jobs to be created and retained, and the companies have received \$102.7M of additional financing to continue their growth. These investments have generated \$150.1M of economic growth, or 42 times the overall investment.

VAF Investment Fast-Tracked Company’s Growth

In 2014, Dr. Hunter McDaniel founded UbiQD, LLC, after leaving Los Alamos National Laboratory, where he was a postdoc in materials science. UbiQD develops and manufactures quantum dots that are substantially free of toxic elements. The company licensed the underlying

technologies exclusively from the Massachusetts Institute of Technology and nonexclusively from Los Alamos National Security, LLC. Together these two inventions represent UbiQD’s founding technology position.

In 2015, UbiQD was one of four companies to receive an investment from VAF. This investment was utilized in two stages—when the company made the first domestic sale of its technology and when it made its first international sale. In total, the company has made approximately 50 sales. Among its national and international research clients are Cornell University, the University of Texas-Dallas, Los Alamos, the University of Milan, and the University of British Columbia. Fortune 500 and Fortune 100 companies, as well as research and development scientists, also count themselves as part of UbiQD’s ever-growing list of clients.

UbiQD received a Phase 1 Small Business Innovation & Research (SBIR) grant from the Department of Energy and obtained other key investments to further develop solid-state lighting.

Currently, with five full-time and five part-time employees, UbiQD is aiming to double its workforce by the end of 2017. The company has doubled its workforce each year since its inception. In 2015, UbiQD was recognized as a northern New Mexico high-growth company by the Regional Development Corporation. The company recently moved into a new manufacturing facility in Los Alamos.



Mid-Atlantic Forums Result in Downstream Outcome for Regional T2 Activities



Over the past eight months, FLC Mid-Atlantic Region officers have held a series of innovation forums throughout the region to bolster the federal laboratory resources available to businesses, as well as to survey the commercial technology needs of the industries that call the Delmarva Peninsula home. The forums focused on mapping, satellite, and sensor technologies—technology industries that are growing in the region and for which federal labs can provide plenty of collaborative technology transfer (T2) opportunities.

The first forum, which kicked off in October 2015 at Washington College on Maryland's Eastern Shore, focused on bringing together researchers representing labs from the National Oceanic and Atmospheric Administration, U.S. Geological Survey (USGS), National Institute of Standards and Technology, Naval Research Laboratory (NRL), National Aeronautics and Space Administration (NASA), National Security Agency, U.S. Department of Agriculture (USDA), National Geospatial-Intelligence Agency, and regional university research centers. During the workshop, research expertise and capacity, as well as commercial needs related to mapping and remote sensing on the Delmarva Peninsula, were discussed.

For the second forum, held in May 2016, the focus shifted and involved some participants from the first workshop who saw an opportunity to work together. As a result, a research team involving three universities (Washington College, Salisbury University, and University of Maryland), four federal labs (NRL, USDA, NASA, and USGS), and three companies (Verizon, Earth Data, and Aloft Aerial Photography) was formed. This research team developed a series of common research and commercialization goals that will benefit all members involved. The future of this team's collaborative efforts is bright, and provides a positive downstream outcome for the Mid-Atlantic Region's goal of providing networking and technology development opportunities among labs and businesses in the region.

Future innovation workshops for the research team will be held over the next several months as they share best practices and learn more about the application of these technologies for additional research and commercial viability.



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U.S. Department of Homeland Security

U.S. Coast Guard Research and Development Center

LT Keely Higbie, USCG RDC, attends a direction-finding cUAS system operational test and evaluation demonstration at the U.S. Army Armament Research, Development and Engineering Center in Picatinny, New Jersey, to assess its capability to locate UAS and their ground control stations.

Photo credit: USCG



Coast Guard and DHS Labs in the Northeast Collaborate on Counter Unmanned Aerial System Research



The Coast Guard Research and Development Center (RDC) recently collaborated with the Department of Homeland Security Science and Technology (DHS S&T) National Urban Security Technology Laboratory (NUSTL) to assess different counter unmanned aerial system (cUAS) technologies that can be used by DHS and U.S. Coast Guard (USCG) first responders. The collaboration includes the reciprocal embedment of research staff between the two labs.

In January 2017, RDC and NUSTL partnered with the U.S. Army Adaptive Red Team (ART) and Unique Mission Cell to assess different commercial off-the-shelf (COTS) cUAS technologies in a densely populated urban and maritime environment. These cUAS operational test and evaluation events are a national effort to develop a cUAS solution that can be used by federal and state first responders to counteract the illicit use of UASs within the United States.

The local and state first responder community was the focus of NUSTL's efforts, with the New York Police Department (NYPD) as a stakeholder in the project. While NUSTL often works with the NYPD to evaluate the systems, the technology is meant for all state and local first responders.

Additionally, a cUAS COTS technology assessment conducted in April was executed in collaboration with the city of New Orleans, the New Orleans Police Department, the New Orleans Harbor Police, and the local DHS contingent. This collaboration allowed RDC/ART access to urban locations, including the Superdome, City Hall, Lafayette Square, and the Erato Street Cruise Terminal.

In November 2016, RDC and NUSTL conducted an operational test and evaluation of a direction-finding cUAS system. Held at the U.S. Army Armament Research, Development and Engineering Center in Picatinny, New Jersey, the test assessed the system's capability to locate UASs and their ground control stations. The event was attended by representatives from the NYPD, the Port Authority of New York and New Jersey, and the U.S. Coast Guard.

The Coast Guard R&D Center is located in New London, Connecticut. Its project portfolio can be found at: <http://www.uscg.mil/acquisition/rdc/rdc.asp>.

LT Joseph DiRenzo, USCG RDC, joins a team of first responders in New York City while working with the DHS National Urban Security Technology Laboratory to promote and discuss advances in science and technology applications.

Photo credit: USCG



Improving Human, Animal, and Environmental Health

Much of the research our federal laboratories conduct goes into improving the welfare of our society. Whether dealing with medicine, agriculture or environmental sustainability, federal agencies work with state agencies and organizations to address the issues occurring in any given region. Vital work such as combating life-threatening diseases, improving water quality for small rural communities, or protecting endangered species has resulted from state and local governments working in unison with federal laboratories. The preventative and lifesaving technologies developed through the work you will discover in these upcoming pages has the potential to benefit life far beyond the affected regions.



CDC Efforts Benefit State and Local Government Partners Combating Zika

The Zika virus is a serious concern in the United States that requires developing and maintaining successful partnerships. From January 1, 2015, through March 22, 2017, more than 43,000 symptomatic Zika virus disease cases (confirmed and probable) were reported to ArboNET. This included 222 cases in Florida and Texas, and more than 38,000 cases in the U.S. territories (Puerto Rico, U.S. Virgin Islands, and American Samoa) acquired through presumed local mosquito-borne transmission. As of March 14, 2017, nearly 5,000 cases of pregnant women with any laboratory evidence of Zika infections were reported in the United States and Puerto Rico.

certified state public health laboratories. The CDC TTO also executed licenses with four major U.S. reference laboratories for the Zika MAC-ELISA assay, both for diagnostic development and patient clinical testing of Zika infections. CDC continues to manufacture and distribute reagents for these assays.

CDC has also facilitated mosquito surveillance and control efforts. CDC staff created an online mosquito and insecticide resistance data reporting tool, MosquitoNET, to enable state and local surveillance of *Aedes* mosquitoes known to transmit Zika virus.

The Centers for Disease Control and Prevention (CDC) is responding to the Zika epidemic on multiple fronts, including research and development, scientific knowledge sharing, education, surveillance, mosquito control, and more. As part of these efforts, the CDC Technology Transfer Office (TTO) has helped state and local partners by transferring CDC's Zika virus specimens for research purposes, CDC-developed diagnostics, and CDC technology for mosquito surveillance and abatement.

