Federal Laboratories & STATE AND LOCAL GOVERNMENTS

Partners for Technology Transfer Success

Federal Laboratory Consortium for Technology Transfer

FLC

Federal Laboratories & STATE AND LOCAL GOVERNMENTS

Partners for Technology Transfer Success

www.federallabs.org/sandlg

FLC

Prepared by the FLC Management Support Office in conjunction with FLC State and Local Government Committee Chair Belinda Padilla.

©2011 by Universal Technical Resource Services, Inc. Those portions of this work contributed by federal government personnel are not covered by copyright. The federal government may have certain rights in this copyright. Portions of this work may also be individually copyrighted.

As global and national economies get increasingly more competitive, regions, states and communities are forging stronger and more frequent public-private partnerships to ensure a viable edge. Promoting partnerships among local stakeholders, including research institutions, businesses, and local regional economic development entities, to obtain greater collective impacts is key to successful technology-based economic development.

In collaboration with state and local governments across the nation, federal laboratories are helping to facilitate projects that support the scientific and national missions of our national laboratories, while simultaneously contributing to local workforce enhancement and the dissemination of scientific knowledge and understanding. Increasingly, federal funding for research and development is supplemented and leveraged by states and the private sector to accelerate initiatives.

The latest figures available from the National Science Foundation's report of federal research and development obligations estimated that federal R&D obligations across the U.S. exceeded $108 billion dollars from 2006-2008. Nearly every state of the union has representation from the following 11 agencies:

- Department of Agriculture
- Department of Commerce
- Department of Defense
- Department of Energy
- Department of Health and Human Services
- Department of Homeland Security
- Department of the Interior
- Department of Transportation
- Environmental Protection Agency
- National Aeronautics and Space Administration
- National Science Foundation.

The Federal Laboratory Consortium for Technology Transfer (FLC) seeks to add value to all federal agencies, laboratories, and their partners to accomplish the rapid integration of research and development efforts into the mainstream of the U.S. economy. The FLC, through its State and Local Government Committee, is also tasked by federal legislation to assist regional, state and local organizations to better harvest value from the national laboratories.

The FLC coordinates its efforts through six geographic regions across the U.S to enable more intimate and regionally relevant resources. Through these regions, state and local government organizations are made aware of the benefits available to them through technology transfer partnerships and collaborations with federal laboratories.

Belinda Padilla
FLC State and Local Government Committee Chair

TABLE OF CONTENTS

Introduction Letter 1
Table of Contents 2
About the FLC 4
FLC Regions 5
FLC Technology Locator 62
FLC Member Directory 64

6 FAR WEST REGION

Assessing Pavements as a Highway Traffic Noise Reduction Strategy in Arizona 8
Safeguarding Radar From Wind Turbine Effects 10
California Department of Water Resources Partners With NASA to Confront Water Management Challenges 12

14 MID-CONTINENT REGION

Sandia Creates Science and Technology Park 16
Crossing the Chasm: NASA and Colorado in Unique Partnership to Accelerate Innovation in Aerospace and Clean Energy 18
Air Force Research Laboratory Holds New Mexico State and City Officials Day 20
Ultra-Light, Low-Cost Solar Concentrator Offers Unparalleled Efficiency and Performance 22

24 MIDWEST REGION

Military-to-Medical Partnership Challenges Young Entrepreneurial Students 26
University Market Research Supports Forest Products Commercialization in Wisconsin 28
Argonne Teams With the Illinois Tollway to Study Fuel Use 30

32 NORTHEAST REGION

Brookhaven National Laboratory Partners With New York State Government to Study Energy Policy 34

New York State Utilities Witness Smart Grid Technology Demonstration at Brookhaven National Laboratory 36

Brookhaven National Laboratory Contributes Scientific Expertise to Energy Storage 38

Jet Propulsion Laboratory Addresses Need for Health Monitoring Steam Pipes for Large Cities 40

USDOT Volpe Center Produces Recommendations to Reduce Delays at JFK Airport 42

Volpe Year In Review (all regions) 43

44 MID-ATLANTIC REGION

FLC Mid-Atlantic Region Fosters Technology Transfer 46

NASA Goddard and the University of Baltimore Introduce MBA Students to Tech Transfer Business Practices 48

Army Research Laboratory Teams With University System to Accelerate the Commercialization of University-Developed Technologies 50

NASA Goddard and Maryland TEDCO Partner to Stimulate Economic Growth 52

Chief Science Officer (CSO) Development Training Certificate Program 54

56 SOUTHEAST REGION

New UT/ORNL Center: Taking on the World's Energy Problems and Translating Intellectual Capital Into Economic Investment 58

Y-12 Proves the Power of Partnerships 60

FEDERAL LABORATORY CONSORTIUM
FLC™
FOR TECHNOLOGY TRANSFER

Advancing Federal Research and Technology

The Federal Laboratory Consortium for Technology Transfer (FLC), a nationwide network of over 250 federal laboratories, is the only government-wide forum for technology transfer (T2). Organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986, the FLC provides the framework for developing T2 strategies and opportunities by promoting and facilitating technical cooperation among federal laboratories, industry, academia, and state and local governments.

As the recognized leader in maximizing collaborative research for the transfer of technologies, the FLC enhances the socioeconomic well-being of the nation in the global marketplace.