CDC's Autocidal Gravid Ovitrap (AGO) mosquito trap has been successfully used by mosquito control programs for mosquito surveillance and control. The patented AGO trap attracts and catches female *Aedes aegypti* mosquitoes looking for a place to lay eggs. Field trials in which the AGO trap has been installed in most homes in a community have shown it reduces mosquito populations as well as rates of infection. Smaller scale field trials were so successful that CDC and the Puerto Rico Department of Health are implementing large-scale installation of AGO traps throughout several communities to reduce mosquito populations and the viruses they spread. The TTO and CDC staff are working with outside partners to mass-produce the trap and use it further in Puerto Rico.

Thus far, CDC has transferred Zika virus isolates (specimens) for research purposes from CDC laboratories to 13 state, 1 county, and 2 city public health laboratories. CDC laboratories have also provided confirmatory testing and surge capacity for Zika virus testing, having processed more than 165,000 specimens as of January 2017.

In response to the Zika outbreak, CDC has transferred federally developed technology and scientific knowledge to state and local health partners. Working together to share and create innovations may quickly affect people's daily lives and the communities in which they live.

CDC developed the first diagnostic tests for Zika—the Zika MAC-ELISA and Triplex rRT-PCR—which received FDA Emergency Use Authorization (EUA) to diagnose Zika virus infection. Both tests are being distributed to

CDC's Autocidal Gravid Ovitrap (AGO) mosquito trap for control and surveillance

Photo credits: James Gathany and CDC NCEZID Puerto Rico laboratory



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Ammonia Water Treatment in Small Communities



The U.S. Environmental Protection Agency's (EPA) National Risk Management Research Laboratory developed a patented technology to oxidize ammonia in drinking water. The treatment approach enhances the natural nitrification process during which, in the presence of oxygen, ammonia is converted to nitrite and then to nitrate. Patented in 2011, the technology combines aeration and biological filtration to oxidize excessive levels of ammonia in drinking water.

Many regions in the United States have excessive ammonia in their source waters as a result of natural or agricultural sources. Although ammonia is not a regulated contaminant in drinking water, high levels of ammonia may be problematic. Ammonia in water may create high chlorine demand for disinfection, and high ammonia levels may interfere with the removal of other regulated contaminants such as arsenic, iron, and manganese. Ammonia in raw water may also result in nitrification in the distribution systems, and can cause corrosion, poor taste, and odor issues. Legacy treatment approaches for the removal of ammonia, such as ion exchange or reverse osmosis, generate high total dissolved solids wastewater, a challenge that is eliminated in this treatment system.

To test the effectiveness of the technology, the EPA partnered with a number of small communities in the Midwest and southeastern U.S. The EPA lab developed

a portable skid upon which a small-scale treatment system could be installed. The EPA then took this pilot skid to several small communities in Iowa and North Carolina with ammonia water issues. These pilots demonstrated the effective removal of ammonia from the water streams with a system that is easy to scale up to full-scale treatment and simple to maintain.

A number of these pilot communities have opted to install full-scale treatment systems utilizing this EPA-developed technology. After it was initially installed, the EPA assisted with the analysis of data from the full-scale Palo, Iowa, water treatment system via a Cooperative Research and Development Agreement (CRADA). Additionally, the Agency partnered with AdEdge, LLC, the licensee of this technology, to create a pilot-scale system in Gilbert, Iowa, using the licensee's commercial system. AdEdge is marketing the technology as NoMonia, an innovative water treatment technology to remove ammonia, arsenic, iron and manganese. It is installing the technology as a two-stage aerobic treatment system.

AdEdge and the EPA have developed a technology that can help hundreds of communities in the U.S. that suffer from excessive levels of ammonia in their groundwater, and related concerns such as elevated nitrite levels, disinfection byproducts, odor, and taste issues.

NoMonia field demonstration

Photo credit: Darren Lytle



AOML summer intern students set autosampler to test microbial water quality in Florida Keys residential canals.

Photo credit: NOAA/AOML



www.aoml.noaa.gov
[/NOAAResearch](https://www.facebook.com/NOAAResearch)
[@NOAA_AOML](https://twitter.com/NOAA_AOML)



The NOAA solution helped determine that gulls were to blame for the water contamination.

Photo credit: Derek Parks, NOAA

National Oceanic and Atmospheric Administration

Atlantic Oceanographic and Meteorological Laboratory

Tools Developed at NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) Lead to Successful Water Remediation on California Beaches



California

Degraded coastal water quality has repercussions for human and ecosystem health, as well as for local, regional, and national economies. Contaminated water negatively affects coastal economies and their associated jobs creation. According to the National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service, U.S. coastal and marine waters support 28.3 million jobs, generate \$54 billion in goods and services, and contribute \$30 billion to the U.S. economy through recreational fishing alone. According to the National Resources Defense Council, U.S. coastal tourism and recreation created 1.6 million jobs in 2000.

Although nonpoint sources of pollution are believed to be the biggest contributors of waste to natural waters (e.g., agricultural runoff), it is difficult to identify specific sources of microbial pollution. Despite the difficulty, source identification is mandated by many state statutes via implementation of total maximum daily loads (TMDLs) for impaired waters. The implementation of these requirements to remediate impaired water quality is a \$3 billion problem for the U.S. annually; therefore, tools to address source identification are critically needed by stakeholders. Such tools can help local communities devise effective remediation strategies to restore water quality, with the outcome of decreased risk of infection and preserved coastal economies.

Not only must such tools be developed, they also must be effectively transferred if they are to be used routinely. The Environmental Microbiology Program at the Atlantic Oceanographic & Meteorological Laboratory (AOML) has successfully transferred two of its microbial source tracking (MST) diagnostics to Weston Solutions,

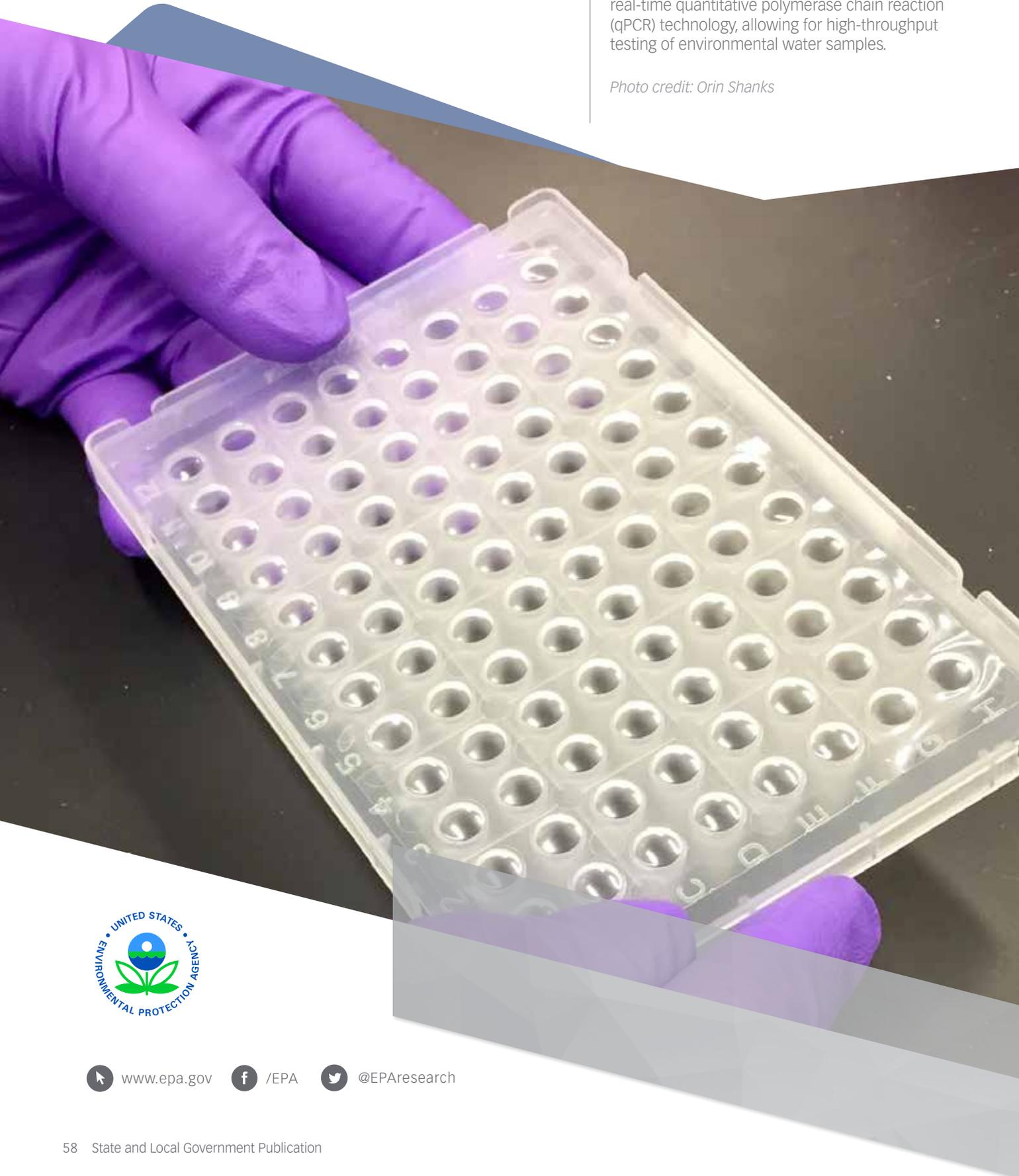
a commercial environmental solutions company. Weston's use of these technologies primarily serves city and county stakeholders. To date, it has utilized the technologies in two different watersheds, and plans to expand regionally and nationally. Weston uses the technologies in a "tool box" approach to quantify and identify the prevalent sources of fecal contamination for the following applications:

- TMDLs
- Stormwater monitoring
- Watershed assessment
- Assessment of current remediation efforts.

The successful transfer of the technology has subsequently led to a peer-reviewed paper and a successful management activity in a California watershed. Previous remediation efforts at the study site had proven unsuccessful despite an infrastructure investment of \$3 million to construct a facility to ultraviolet-treat watershed runoff before it enters the ocean. The AOML-developed test for gull fecal contamination provided actionable information for local water quality managers that led to a relatively inexpensive solution—using trained falcons to deter gulls from congregating near the runoff zones. This was not only a successful transition and application of federal research to a commercial application, but it also appears to be the first report of falconry used in bacterial water quality management.

EPA microbial source tracking methods use real-time quantitative polymerase chain reaction (qPCR) technology, allowing for high-throughput testing of environmental water samples.

Photo credit: Orin Shanks



U.S Environmental Protection Agency

National Risk Management Research Laboratory

EPA's Unique Licensing Strategy Provides Communities With Access to Microbial Source Tracking Technology

According to the Environmental Protection Agency's (EPA) National Water Quality Inventory Report to Congress, fecal bacteria are one of the leading causes of U.S. surface water impairment. The presence of fecal bacteria at elevated levels originating from human and other animal wastes in community water systems, at recreational beaches, and shellfish harvesting areas is associated with negative public health outcomes ranging from the more common mild gastrointestinal illness to the rare and more severe illness or even death.

EPA scientists recently developed a series of novel, genetic-based technologies that can characterize fecal pollution levels from specific animal groups in environmental water samples. These microbial source tracking (MST) patented technologies can estimate the concentration of human, cattle, and dog fecal pollution. Due to nationwide fecal pollution concerns and more than 400 peer-reviewed scientific citations, there is a growing demand by research, government, and commercial laboratories to implement these technologies. To accommodate interest from nonprofit entities, the EPA

has developed a new strategy whereby technology can be transferred to commercial partners while simultaneously making it available to noncommercial entities at no cost. This was accomplished through the development of two new licensing formats in addition to a traditional commercial license.

Under the new license format, the academic sector can apply for a royalty-free "research" license for a specific project. Qualified government laboratories (e.g., city, county, and state) can also receive a royalty-free license, but are restricted to using the technology within their area of jurisdiction. In addition, a "government" license prohibits the use of the technology on a fee-for-service basis. To date, five government licenses have been issued, enabling local government laboratories to implement these technologies across the country—from the city of Santa Cruz, California, to the Hampton Roads Sanitation District in Virginia.

There are also two active commercial licenses on these technologies. These companies provide analytical services to a variety of customers.



Arkansas
California
Florida
North Carolina
Ohio
Virginia

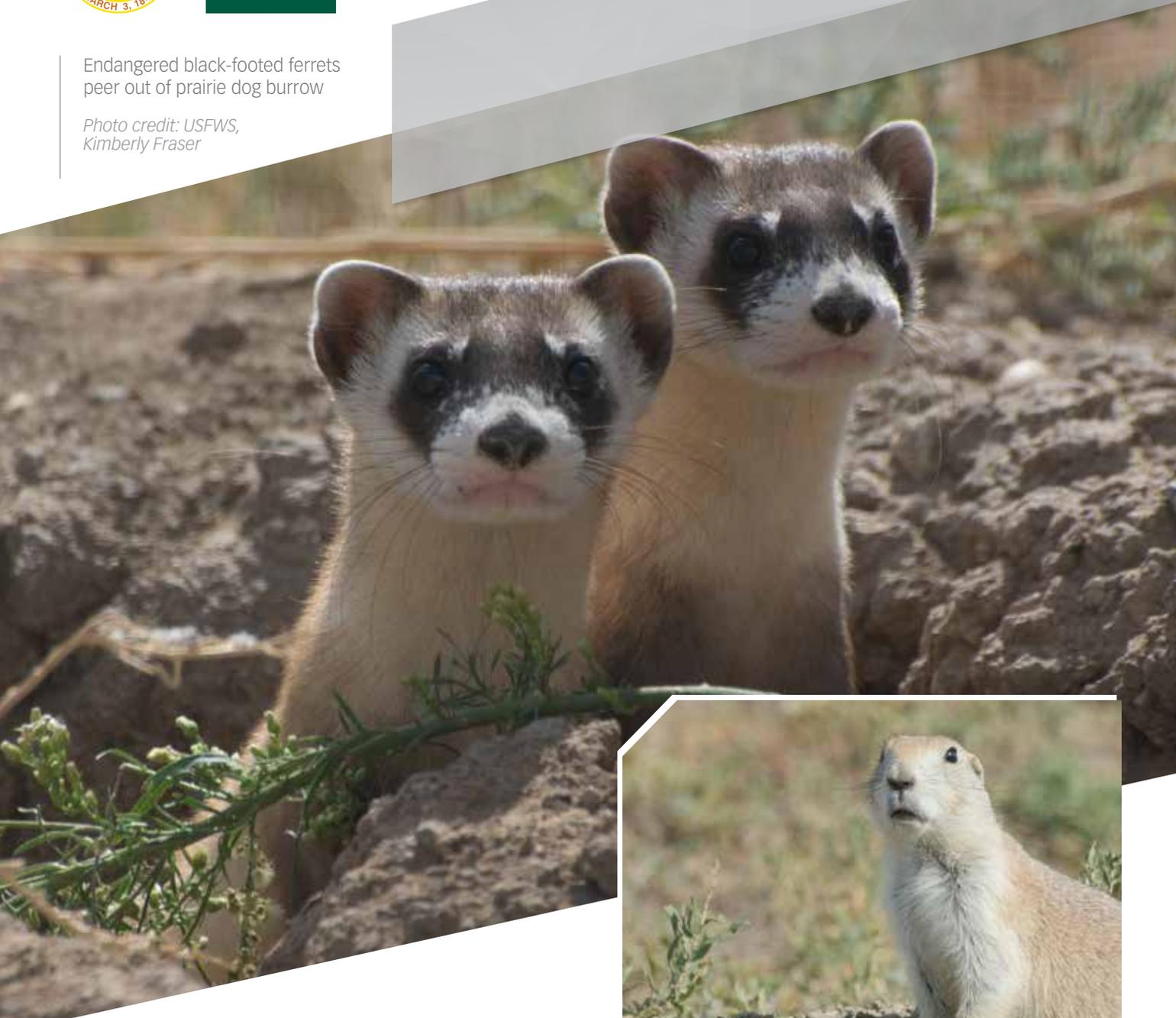


www.epa.gov  /EPA  @EPAresearch



Endangered black-footed ferrets peer out of prairie dog burrow

Photo credit: USFWS, Kimberly Fraser



Black-tailed prairie dog near blue vaccine bait

Photo credit: World Wildlife Fund

www.aphis.usda.gov | www.usgs.gov | www.fws.gov

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U.S. Department of the Interior