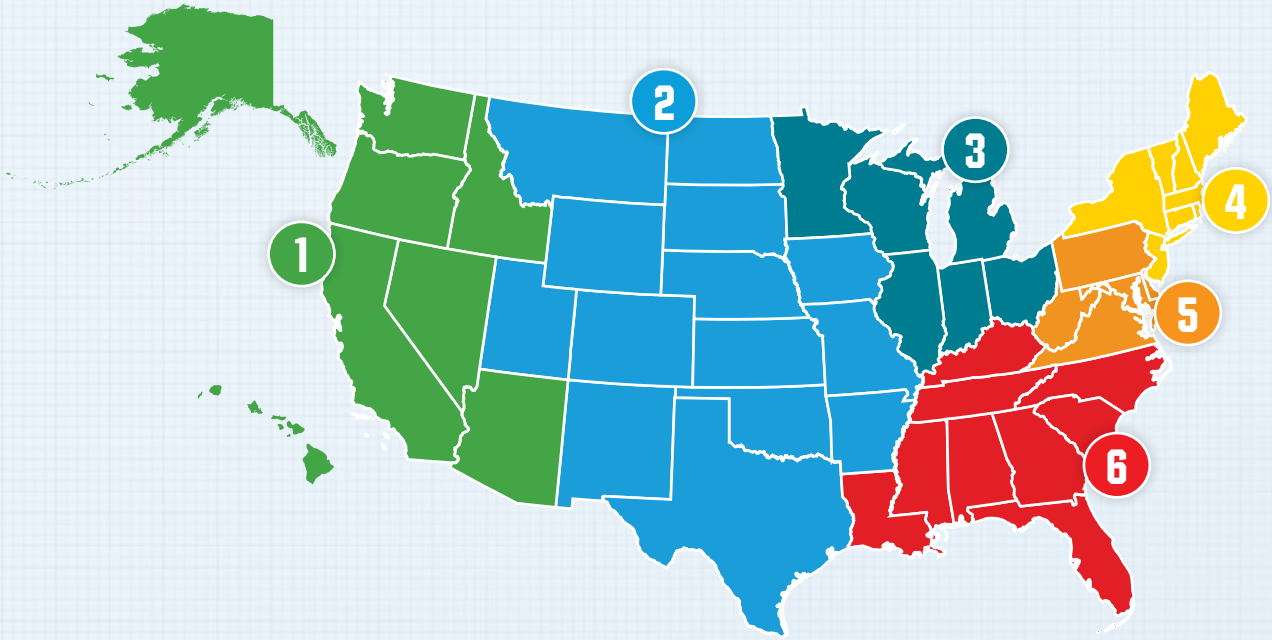
Industry, government, and academic personnel looking to strengthen their T2 capabilities to capitalize on the nation's investment, better their position in the marketplace, or research technology can look to the FLC to foster the rapid movement of federal laboratory research results into the mainstream of the U.S. economy. The FLC advances T2 by expanding communication among industry, government, and academia. The FLC's website, Technology Locator, T2 Desk Reference, *FLC NewsLink*, trade show exhibits, awards program, education and training publications, and network of experts are only a few of the tools it provides for successful T2.

The FLC is a consortium driven by the dedicated people of the federal laboratory system.

These people are the scientists, agency representatives, and T2 professionals who transfer federally funded technology and expertise to the marketplace. Serving as a gateway for industry, government, and academia to access research and development, the FLC also serves as a resource for T2 education and training, news, programming, awards, and initiatives.

www.federallabs.org

FLC Regions



1 FAR WEST

www.flcfarwest.org
Regional Coordinator: Ida Shum
Lawrence Livermore National Laboratory
925-423-9724
shum3@llnl.gov

2 MID-CONTINENT

www.flcmidcontinent.org
Regional Coordinator: J. Susan Sprake
Los Alamos National Laboratory
505-665-3613
sprake@lanl.gov

3 MIDWEST

www.flcmidwest.org
Regional Coordinator: Kristen Schario
Air Force Research Laboratory - Propulsion Directorate
937-255-3428
kristen.schario@wpafb.af.mil

4 NORTHEAST

www.flcnortheast.org
Regional Coordinator: Lewis Meixler
Princeton Plasma Physics Laboratory
609-243-3009
lmeixler@pppl.gov

5 MID-ATLANTIC

www.flcmidatlantic.org
Regional Coordinator: Paul Fritz
Naval Air Warfare Center Aircraft Division
301-342-5586
paul.fritz@navy.mil

6 SOUTHEAST

www.flcsoutheast.org
Regional Coordinator: Dr. Andrew Watkins
Centers for Disease Control and Prevention
770-488-8610
awatkins@cdc.gov

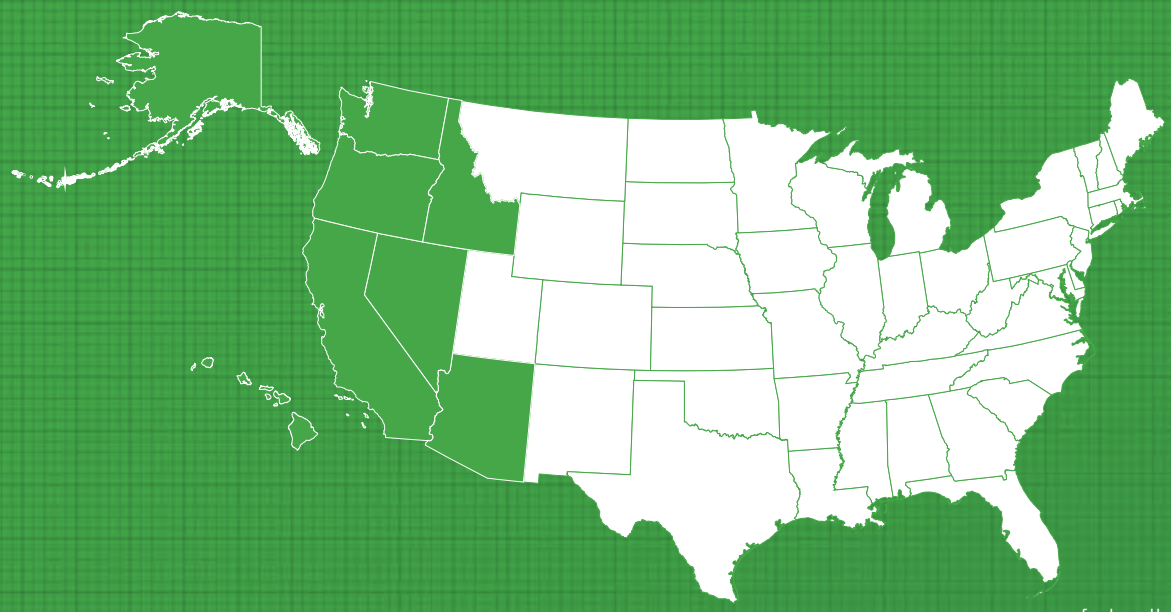
8

10

12

FAR WEST REGION

The Far West Region is one of six FLC regions covering the United States. The Region is comprised of eight western states: Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon and Washington. Among these states, there are over 100 federal laboratories and facilities representing over 27% of federal R&D obligations from 2006-2008. The Far West Region is rich in federal laboratory resources and programs in technology transfer. Successful projects range from reducing the noise from highway traffic to helping California manage its water resources.