U.S. Geological Survey/
U.S. Fish and Wildlife Service

U.S. Department of Agriculture

Animal and Plant Health Inspection Service

Protecting Endangered Black-footed Ferrets From the Plague



Colorado/
Wisconsin

Lewis and Clark first witnessed prairie dogs in 1804 in South Dakota as part of their famous expedition across North America. The small burrowing animals, with their “barking” calls and elaborate colonies, impressed the men so much that a live specimen was shipped back to President Jefferson. Only later would biologists learn how important prairie dogs are to the health and function of the prairie ecosystem.

One of the many factors that affect prairie dog populations is sylvatic plague, a non-native bacterial disease transmitted by fleas. It afflicts many mammal species, including black-footed ferrets and people. Plague is common throughout the western U.S. and periodically causes the death of entire prairie dog colonies. Black-footed ferrets are one of the most endangered mammals in the U.S. They feed almost exclusively on prairie dogs.

Black-footed ferret reintroduction efforts by the U.S. Fish and Wildlife Service (USFWS) can be severely impacted when plague sweeps through a prairie dog colony. Prairie dog colony collapse results in the death of ferrets and the loss of millions of dollars in taxpayer money related to USFWS reintroduction efforts.

Scientists at the U.S. Geological Survey’s (USGS) National Wildlife Health Center have developed an oral vaccine to combat sylvatic plague in prairie dogs. Through a multi year collaboration involving five federal agencies, nine state wildlife management agencies and two private organizations, the vaccine has undergone extensive field testing to demonstrate its effectiveness.

In 2016, Colorado Parks and Wildlife pioneered an affordable technique for mass-producing baits. The USFWS developed mechanized methods, including the use of drones and ATVs, for the cost-effective delivery

of baits. Additionally, 300,000 baits were manufactured at the USDA National Wildlife Research Center with the help of multiple partners. The baits were then applied to over 5,000 acres of black-footed ferret recovery habitat in 5 western states. In 2017, these new methods and technologies again will be used in the production and distribution of baits.

The USGS has licensed the production of the bait’s vaccine component to Colorado Serum Company of Denver, which entered into a bait manufacturing collaboration with the USDA’s Wildlife Services Pocatello Supply Depot. Through this collaboration, more than 1 million baits will be produced and distributed to more than 20,000 acres of black-footed ferret recovery habitat.

The partnership between state and federal agencies and private entities has been critical to the success of this project. The conservation and economic benefits of the project will be realized for years to come as vaccine use grows, black-footed ferrets repopulate areas of the western U.S., and species recovery goals are achieved.

The collaborating organizations are: U.S. Department of Agriculture Wildlife Services and Forest Service; U.S. Department of the Interior, U.S. Fish and Wildlife Service, U.S. Geological Survey and National Park Service; Colorado Parks and Wildlife; Arizona Game and Fish; Utah Division of Wildlife; Wyoming Fish and Game; Montana Fish, Wildlife and Parks; South Dakota Game, Fish and Parks; Kansas Wildlife Parks and Tourism; New Mexico Department of Game and Fish; Texas Parks and Wildlife; Western Association of Fish and Wildlife Agencies; and World Wildlife Fund.

The T2 Toolkit

Our goal is to provide leading-edge resources so that all innovators can understand and better navigate the technology transfer process. We want to guide businesses looking to get their ideas off the ground by providing the connections and expertise they need to meet their business objectives.

Facilitating T2 With Innovative Tools and Services

The core mission of the FLC is to facilitate federal laboratories' T2 goals and missions through FLC-created tools and services that provide successful introductions, information, and an accessible path for members to get their technologies from lab to market. Through its T2 Toolkit, the FLC offers a comprehensive set of tools and services for anyone from startups to large corporations seeking information on how to work with or access federal resources that can propel them along the path to T2 success.

Your T2 Toolkit



FLC Business

A next-generation search tool for federal laboratory resources that provides the most comprehensive laboratory data available. This one-stop shop application integrates the Available Technologies Search Tool and is designed to accelerate T2 by offering easy-to-search access to federal laboratory information, such as thousands of technologies available for licensing, lab facilities and equipment, funding opportunities, and lab-specific programs. fcbusiness.org



T2 Playbook

The T2 Playbook is an online, detailed resource guide that contains 15 commercialization "plays" drawn from case studies and best practices at federal laboratories across the country. federallabs.org/T2-Playbook



Technology Locator Service

The FLC's Technology Locator Service provides immediate, personalized search assistance and referrals that connect entrepreneurs, technology seekers, and other industry representatives with federal laboratory expertise and technologies to further their R&D goals. federallabs.org/Technology-Locator



T2 Mechanisms Database

This online reference guide to technology transfer mechanisms allows users to become familiar with and explore the wide variety of T2 agreement paths available. federallabs.org/T2-Mechanisms

Lab-to-Market Successes



Pioneering Achievements

The following featured lab-to-market successes are examples of revolutionary technologies that continue to advance our world today thanks to the research, development, and commercialization partnerships that took place between federal labs and private companies.

Promoting Lab-to-Market Success

Technology transfer doesn't happen overnight. For many scientists, engineers, inventors and lab professionals, it is a process that can take years to complete depending on the technology and market needs.

Fortunately, the FLC understands the T2 process and how rewarding it can be when a technology is finally introduced to market, which is why we have made it a point to honor the hard work and dedication of our members.

Through annual publications, daily communication and media promotion, and the prestigious FLC awards program, we assist our members' R&D and technology transfer missions by shining the spotlight on their scientific and technological advancements.

The FLC's mission

Connecting federal laboratories with industry to accelerate technology transfer for economic impact.

PROMOTE



EDUCATE



FACILITATE



FLC Member Directory

ALABAMA

Aeromedical Research Laboratory

Dept. of Defense - Army
www.usaarl.army.mil

Air Force Logistics Management Agency

Dept. of Defense - Air Force
www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104536/air-force-logistics-management-agency

Army Aviation and Missile Research, Development, and Engineering Center

Dept. of Defense - Army
www.army.mil/info/organization/unitsandcommands/commandstructure/amrdec

Marshall Space Flight Center

NASA
www.nasa.gov/marshall

Redstone Test Center

Dept. of Defense - Army
www rtc.army.mil

U.S. Army Space and Missile Defense Command/Army Forces Strategic Command

Dept. of Defense - Army
www.army.mil/smdc

ARIZONA

Electronic Proving Ground

Dept. of Defense - Army
www.epg.army.mil

Yuma Proving Ground

Dept. of Defense - Army
www.yuma.army.mil

ARKANSAS

National Center for Toxicological Research

Dept. of Health and Human Services
www.fda.gov/NCTR

CALIFORNIA

The Aerospace Corporation

Dept. of Defense
www.aerospace.org

Agricultural Research Service - Pacific West Area

Dept. of Agriculture
www.ars.usda.gov/pacific-west-area/

Air Force Flight Test Center

Dept. of Defense - Air Force
www.edwards.af.mil

Ames Research Center

NASA
www.nasa.gov/ames

Armstrong Flight Research Center

NASA
www.nasa.gov/armstrong

Aviation and Missile Research, Development, and Engineering Center - Aeroflightdynamics Directorate