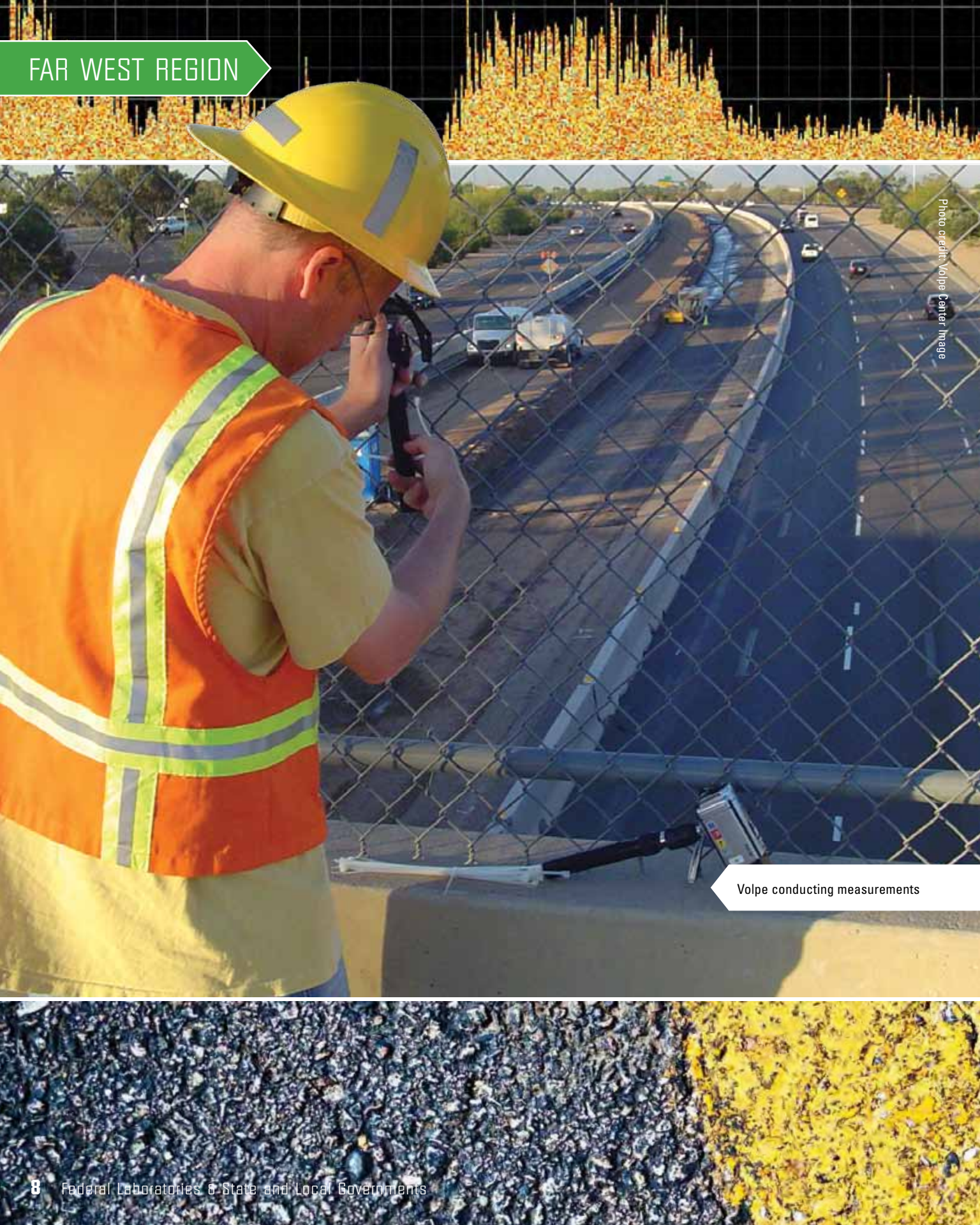


Photo credit: Volpe Center Image

Volpe conducting measurements

Assessing Pavements as a Highway Traffic Noise Reduction Strategy in Arizona

ARIZONA

Excessive levels of highway traffic noise affect people in houses, schools, parks, offices, and other facilities in the vicinity of the highways. A recent World Health Organization report states that "there is overwhelming evidence that exposure to environmental noise has adverse effects on the health of the population. At least one million healthy life years are lost every year from traffic-related noise in the western part of Europe." Transportation agencies typically construct noise barriers to reduce highway traffic noise and are always looking for additional noise reduction strategies. Due to the U.S. Department of Transportation, Research and Innovative Technology Administration, Volpe National Transportation Systems Center's expertise in tire-pavement noise issues and highway traffic noise prediction, two state transportation agencies asked the Center to assess various pavement types for vehicle and highway traffic noise levels.

The Arizona Department of Transportation (ADOT) asked the Volpe Center to conduct two studies. The first examined three different safety surface treatments for Portland Cement Concrete (PCC) and ranked these in terms of noise. The outcome resulted in a change of standard practice in Arizona to the quietest of the three surface treatments. The second study is part of the Quiet Pavement Pilot Program (QPPP), a research program partnering the Federal Highway Administration (FHWA) and ADOT, and is examining the noise-reducing benefit of rubberized asphalt over time. The QPPP allows ADOT to account for the benefits of quieter pavement in noise impact analyses and barrier designs.

The California Department of Transportation (Caltrans) also asked the Volpe Center to help conduct two studies. The first study examined various safety surface treatments for PCC and ranked these in terms of noise; the second examined five asphalt pavements. The noise reduction benefit of each pavement was investigated in terms of pavement age, pavement composition, and vehicle type. Ultimately, this study will contribute to a recommended pavement throughout the state.

These Volpe Center studies will influence the standard practice of pavement choice for highway projects, as well as the national policy on accounting for the effects of pavements in highway traffic noise impact prediction and analysis.

Volpe conducting measurements

Application of rubberized asphalt

Photo credit: Volpe Center Images

CALIFORNIA

Safeguarding Radar From Wind Turbine Effects

Soaring wind turbines that dot the nation's prairies and hills are reaching toward an ambitious U.S. goal of sustainable energy sources. With most of America's wind potential still untapped, wind farms will continue their robust expansion as developers build new turbines, often near airspace heavily used by multiple aircraft or in close proximity to military sites.

At Travis Air Force Base (Travis AFB) near Sacramento, Calif., safety personnel worried that proposed additions to local wind farms could negatively affect radar used to track aircraft, resulting in a shadowing effect from spinning turbine blades. Initial tests of an upgraded-to-digital radar system had alarmed Travis air traffic controllers, who observed nonexistent weather cells and planes that disappeared and reappeared on radar.

Additional upgrades resolved the disturbing readings, but the Air Force was still concerned about the lack of a widely accepted and validated assessment method to predict impacts of future turbine construction on radar systems. Any potential for radar degradation by the 700-plus rotating structures at nearby wind farms, as well as new turbines being proposed, was an important unknown. Travis controllers safeguard airspace traversed by about 1,000 civilian flights daily in addition to military flights.

Growing pressure in 2009 from economic interests to approve additional turbines mandated an expedited resolution to persistent Air Force concerns. The Air Force's Air Mobility Command (AMC) suggested a Cooperative Research and Development Agreement (CRADA), quickly bringing together multiple partners to develop the much-needed predictive modeling tool.

Initiated by the U.S. Transportation Command's (USTRANSCOM) Office of Research and Technology Applications in December 2009, the CRADA met its highest-priority goals within 42 days, with results that radar performance would not be unacceptably degraded with the additional turbines proposed. Before the CRADA, there was no mechanism for formal teaming of the parties, sharing of information, and utilizing the analysis to predict the impact. This teamwork is an example of how the military, business, and surrounding communities can come together to solve a problem with results that are beneficial to all parties.

The CRADA effort—recipient of a 2011 Federal Laboratory Consortium for Technology Transfer (FLC) Interagency Partnership Award—brought together USTRANSCOM, several Air Force entities, the three developers building the new turbines, and other federal partners that included the Department of Energy's Idaho National Laboratory and the Department of Transportation's Volpe Center. Additional private-sector collaborators provided technical support, while cooperation from Solano County officials strengthened the partnership.

CRADA partners obtained baseline radar data and simulated the electromagnetic impact of the pending turbines, manipulating a digital filter in Travis AFB's radar system to quantify the best and worst-case scenarios. One major accomplishment was to set a baseline probability of detection (Pd) value, setting a minimum standard below which air safety is compromised. The CRADA partners are continuing their collaboration to validate the predictive model by collecting data after the new turbines are operating, to compare actual impact with the predicted impact.

Lessons learned have been shared with other government agencies, increasingly important as wind energy evolves into a sought-after renewable energy source. The CRADA's success, which ensures air safety and promotes sustainable energy, confirms the power of collaboration among partners with potentially conflicting interests.

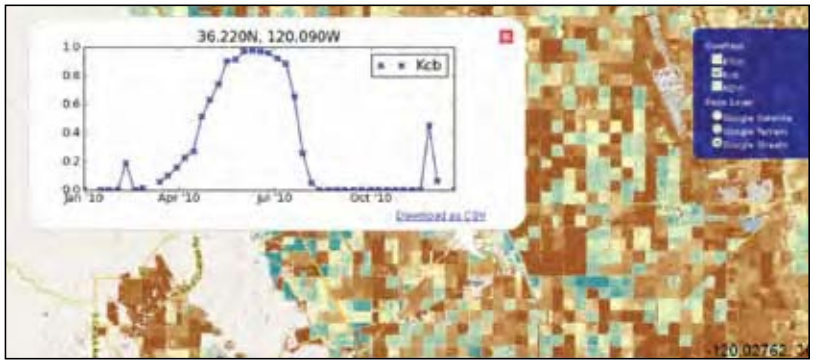
CALIFORNIA

California Department of Water Resources Partners With NASA to Confront Water Management Challenges

Water managers in California are faced with ever-increasing challenges as they attempt to balance competing demands for California's limited water supplies from agricultural producers, industry, environmental uses, and a population of 37 million people. Three years of severe drought (2007-2009) were followed two years later by a snowpack that set new records for late spring and early summer snow depths—which now poses a significant threat for creating floods in the Sacramento and San Joaquin Valleys. In responding to these challenges, NASA and the California Department of Water Resources (CDWR) formed a partnership to investigate and develop new applications of NASA technologies. Through this partnership, NASA science teams from Ames Research Center (ARC), the Jet Propulsion Laboratory (JPL), and Marshall Space Flight Center (MSFC) worked with technical experts at CDWR to apply NASA technologies and data to address a broad range of CDWR information needs. The partnership developed new data systems that integrate NASA technologies to provide a range of new information products to water managers and water users in California.

One of the primary challenges facing water managers in California is the effect of the formation and depletion of snow melt on seasonal water supply. Decisions about water releases from reservoirs around the state are determined in part by models that predict runoff from snow melt over the course of the spring and summer. Using data from the MODIS instrument onboard the NASA Terra and Aqua satellites, and snow melt models developed by JPL, NASA and CDWR developed a new approach for continuous monitoring of Sierra Nevada snow pack. This new approach provides a means to evaluate snowpack water storage across the watershed at various elevations, ultimately providing the foundation for the next generation of hydrologic modeling and management tools.

Responding to California's water management challenges requires not only information about the state's water supply, but also information on where water is needed and when. As such, accurately estimating the irrigation demand is critical to move water efficiently to agricultural producers. To improve monitoring of irrigation demand, NASA

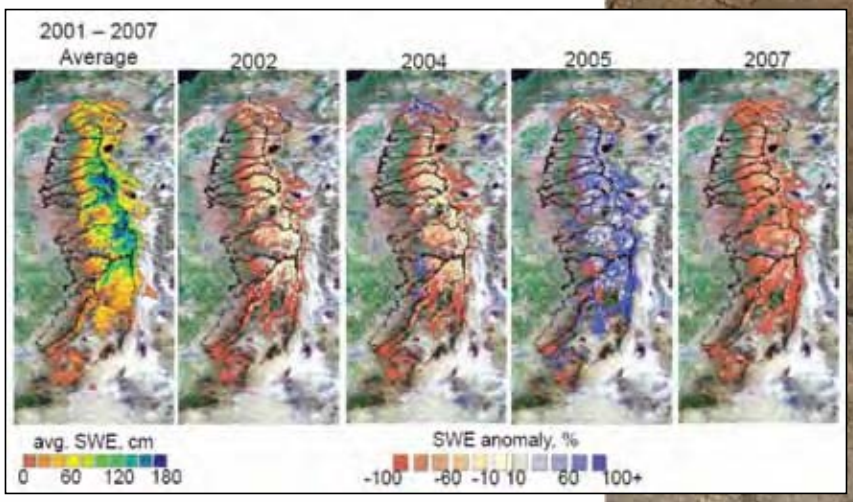


The TOPS Satellite Irrigation Management Support web interface, showing maps and seasonal profiles of crop canopy conditions, crop coefficients, and irrigation demand (basal crop evapotranspiration — ETcb)