Dept. of Defense - Army
www.army.mil/info/organization/unitsandcommands/commandstructure/amrdec

Defense Language Institute Foreign Language Center

Dept. of Defense
www.dliflc.edu

Defense Microelectronics Activity

Dept. of Defense
www.dmea.osd.mil

Fleet Readiness Center Southwest

Dept. of Defense - Navy
www.navair.navy.mil/frcsww

Forest Service - San Dimas Technology and Development Center

Dept. of Agriculture
www.fs.fed.us/eng/techdev/sdtdc

Jet Propulsion Laboratory

NASA
www.jpl.nasa.gov

Lawrence Berkeley National Laboratory

Dept. of Energy
www.lbl.gov

Lawrence Livermore National Laboratory

Dept. of Energy
www.llnl.gov

Sandia National Laboratories - California

Dept. of Energy
www.ca.sandia.gov

National Oceanic and Atmospheric Administration - Southwest Fisheries Science Center

Dept. of Commerce
swfsc.noaa.gov

Naval Air Warfare Center - Weapons Division - China Lake and Pt. Mugu

Dept. of Defense - Navy
www.navair.navy.mil/nawcww

Naval Facilities Engineering and Expeditionary Warfare Center

Dept. of Defense - Navy
www.navfac.navy.mil

Naval Health Research Center

Dept. of Defense - Navy
www.med.navy.mil/sites/nhrc

Naval Medical Center - San Diego

Dept. of Defense - Navy
www.med.navy.mil/sites/nmcsd

Naval Postgraduate School

Dept. of Defense - Navy
www.nps.edu

Naval Surface Warfare Center - Corona Division

Dept. of Defense - Navy
www.navsea.navy.mil/Home/Warfare-Centers/NSWC-Corona/

Naval Surface Warfare Center - Port Hueneme Division

Dept. of Defense - Navy
www.navsea.navy.mil/Home/Warfare-Centers/NSWC-Port-Hueneme/

Space and Naval Warfare Systems Center - Pacific

Dept. of Defense - Navy
www.public.navy.mil/spawar/pacific

Stanford Linear Accelerator Center

Dept. of Energy
www.slac.stanford.edu

University of California, Los Angeles - Laboratory of Structural Biology and Molecular Medicine

Dept. of Energy
www.doe-mbi.ucla.edu

COLORADO

Air Force Academy

Dept. of Defense - Air Force
www.usafa.af.mil

Boulder Laboratories - NIST

Dept. of Commerce
www.nist.gov

Bureau of Reclamation

Dept. of Interior
www.usbr.gov

Earth System Research Laboratory

Dept. of Commerce
www.esrl.noaa.gov

FLC MEMBER DIRECTORY

Federal Railroad Administration - Transportation Technology Center

Dept. of Transportation
www.aar.com

Forest Service - Rocky Mountain Research Station

Dept. of Agriculture
www.fs.fed.us/rm

National Centers for Environmental Information

Dept. of Commerce
www.ncei.noaa.gov

National Telecommunications and Information Administration

Dept. of Commerce
www.its.bldrdoc.gov

National Renewable Energy Laboratory

Dept. of Energy
www.nrel.gov

USDA National Wildlife Research Center

Dept. of Agriculture
www.aphis.usda.gov

USGS National Labs

Dept. of Interior
www.usgs.gov

CONNECTICUT

Naval Submarine Medical Research Laboratory

Dept. of Defense - Navy
www.med.navy.mil/sites/nsmrl

U.S. Coast Guard Research and Development Center

Dept. of Homeland Security
www.uscg.mil/acquisition/rdc

DISTRICT OF COLUMBIA

Center for Food Safety and Applied Nutrition

Dept. of Health and Human Services
www.fda.gov/Food

Missile Defense Agency

Dept. of Defense
www.mda.mil

National Center for Environmental Research

Environmental Protection Agency
www.epa.gov/ncer

Naval Research Laboratory

Dept. of Defense - Navy
www.nrl.navy.mil

Office and Research Development

Dept. of Veteran Affairs
www.research.va.gov

Office of Science Policy

Environmental Protection Agency
www.epa.gov/osp

U.S. Naval Observatory

Dept. of Defense - Navy
www.usno.navy.mil/USNO

FLORIDA

Air Force Research Laboratory - Munitions Directorate

Dept. of Defense - Air Force
www.eglin.af.mil/units/afrlmunitionsdirectorade

Air Force Civil Engineer Support Agency

Dept. of Defense - Air Force
www.afcec.af.mil

Fleet Readiness Center Southeast

Dept. of Defense - Navy
www.navair.navy.mil

Hemispheric Center for Environmental Technology

Dept. of Energy
www.arc.fiu.edu

Kennedy Space Center

NASA
www.nasa.gov/kennedy

National High Magnetic Field Laboratory

National Science Foundation
www.magnet.fsu.edu

National Oceanic and Atmospheric Administration - Atlantic Oceanographic & Meteorological Laboratory

Dept. of Commerce
www.aoml.noaa.gov

National Oceanic and Atmospheric Administration - Southeast Fisheries Science Center

Dept. of Commerce
sefsc.noaa.gov

Naval Air Warfare Center Training Systems Division

Dept. of Defense - Navy
www.navair.navy.mil/nawctsd

Naval Surface Warfare Center - Panama City Division

Dept. of Defense - Navy
www.navsea.navy.mil/nswc/panamacity

U.S. Army Research, Development and Engineering Command - Simulation and Training Technology Center

Dept. of Defense - Army
www.arl.army.mil/rdecom

GEORGIA

Centers for Disease Control and Prevention

Dept. of Health and Human Services
www.cdc.gov

Capability Development Integration Directorate - Experimentation Division (Network Battle Lab)

Dept. of Defense - Army
www.gordon.army.mil

Federal Law Enforcement Training Center

Dept. of Homeland Security
www.fletc.gov

Office of Infectious Diseases

Dept. of Health and Human Services
www.cdc.gov/oid

Warner Robins Air Logistics Center

Dept. of Defense - Air Force
www.robins.af.mil

HAWAII

National Oceanic and Atmospheric Administration (NOAA) - Pacific Island Fisheries Science Center

Dept. of Commerce
www.pifsc.noaa.gov

IDAHO

Idaho National Laboratory

Dept. of Energy
www.inl.gov

ILLINOIS

Agricultural Research Service - Midwest Area

Dept. of Agriculture
www.ars.usda.gov/mwa

Argonne National Laboratory

Dept. of Energy
www.anl.gov

Center for Advanced Cement-Based Materials

Dept. of Commerce
https://engineering.purdue.edu/Engr/Research/
LabsFacilities/CACM

FLC MEMBER DIRECTORY

Fermi National Accelerator Laboratory

Dept. of Energy
www.fnal.gov

New Brunswick Laboratory

Dept. of Energy
www.nbl.doe.gov

U.S. Transportation Command

Dept. of Defense
www.transcom.mil

U.S. Army Corps of Engineers - Engineer Research and Development Center - Construction Engineering Research Laboratory