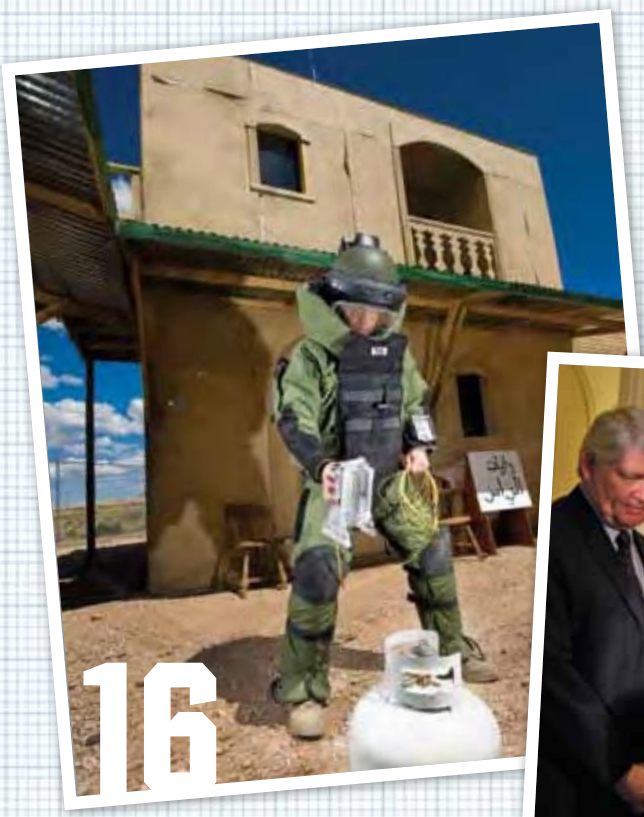
Photo credits: CDWR

and CDWR applied NASA satellite observations to extend the California Irrigation Management Information System (CIMIS). CIMIS includes 125 weather stations operating around California, and provides hourly information statewide on reference evapotranspiration, a key measure of crop irrigation demand. Building on past work by USDA and NASA, scientists at NASA worked with the CDWR CIMIS team and implemented an automated data processing system that runs on computer resources at the NASA Advanced Supercomputing Facility at Moffett Field, Calif.

Partnerships between agencies can require many years to build, and the NASA and CDWR teams have worked closely to accelerate this process. As a result, in just a few years they have developed a number of innovations that offer substantial promise for improving water management in California. Most importantly, the partners worked to develop a strategy for sustaining the partnership over the long term, and to ensure successful transfer of new information products from research to operations.

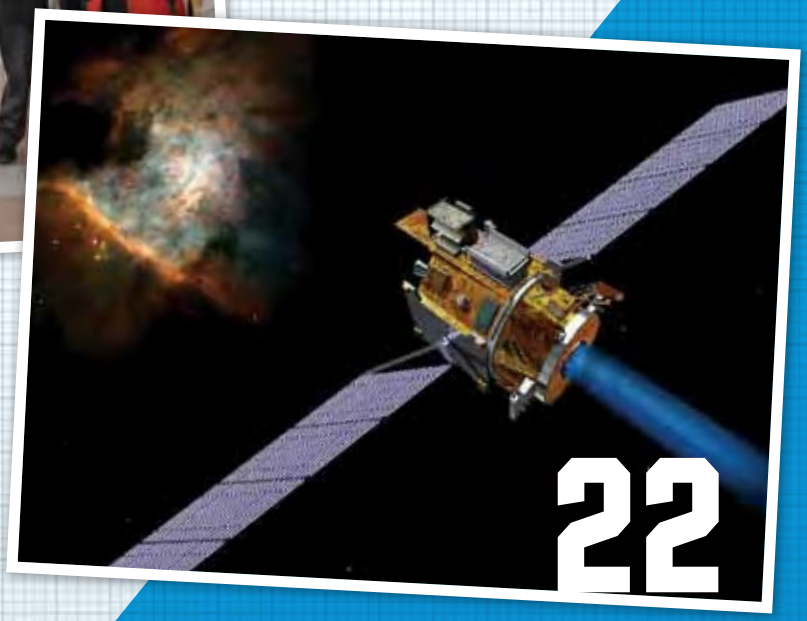


Maps of anomalies in snow water equivalent for the Sierra Nevada for 2001-2007


16

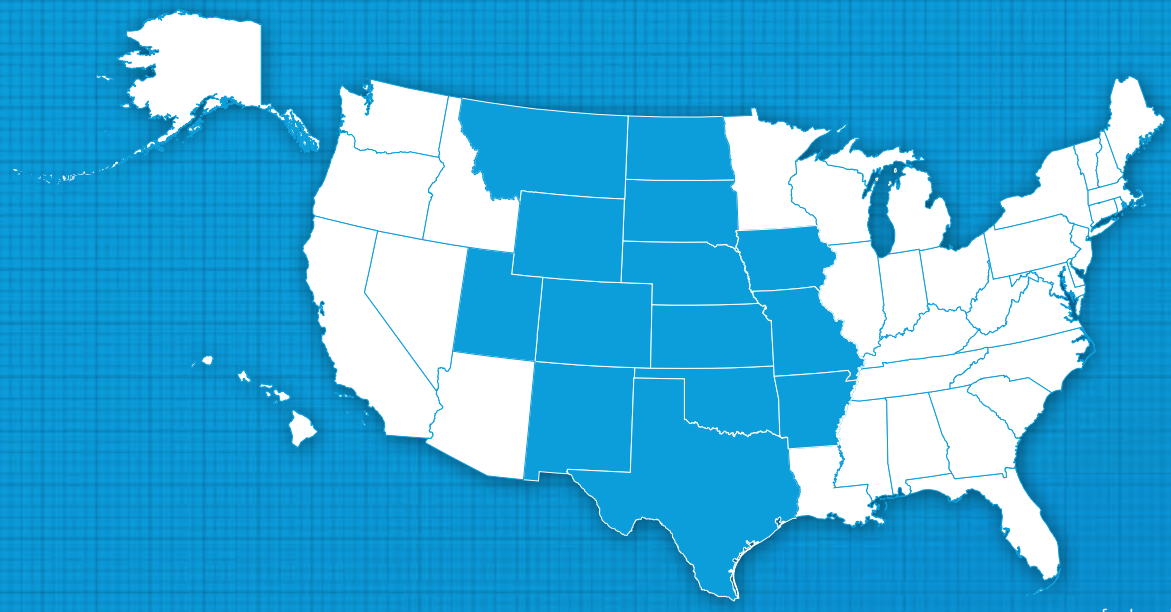
18

20


22

MID-CONTINENT REGION

The Mid-Continent Region covers 14 states, including Arkansas, Colorado, Iowa, Kansas, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming. The over 100 federal laboratories in this region represent approximately 13% of federal R&D obligations from 2006-2008. Consistent with the charter of the other FLC regions, the Mid-Continent Region often serves as a "matchmaker" between federal resources and public needs. These services can include licensable technologies, free technical assistance, and partnering opportunities. Highlights in this region include innovative partnering mechanisms such as research parks adjacent to national laboratories and a technology acceleration program that seeks to advance innovation in aerospace and clean energy.



Airman 1st Class Patrick Connolly of Dayton, Ohio, demonstrates placement of the Stingray, a water disruptor developed at Sandia National Laboratories by TEAM Technologies, near its target in a simulated village used to train soldiers heading overseas.

Photo credit: Randy Montoya, courtesy of Sandia National Laboratories

Sandia Creates Science and Technology Park

NEW MEXICO

Companies often prefer to be located in close proximity to their partners or their customers. When their partner or customer is a national or federal laboratory, this can be challenging due to security precautions at the laboratories.