Dept. of Defense - Army
www.erd.c.usace.army.mil/cerl

INDIANA

Naval Surface Warfare Center - Crane Division

Dept. of Defense - Navy
www.navsea.navy.mil/nswc/crane

IOWA

Ames Laboratory

Dept. of Energy
www.ameslab.gov

KANSAS

U.S. Army Training and Doctrine Command Analysis Center

Dept. of Defense - Army
www.trac.army.mil

MARYLAND

Agricultural Research Center - North East Area

Dept. of Agriculture
www.ba.ars.usda.gov

Aberdeen Test Center

Dept. of Defense - Army
www.atc.army.mil

Army Research Laboratory - Aberdeen Proving Ground Site

Dept. of Defense - Army
www.arl.army.mil

Army Research Laboratory - Adelphi Site

Dept. of Defense - Army
www.arl.army.mil

Center for Biologics Evaluation and Research

Dept. of Health and Human Services
www.fda.gov/BiologicsBloodVaccines

Center for Devices and Radiological Health

Dept. of Health and Human Services
www.fda.gov/AboutFDA/CentersOffices/
OfficeofMedicalProductsandTobacco/CDRH

Center for Drug Evaluation and Research

Dept. of Health and Human Services
www.fda.gov/cder

Center for Environmental Health Research

Dept. of Defense - Army
http://usacehr.amedd.army.mil

Center for Information Technology

Dept. of Health and Human Services
http://cit.nih.gov

Center for Veterinary Medicine

Dept. of Health and Human Services
www.fda.gov/cvm

Chemical Security Analysis Center

Dept. of Homeland Security
www.dhs.gov/st-csac

Clinical Center at the National Institutes of Health

Dept. of Health and Human Services
www.cc.nih.gov

Defense Information Systems Agency - Joint Interoperability Test Command

Dept. of Defense
http://jitc.fhu.disa.mil

Edgewood Chemical Biological Center

Dept. of Defense - Army
www.ecbc.army.mil

Fogarty International Center

Dept. of Health and Human Services
www.fic.nih.gov

Frederick National Laboratory for Cancer Research

Dept. of Health and Human Services
http://frederick.cancer.gov

Goddard Space Flight Center

NASA
www.nasa.gov/goddard

Institute for Systems Research

National Science Foundation
www.isr.umd.edu

National Biodefense Analysis and Countermeasures Center

Dept. of Homeland Security
www.dhs.gov/national-biodefense-analysis-
and-countermeasures-center

National Cancer Institute

Dept. of Health and Human Services
www.cancer.gov

National Center for Advancing Translational Sciences

Dept. of Health and Human Services
www.ncats.nih.gov

National Center for Complementary and Alternative Medicine

Dept. of Health and Human Services
http://nccam.nih.gov

National Center for Research Resources

Dept. of Health and Human Services
www.ncrr.nih.gov

National Eye Institute

Dept. of Health and Human Services
www.nei.nih.gov

National Heart, Lung, and Blood Institute

Dept. of Health and Human Services
www.nhlbi.nih.gov

National Human Genome Research Institute

Dept. of Health and Human Services
www.genome.gov

National Institute of Allergy and Infectious Diseases

Dept. of Health and Human Services
www.niaid.nih.gov

National Institute of Arthritis and Musculoskeletal and Skin Diseases

Dept. of Health and Human Services
www.niams.nih

National Institute of Biomedical Imaging and Bioengineering

Dept. of Health and Human Services
www.nibib.nih.gov

National Institute of Child Health and Human Development

Dept. of Health and Human Services
www.nichd.nih.gov

FLC MEMBER DIRECTORY

National Institute of Dental and Craniofacial Research

Dept. of Health and Human Services
www.nidcr.nih.gov

National Institute of Diabetes and Digestive and Kidney Diseases

Dept. of Health and Human Services
www2.niddk.nih.gov

National Institute of General Medical Sciences

Dept. of Health and Human Services
www.nigms.nih.gov

National Institute of Mental Health

Dept. of Health and Human Services
www.nimh.nih.gov

National Institute of Neurological Disorders and Stroke

Dept. of Health and Human Services
www.ninds.nih.gov

National Institute of Nursing Research

Dept. of Health and Human Services
www.ninr.nih.gov

National Institute of Standards and Technology

Dept. of Commerce
www.nist.gov

National Institute on Aging

Dept. of Health and Human Services
www.nia.nih.gov

National Institute on Alcohol Abuse and Alcoholism

Dept. of Health and Human Services
www.niaaa.nih.gov

National Institute on Deafness and Other Communication Disorders

Dept. of Health and Human Services
www.nidcd.nih.gov

National Institute on Drug Abuse

Dept. of Health and Human Services
www.nida.nih.gov

National Institutes of Health

Dept. of Health and Human Services
www.nih.gov

National Library of Medicine

Dept. of Health and Human Services
www.nlm.nih.gov

National Security Agency

Dept. of Defense
www.nsa.gov

National Oceanic and Atmospheric Administration - Air Resources Laboratory

Dept. of Commerce
www.arl.noaa.gov

National Oceanic and Atmospheric Administration - Center for Coastal Monitoring and Assessment

Dept. of Commerce
coastalscience.noaa.gov/about/centers/ccma

National Oceanic and Atmospheric Administration - Center for Satellite Applications and Research

Dept. of Commerce
www.star.nesdis.noaa.gov/star/index.php

National Oceanic and Atmospheric Administration - Meteorological Development Laboratory

Dept. of Commerce
www.nws.noaa.gov/tdl

National Oceanic and Atmospheric Administration - National Centers for Environmental Prediction

Dept. of Commerce
www.ncep.noaa.gov

National Oceanic and Atmospheric Administration - National Oceanic Data Center

Dept. of Commerce
www.nodc.noaa.gov

National Oceanic and Atmospheric Administration - Office of Aquaculture

Dept. of Commerce
www.nmfs.noaa.gov/aquaculture

Naval Air Warfare Center - Aircraft Division - Patuxent River

Dept. of Defense - Navy
www.navair.navy.mil/nawcad

Naval Medical Research Center

Dept. of Defense - Navy
www.nmrc.navy.mil

Naval Surface Warfare Center - Carderock Division

Dept. of Defense - Navy
www.navsea.navy.mil/nswc/carderock

Naval Surface Warfare Center - Indian Head Division

Dept. of Defense - Navy
www.navsea.navy.mil/nswc/indianhead

Office of Research Services

Dept. of Health and Human Services
www.ors.od.nih.gov

U.S. Army Clinical Investigation Regulatory Office

Dept. of Defense - Army
www.cs.amedd.army.mil

U.S. Army Developmental Test Command

Dept. of Defense - Army
www.atec.army.mil

U.S. Army Medical Materiel Development Activity

Dept. of Defense - Army
www.usammda.army.mil

U.S. Army Medical Research Institute of Chemical Defense

Dept. of Defense - Army
<http://usamricd.apgea.army.mil>

U.S. Army Medical Research Institute of Infectious Diseases

Dept. of Defense - Army
www.usamriid.army.mil

U.S. Army Medical Research and Materiel Command

Dept. of Defense - Army
<https://mrmc.detrick.army.mil>

U.S. Army Medical Research and Materiel Command - Telemedicine and Advanced Technology Research Center

Dept. of Defense - Army
www.tatrc.org

U.S. Army Research, Development and Engineering Command - Communications-Electronics Research, Development and Engineering Center Command, Power & Integration Directorate - CP&I

Dept. of Defense - Army
http://www.cerdec.army.mil/inside_cerdec/cpi

U.S. Army Research, Development and Engineering Command - Communications-Electronics Research, Development and Engineering Center - Intelligence and Information Warfare Directorate

Dept. of Defense - Army
www.cerdec.army.mil/inside_cerdec/i2wd

U.S. Army Research, Development and Engineering Command - Communications-Electronics Research, Development and Engineering Center - Software Engineering Directorate

Dept. of Defense - Army
www.cerdec.army.mil/inside_cerdec/sed

FLC MEMBER DIRECTORY

U.S. Army Research, Development and Engineering Command - Communications-Electronics Research, Development and Engineering Center - Space and Terrestrial Communications Directorate