Sandia National Laboratories (SNL), in partnership with several public-private partners, launched the Sandia Science & Technology Park (SS&TP) in response to many requests by SNL partners who wanted to be located close to the laboratories. The SS&TP is an internationally recognized 340-acre technology community affiliated with SNL and widely acclaimed for its public-private partnership, as well as its role in technology-based economic development.

When SNL initiated the SS&TP in 1998 as a partnership and technology transfer tool for the laboratories, Albuquerque and the State of New Mexico were two of the original partners who supported creation of the park. While SNL was the primary draw for companies wanting to be in the SS&TP, both the city and the state provided grants and critical infrastructure improvements, ensuring that the SS&TP was properly developed. The city provided the first monies, which paid for a conceptual design and market survey for the Park. Since then, streets have been built out and roads have been improved, and mayoral and City Council leadership continue to offer support. The State of New Mexico provided funding for two pocket parks, a monument sign, landscaped medians, and street signs. The Governor's office and State Legislature also continue to provide leadership in support of the park.

The results from this partnership between a federal laboratory and state and local governments are exceptional. Since SS&TP's inception, 31 companies/organizations have moved in, almost 2100 people are employed there, and more than $350 million has been invested. The average annual salary for jobs at SS&TP is more than twice the New Mexico average. SS&TP-based operations have paid $2.3 billion in wages and salaries. The mayor of Albuquerque has praised SS&TP "for helping bring high-paying research and development jobs to Albuquerque and for revitalizing a portion of the southeast heights."

Several SNL technology transfer and commercialization successes are directly associated with the SS&TP. EMCORE Corporation, a publicly traded company that moved its corporate headquarters to SS&TP, has licensed solar cell and transponder technologies from the laboratories. The firm currently manufactures solar cells for satellites at its SS&TP facility; more recently, it has begun to build terrestrial-based concentrator photovoltaic arrays here as well.

TEAM Technologies, a small business located in SS&TP, licensed technology from SNL to develop Stingray, a device that shoots a thin blade of water capable of penetrating steel and disabling deadly improvised explosive devices (IEDs). Over 7000 units of this product have been shipped to Afghanistan to support U.S. soldiers.

New Mexico State Senator Tim Keller summed it up best when he said, "The Sandia Science & Technology Park is a role model for economic development in New Mexico. The Park's thousands of jobs, millions in economic impact…are all a testament to the value of the state, city, and laboratory partnership…"

Photo credit: Sandia National Laboratories

COLORADO

Crossing the Chasm: NASA and Colorado in Unique Partnership to Accelerate Innovation in Aerospace and Clean Energy

Startup companies are the heart and soul of innovation, and they contribute significantly to America's innovative economy, the creation of jobs, new technologies, and economic growth. As startups try to mature into viable commercial ventures, they face a multitude of challenges before scaling up from one-off prototypes to manufacturing. Financial as well as other forms of capital are critical for success: physical (plant and equipment); intellectual (knowledge and skills); and social (access to common social networks). To address these needs, NASA and multiple Colorado organizations formed a partnership in December 2010, for the Aerospace and Clean Energy (ACE) Regional Innovation Cluster, to help Colorado clean energy and aerospace companies achieve product scalability and manufacturability through technology acceleration. NASA joined with the Colorado Association of Manufacturing and Technology (CAMT), the National Institute of Standards and Technology (NIST), the National Renewable Energy Laboratory (NREL), and the State of Colorado in December 2010 to create a technology acceleration program (TAP) with several unique aspects:

- A focus on the technology synergy between space exploration and clean energy
- The development of a multi-industry regional innovation cluster
- Leveraging existing federal, state, regional and local investments, and including small- and large-scale industry, state universities and nonprofit sectors that drive innovation.

"New technology development doesn't start in Washington, it starts in high-tech regional innovation clusters like the one being created through the Colorado Technology Acceleration Program and the Aerospace and Clean Energy Park," said NASA Deputy Administrator Lori Garver. "This initiative will leverage Colorado's existing competitive strengths to boost economic growth while creating new jobs and products for aerospace and energy industries."

The ACE Regional Innovation Cluster offers several programs to help manufacturers streamline the crucial transition of research and development (R&D) to widespread market penetration. These programs include a Government Programs and Grants Office, supplier scouting, and asset mapping. NASA will locate a representative onsite to ensure direct links to resources and technologies from the ten NASA Centers.

A physical extension of the ACE Regional Innovation Cluster is the ACE Manufacturing and Innovation Park, a 200-acre, privately developed manufacturing campus that will bring together nearly 100 companies. Tenants will benefit from shared onsite services, including those from federal labs such as NASA and NREL, and a collaborative environment to accelerate the commercialization of new technology-based products. The park's centerpiece will be a 100,000-square-foot shared services building that will:

- House an advanced manufacturing lab
- Provide collaboration space for manufacturing
- Offer educational programs, such as workforce development
- Develop a consumer showcase of 21st century technologies.

CAMT CEO Elaine Thorndike delivers remarks at the Colorado State Capitol, prior to the signing of the agreement.

Photo credit: Bill Ingalls, courtesy of NASA

"New technology development doesn't start in Washington, it starts in high-tech regional innovation clusters like the one being created through the Colorado Technology Acceleration Program and the Aerospace and Clean Energy Park..."

Lori Garver, NASA Deputy Administrator

NASA Deputy Administrator Lori Garver delivers remarks at the Colorado State Capitol, prior to signing of the agreement.

"CAMT's goal for this initiative is to create 10,000 direct jobs in the next five years," said Elaine Thorndike, CAMT CEO. NASA plans to replicate this partnership model in additional regions to drive economic growth and strengthen aerospace and energy supply chains. NASA also intends to look for additional opportunities to strengthen the U.S. economy by partnering NASA technology with other industrial and research sectors, such as bio-agriculture and robotics.

CAMT CEO Elaine Thorndike, seated left, and NASA Deputy Administrator Lori Garver, seated right, sign an agreement at the Colorado State Capitol in Denver on Dec. 13, 2010, that created a Technology Acceleration Program and Regional Innovation Cluster for Aerospace and Clean Energy. Looking on from left, Colorado Office of Economic Development and International Trade Executive Director Don Marostica, Colorado State Representative Su Ryden, Colorado State Senate President Brandon Schaffer, Representative from U.S. Senator Udall's office Jimmy Haugue, NIST/MEP Director Roger Kilmer and Colorado State Governor Bill Ritter.

Jim Goodding, an Air Force Research Laboratory contractor from Moog CSA Engineering, explains how the evolved expendable launch vehicle secondary payload adapter allows secondary satellites to share a ride to space, reducing the cost of space travel.

Photo credits: Anita Collins, courtesy of AFRL

Air Force Research Laboratory Holds New Mexico State and City Officials Day

NEW MEXICO

On April 5, 2011, the Air Force Research Laboratory's (AFRL) Directed Energy and Space Vehicles directorates, both located at Kirtland Air Force Base, New Mexico, hosted 22 state, county, and city dignitaries for a tour of AFRL's laboratories and a review of its technology capabilities. The Directorates developed the concept of a New Mexico State and City Officials Day to expand the state and city leaders' knowledge of AFRL and the laboratory's economic impact on New Mexico.

The New Mexico State and City Officials Day offered the opportunity for New Mexican state officials and Albuquerque city leaders to see and touch the laboratory's latest technologies. AFRL scientists explained their technology research efforts in support of the nation, and demonstrated a plug-and-play satellite, over-the-horizon relay mirror for laser imaging and non-lethal, millimeter wave technologies.

Included among the distinguished visitors were the state auditor; representatives from each of New Mexico's congressional delegations; representatives from the Albuquerque mayor's office; and several other city officials and industry and university leaders.

The AFRL Directorates were delighted to showcase the laboratory's technology and plan to host similar events on an annual basis. The Directorates believe it is important to convey to New Mexico officials and leaders the contributions of AFRL to New Mexico. "The Air Force Research Laboratory has a tremendous impact on New Mexicans and the state economy," said Cynthia Kaiser, chief engineer for AFRL's Directed Energy Directorate. "These two labs employ 1,600 professionals and have a combined budget of over $700 million, with most of the funds placed on contracts."

The Space Vehicles Directorate is the U.S. Air Force's center of expertise for space research and development. Three distinct units form the Directorate's core operations: the Battlespace Environment Division specifies, forecasts, mitigates and exploits environmental impacts to U.S. space systems and operations; the Spacecraft Technology Division develops next-generation spacecraft bus and payload technology elements to reduce cost, improve performance, and enable new missions; and the Integrated Experiments and Evaluation Division works to develop and integrate ground, space and near-space experiments designed to assess and prove emerging technologies and concept of operations for military space applications.

Colonel William Cooley, Air Force Research Laboratory Space Vehicles Directorate director, discusses the purpose of New Mexico State and City Officials Day and the economic impact the Air Force Research Laboratory has on the state with Albuquerque television reporter Crystal Kobza.

Diane MacAlpine, deputy director of the Air Force Research Laboratory's La Luz Academy, demonstrates the concept of solar wind with a Van de Graaff generator for New Mexico State and City Officials Day visitors.

The Directed Energy Directorate is the U.S. Air Force's center of expertise for directed energy technology. It researches technologies related to high energy lasers, high power microwaves, beam control, space situational awareness, and modeling and simulation. Research focuses on enhancing warfighter capabilities in force protection, long-range strike, precision engagement, and space situational awareness. Directed Energy technology complements traditional bullets and bombs to provide an integrated dominance that is essential for national defense.

TEXAS

Ultra-Light, Low-Cost Solar Concentrator Offers Unparalleled Efficiency and Performance

Technology developed through multiple, related Small Business Innovation Research (SBIR) contracts with Entech® Solar, Inc., in partnership with NASA's Glenn Research Center (GRC) has produced a high-performance, ultra-light solar concentrator for space and ground applications. The Stretched Lens Array (SLA) uses a thin film lens to concentrate a large area of sunlight onto a small area of photovoltaic (PV) cells, with simple waste heat rejection performed by a thin sheet of thermally conductive material beneath the cells. This record-breaking technology offers unprecedented performance and cost-effectiveness by employing flexible Fresnel lenses for optical concentration, minimizing solar cell area, mass, and cost. The SLA has been optimized for the best performance, reliability, and efficiency through NASA's award-winning space demonstration on Deep Space 1. On the ground, the same basic concept is now being used with the commercial launch of Entech Solar's new terrestrial product, the SolarVolt™ module.

The SLA is a unique technology that uses ultra-thin arched Fresnel lens concentrators to focus sunlight onto high-efficiency solar cells. Although the materials are different, the fundamental design is similar for space and ground PV concentrators. In space, the need is to minimize weight, while the focus on the ground is to reduce cost. The material efficiency of the SLA is critical to both. Space modules have used specially qualified silicone lenses focusing sunlight onto multi-junction solar cells mounted to thin carbon-fiber composite radiators. The terrestrial SolarVolt module (40" x 65" x 6") uses lower cost acrylic lenses to focus sunlight onto high-efficiency, low-cost crystalline silicon cells. Hundreds or thousands of SolarVolt modules can be installed in large arrays for utility-scale applications.

Commercial applications for the SLA technology include utility-scale power plants, distributed energy for smart grid systems, communications systems, industrial building power systems, and military power systems. Space applications include NASA exploration missions; solar power high radiation environments; orbit raising or lowering of spacecraft for science missions around the Earth, moon, and asteroids; and solar electric propulsion to advance thruster systems that minimize chemical use.

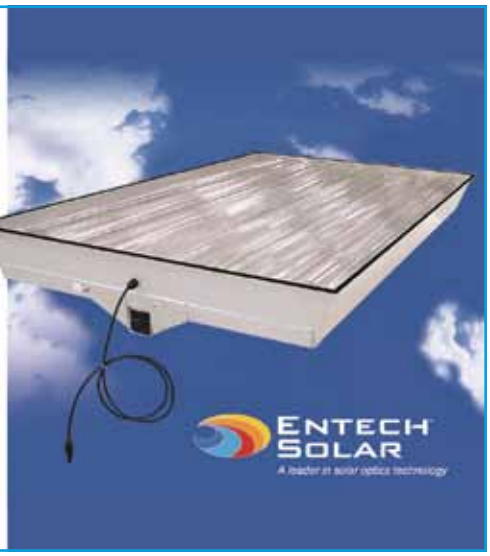
In the late 1970s and early 1980s, Entech Solar (then Entech, Inc.) developed a solar power concen-

The highly successful asteroid/comet rendezvous mission, Deep Space 1, demonstrated the performance and long-term durability of the solar array design and laid the foundation for further improvements.

Photo credit: Courtesy NASA

Benefits of Technology Transfer

- Record-breaking solar array efficiencies of approximately 30 percent will be achieved in SLA space-optimized designs.
- PV material will be reduced by more than 90 percent, compared to one-sun modules, significantly reducing the concentrator system cost for both space and ground applications.
- Dramatic decreases in cost per watt will be realized due to PV material reduction, making the SolarVolt module a reliable, low-cost green energy system.
- Powerful concentration (10X for space missions and 20X for terrestrial uses) will deliver unparalleled performance across a broad range of applications.
- U.S.-based jobs will be created as Entech Solar implements its mass production plan for the SolarVolt manufacturing facility. In addition, hundreds of construction jobs would be created to build each utility-scale PV power plant using this NASA-derived technology.



trator for terrestrial applications that was spun into a space concentrator in the late 1980s. Collaborative work among NASA, the Ballistic Missile Defense Organization, and Entech continued through the 1990s, culminating in the Solar Concentrator Array with Refractive Linear Element Technology (SCARLET) design, which was used on NASA's New Millennium Deep Space 1 mission (1998-2001). That highly successful asteroid/comet rendezvous mission demonstrated the performance and long-term durability of the solar array design and laid the foundation for further improvements. Additional NASA-funded programs in the 2000s enabled Entech and its development partners from NASA, the Department of Defense, and the aerospace industry to refine the SLA for space applications.