Dept. of Defense - Army
www.cerdec.army.mil/inside_cerdec/stcd

Uniformed Services University of the Health Services

Dept. of Defense
www.usuhs.mil

United States Naval Academy

Dept. of Defense - Navy
www.usna.edu

Walter Reed Army Institute of Research

Dept. of Defense - Army
<http://wrair-www.army.mil>

MASSACHUSETTS

Air Force Research Laboratory - Space Vehicles Directorate Hanscom AFB

Dept. of Defense - Air Force
www.hanscom.af.mil

Electronic Systems Center

Dept. of Defense - Air Force
<http://afcmc.afacquisitioncareers.com>

Massachusetts Institute of Technology Lincoln Laboratory

Dept. of Defense
<https://www.ll.mit.edu/index.html>

Natick Soldier Research, Development & Engineering Center

Dept. of Defense - Army
<http://nsrdec.natick.army.mil>

National Oceanic and Atmospheric Administration - Northeast Fisheries Science Center

Dept. of Commerce
www.nefsc.noaa.gov

Navy Clothing and Textile Research Facility

Dept. of Defense - Navy
<https://www.mynavyexchange.com>

U.S. Army Research Institute of Environmental Medicine

Dept. of Defense - Army
www.usariem.army.mil

Volpe National Transportation Systems Center

Dept. of Transportation
www.volpe.dot.gov

MICHIGAN

Great Lakes Science Center

Dept. of Interior
www.glsc.usgs.gov

National Oceanic and Atmospheric Administration - Great Lakes Environmental Research Laboratory

Dept. of Commerce
www.glerl.noaa.gov

U.S. Army Tank Automotive Research, Development and Engineering Center

Dept. of Defense - Army
www.army.mil/tardec

MISSISSIPPI

Agricultural Research Service - South East Area

Dept. of Agriculture
www.ars.usda.gov/msa

Engineer Research and Development Center

Dept. of Defense - Army
www.erd.c.usace.army.mil

Naval Meteorology and Oceanography Command

Dept. of Defense - Navy
www.navmetoccom.navy.mil

National Oceanic and Atmospheric Administration - National Data Buoy Center

Dept. of Commerce
www.ndbc.noaa.gov

Stennis Space Center

NASA
<http://www.nasa.gov/stennis>

U.S. Army Corps of Engineers - Coastal and Hydraulics Laboratory

Dept. of Defense - Army
<http://chl.erdc.usace.army.mil>

U.S. Army Corps of Engineers - Environmental Laboratory

Dept. of Defense - Army
<http://el.erdc.usace.army.mil>

U.S. Army Corps of Engineers - Geospatial Research Laboratory

Dept. of Defense - Army
www.erd.c.usace.army.mil/Locations/GRL

U.S. Army Corps of Engineers - Geotechnical and Structures Laboratory

Dept. of Defense - Army
<http://gsl.erdc.usace.army.mil>

U.S. Army Corps of Engineers - Information Technology Laboratory

Dept. of Defense - Army
<http://itl.erdc.usace.army.mil>

MISSOURI

Kansas City National Security Campus

Dept. of Energy
www.nnsa.energy.gov/aboutus/ourlocations/kansas-city-plant

MONTANA

Forest Service - Missoula Technology and Development Center

Dept. of Agriculture
www.fs.fed.us/eng/techdev/mtdc

NEBRASKA

557th Weather Wing

Dept. of Defense - Air Force
www.557weatherwing.af.mil

NEVADA

National Nuclear Security Administration - Nevada Field Office

Dept. of Energy
www.nv.doe.gov

NEW HAMPSHIRE

Portsmouth Naval Shipyard

Dept. of Defense - Navy
www.navsea.navy.mil/Home/Shipyards/Portsmouth

U.S. Army Corps of Engineers - Cold Regions Research and Engineering Laboratory

Dept. of Defense - Army
www.erd.c.usace.army.mil/Locations/CRREL

NEW JERSEY

Air Mobility Battlelab

Dept. of Defense - Air Force
www.amc.af.mil

National Oceanic and Atmospheric Administration - Geophysical Fluid Dynamics Laboratory

Dept. of Commerce
www.gfdl.noaa.gov

Naval Air Warfare Center - Aircraft Division - Lakehurst

Dept. of Defense - Navy
www.navair.navy.mil/nawcad/Lakehurst

Princeton Plasma Physics Laboratory

Dept. of Energy
www.pppl.gov

Transportation Security Laboratory

Dept. of Homeland Security
www.dhs.gov/science-and-technology/transportation-security-laboratory

FLC MEMBER DIRECTORY

U.S. Army Armament Research, Development, and Engineering Command

Dept. of Defense - Army
<http://www.ardec.army.mil>

William J. Hughes Technical Center

Dept. of Transportation
www.tc.faa.gov

NEW MEXICO

Air Force Research Laboratory - Directed Energy Directorate

Dept. of Defense - Air Force
www.kirtland.af.mil/Units/AFRL-Directed-Energy-Directorate

Los Alamos National Laboratory

Dept. of Energy
www.lanl.gov

Sandia National Laboratories

Dept. of Energy
www.sandia.gov

NEW YORK

Air Force Research Laboratory - Information Directorate

Dept. of Defense - Air Force
www.wpafb.af.mil/afrl/ri

Benét Laboratories

Dept. of Defense - Army
www.ardec.army.mil/benet

Brookhaven National Laboratory

Dept. of Energy
www.bnl.gov

National Urban Security Technology Laboratory

Dept. of Homeland Security
www.dhs.gov/st-nustl

Plum Island Animal Disease Center

Dept. of Homeland Security
www.dhs.gov/st-piadc

NORTH CAROLINA

Army Research Laboratory - Army Research Office

Dept. of Defense - Army
www.arl.army.mil

Fleet Readiness Center - Vertical Lift Center of Excellence

Dept. of Defense - Navy
www.navair.navy.mil/frce

Forest Service - Southern Research Station

Dept. of Agriculture
www.srs.fs.usda.gov

National Center for Computational Toxicology

Environmental Protection Agency
www.epa.gov/comptox

National Exposure Research Laboratory

Environmental Protection Agency
www.epa.gov/nerl

National Health and Environmental Effects Research Laboratory

Environmental Protection Agency
www.epa.gov/nheerl

National Institute of Environmental Health Sciences

Dept. of Health and Human Services
www.niehs.nih.gov

National Oceanic and Atmospheric Administration - Center for Coastal Fisheries and Habitat Research

Dept. of Commerce
<http://coastalscience.noaa.gov/about/centers/ccfhr>

National Oceanic and Atmospheric Administration - National Climatic Data Center

Dept. of Commerce
www.ncdc.noaa.gov

NORTH DAKOTA

Northern Prairie Wildlife Research Center

Dept. of Interior
www.npwrc.usgs.gov

OHIO

Air Force Research Laboratory - 711th Human Performance Wing

Dept. of Defense - Air Force
www.wpafb.af.mil/afrl/711HPW

Air Force Research Laboratory - Aerospace Systems Directorate

Dept. of Defense - Air Force
www.wpafb.af.mil/afrl/rq

Air Force Research Laboratory - Air Vehicles Directorate

Dept. of Defense - Air Force
www.wpafb.af.mil/afrl/rq

Air Force Research Laboratory - Materials and Manufacturing Directorate

Dept. of Defense - Air Force
www.wpafb.af.mil/afrl/rx

Air Force Research Laboratory - Sensors Directorate

Dept. of Defense - Air Force
www.wpafb.af.mil/afrl/ry

Army Research Laboratory - Vehicle Technology Directorate - Propulsion Program

Dept. of Defense - Army
www.arl.army.mil/vtd

Air Force - Aeronautical Systems Center

Dept. of Defense - Air Force
www.wpafb.af.mil/asc

Air Force Institute of Technology

Dept. of Defense - Air Force
www.afit.edu

Air Force Research Laboratory

Dept. of Defense - Air Force
www.wpafb.af.mil/AFRL

Glenn Research Center

NASA
www.nasa.gov/glenn

National Homeland Security Research Center

Environmental Protection Agency
www.epa.gov/NHSRC

National Institute for Occupational Safety and Health

Dept. of Health and Human Services
www.cdc.gov/niosh

National Risk Management Research Laboratory

Environmental Protection Agency
www.epa.gov/nrmrl

OKLAHOMA

Federal Aviation Administration - Civil Aerospace Medical Institute

Dept. of Transportation
www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/cami

National Oceanic and Atmospheric Administration - National Severe Storms Laboratory

Dept. of Commerce
www.nssl.noaa.gov

National Oceanic and Atmospheric Administration - NEXRAD Radar Operations Center

Dept. of Commerce
www.roc.noaa.gov

Oklahoma City Air Logistics Center

Dept. of Defense - Air Force
www.tinker.af.mil

FLC MEMBER DIRECTORY

OREGON

Forest Service - Pacific Northwest Research Station

Dept. of Agriculture
www.fs.fed.us/pnw

National Energy Technology Laboratory - Albany, OR

Dept. of Energy
www.netl.doe.gov

PENNSYLVANIA

Advanced Technology for Large Structural Systems Center

National Science Foundation
www.atlss.lehigh.edu

Forest Service - Northern Research Station

Dept. of Agriculture
www.nrs.fs.fed.us

National Institute for Occupational Safety and Health - Pittsburgh Research Laboratory

Dept. of Health and Human Services
www.cdc.gov/niosh

National Energy Technology Laboratory - Pittsburgh

Dept. of Energy
www.netl.doe.gov

RHODE ISLAND

Naval Undersea Warfare Center - Division Newport

Dept. of Defense - Navy
<http://www.navsea.navy.mil/Home/Warfare-Centers/NUWC-Newport>

Naval War College

Dept. of Defense - Navy
www.usnwc.edu

SOUTH CAROLINA

Savannah River National Laboratory

Dept. of Energy
<http://srnl.doe.gov>

Space and Naval Warfare Systems Center - Atlantic

Dept. of Defense - Navy
www.spawar.navy.mil

National Oceanic and Atmospheric Administration - Center for Coastal Environmental Health and Biomolecular Research

Dept. of Commerce
<http://coastalscience.noaa.gov/about/centers/ccehbr>

National Oceanic and Atmospheric Administration - Hollings Marine Laboratory

Dept. of Commerce
<http://coastalscience.noaa.gov/about/centers/hml>

SOUTH DAKOTA

Earth Resources Observation & Science Center

Dept. of Interior
<http://eros.usgs.gov>

South Dakota Water Science Center

Dept. of Interior
<http://sd.water.usgs.gov>

TENNESSEE

Arnold Engineering Development Center

Dept. of Defense - Air Force
www.arnold.af.mil

Oak Ridge National Laboratory

Dept. of Energy
www.ornl.gov

Y-12 National Security Complex

Dept. of Energy
www.y12.doe.gov

TEXAS

25th Air Force

Dept. of Defense - Air Force
www.afisr.af.mil

688th Information Operations Wing

Dept. of Defense - Air Force
<http://www.24af.af.mil/units/688thinformationoperationswing>

Agricultural Research Service - Southern Plains Area

Dept. of Agriculture
www.ars.usda.gov/npa

Air Force - 311th Human Systems Wing

Dept. of Defense - Air Force
www.afhra.af.mil

Air Force Center for Environmental Excellence

Dept. of Defense - Air Force
www.afcec.af.mil

Air Force Medical Service

Dept. of Defense - Air Force
www.afms.af.mil

Center for AMEDD Strategic Studies

Dept. of Defense - Army
www.cs.amedd.army.mil/mcic

Institute for Fusion Studies

Dept. of Energy
<http://w3fusion.ph.utexas.edu/ifs/>

Johnson Space Center

NASA
www.nasa.gov/johnson

National Nuclear Security Administration - Pantex Plant

Dept. of Energy
www.pantex.com

U.S. Army Institute of Surgical Research

Dept. of Defense - Army
www.usaisr.amedd.army.mil

UTAH

Brigham Young University

National Science Foundation
www.byu.edu

Dugway Proving Ground

Dept. of Defense - Army
<http://www.dugway.army.mil>

Ogden Air Logistics Center

Dept. of Defense - Air Force
www.hill.af.mil

VIRGINIA

Air Force Research Laboratory - Air Force Office of Scientific Research

Dept. of Defense - Air Force
www.wpafb.af.mil/afri/afosr

Army Research Laboratory - Vehicle Technology Directorate - Structures Program

Dept. of Defense - Army
www.arl.army.mil/vtd

Air Combat Command

Dept. of Defense - Air Force
www.acc.af.mil

Army Research Institute for Behavioral and Social Sciences

Dept. of Defense - Army
www.arl.army.mil

Aviation Applied Technology Directorate

Dept. of Defense - Army
www.aatd.eustis.army.mil

FLC MEMBER DIRECTORY

Defense Advanced Research Projects Agency

Dept. of Defense
www.darpa.mil

Defense Technical Information Center

Dept. of Defense
www.dtic.mil

Federal Highway Administration - Turner-Fairbanks Highway Research Center

Dept. of Transportation
www.tfhr.gov

Langley Research Center

NASA
www.nasa.gov/langley

Marine Corps Network Operations and Security Center

Dept. of Defense
<https://marinecorpsconceptsandprograms.com/organizations/operating-forces/us-marine-corps-forces-cyberspace-marforcyber>

Mine Safety and Health Administration

Dept. of Labor
www.msha.gov

National Energy Technology Laboratory - Fairbanks

Dept. of Energy
www.netl.doe.gov

National Geospatial-Intelligence Agency

Dept. of Defense
<https://www.nga.mil>

National Radio Astronomy Observatory

National Science Foundation
www.nrao.edu

Naval Medical Center - Portsmouth

Dept. of Defense - Navy
www.med.navy.mil/sites/NMCP2

Naval Surface Warfare Center - Dahlgren Division

Dept. of Defense - Navy
www.navy.mil/local/NSWCDD

Navy Warfare Development Command

Dept. of Defense - Navy
www.navy.mil/local/nwdc

Office of Naval Research

Dept. of Defense - Navy
www.onr.navy.mil

U.S. Army Research, Development and Engineering Command - Communications-Electronics Research, Development and Engineering Center - Night Vision and Electronic Sensors Directorate

Dept. of Defense - Army
www.nvl.army.mil

Thomas Jefferson National Accelerator Facility

Dept. of Energy
www.jlab.org

U.S. Joint Forces Command

Dept. of Defense
www.jfcom.mil

United States Army Corps of Engineers - Institute for Water Resources

Dept. of Defense - Army
www.iwr.usace.army.mil

Virginia Water Science Center

Dept. of Interior
<http://va.water.usgs.gov>

WASHINGTON

Department of Energy - Hanford Site

Dept. of Energy
www.hanford.gov

National Institute for Occupational Safety and Health - Spokane Research Laboratory

Dept. of Health and Human Services
<http://www.cdc.gov/niosh/contact/im-srl>

National Oceanic and Atmospheric Administration - Alaska Fisheries Science Center

Dept. of Commerce
www.afsc.noaa.gov

National Oceanic and Atmospheric Administration - Northwest Fisheries Science Center

Dept. of Commerce
www.nwfs.noaa.gov

National Oceanic and Atmospheric Administration - Pacific Marine Environmental Laboratory

Dept. of Commerce
www.pmel.noaa.gov

Naval Undersea Warfare Center - Division Keyport

Dept. of Defense - Navy
www.navsea.navy.mil/nuwc/keyport

Pacific Northwest National Laboratory

Dept. of Energy
www.pnnl.gov

WEST VIRGINIA

National Energy Technology Laboratory

Dept. of Energy
www.netl.doe.gov

WISCONSIN

Forest Service - Forest Products Laboratory

Dept. of Agriculture
www.fpl.fs.fed.us



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