The benefits of SLA technology have led to its spinout for terrestrial use (the SolarVolt module), as well as continued exploration of its use in space, especially for solar electric propulsion applications, deep space missions, and high radiation environments.

Spanning three decades and counting, the NASA-industry SBIR collaborative work on the SLA continues as NASA Glenn innovators work with Deployable Space Systems, Inc. (DSS), based in Goleta, Calif., to develop the Stretched Optical Lens Architecture on Roll-Out Solar Array (SOLAROSA), a fusion of the Entech Solar SLA concentrator technology with DSS's lightweight deployable structural platform. Ad Astra Rocket Co. of Webster, Tex., is interested in using the SOLAROSA to support its Variable Specific Impulse Magnetoplasma Rocket (VASIMR™) engine, an advanced plasma propulsion system with the potential to support an emerging in-space transportation market.

> *"The story of this technology is absolutely about the Entech-NASA partnership. It was NASA's need for a smaller, lighter weight, inexpensive technology that drove the work and pushed the envelope to achieve these extraordinary results."*
>
> Roshanak Hakimzadeh, Deputy Chief Technologist, NASA's Glenn Research Center

Entech Solar is planning to commercialize the SolarVolt module in 2012. The technology is currently undergoing International Electrotechnical Commission (IEC 62108) certification testing, and is protected by a number of issued and pending patents. The company is completing manufacturing scale-up plans, both in-house and at key suppliers, which will create U.S.-based jobs as it implements its mass production plan.

Entech Solar of Fort Worth, Tex., is a leading developer of solar energy technologies and sustainable daylighting solutions. The company designs, manufactures, and markets concentrating PV solar modules that produce electricity from sunlight. The Entech Solar team has been developing, field testing, refining, and commercializing Fresnel lens concentrators for more than three decades.

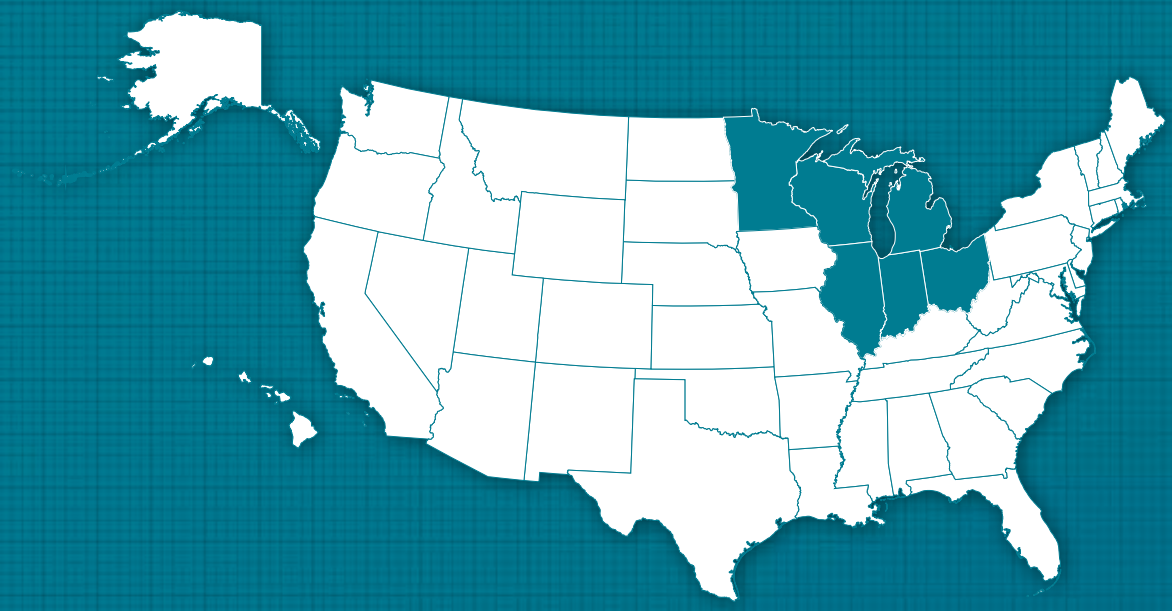
26

28

GREEN RACING
30

MIDWEST REGION

The Midwest Region comprises Ohio, Indiana, Illinois, Michigan, Wisconsin, and Minnesota. Within this region, more than 30 facilities conduct federal research and development in a wide range of topics. Approximately 8% of federal R&D obligations are invested in the Midwest. From the examination of the smallest particles in the universe to the development of new engine lubricants to alternative manufacturing processes, each facility in the Midwest Region is involved in expanding the bounds of knowledge and our nation's technical capabilities. The Midwest Region's mission is to link government scientists with each other and with appropriate commercial, industrial, and academic partners so that technologies developed in federal laboratories may be widely disseminated throughout the Region, the nation, and the world.



Expanding on the initial military patent, Ball State students Sean Linehan and Dawn Savidge recognized the potential of the simulant to provide more realistic models for medical personnel to practice surgical techniques. Most doctors, nurses and medical students currently practice on unrealistic, plastic body parts or expensive human cadavers.

Photo credit: BSU Photo Services

Military-to-Medical Partnership Challenges Young Entrepreneurial Students

INDIANA

Taking patented military technologies and creating products for commercial use is the goal of a partnership between Naval Surface Warfare Center, Crane Division (NSWC Crane) and Ball State University's Entrepreneurship Center.

Through an Educational Partnership Agreement (EPA), Ball State entrepreneurial students work directly with NSWC Crane scientists and engineers to research and identify commercial opportunities for technology and intellectual property (IP) developed and patented by NSWC Crane for military use.

In a best-case scenario, a new technology is licensed and a new company is developed through the technology transfer initiative, as in the case of the simulated skin project.

Previously, the military needed an updated, realistic method to accurately test the impact of nonlethal munitions on human skin. NSWC Crane scientist Dennis Jones developed a skin and tissue simulant made of a gelatin composite block to represent tissue wrapped in a polyurethane sheet to mimic human skin. The simulant was patented in 2007 and currently is used in ballistics testing.

Expanding on the initial concept of the patent, two Ball State students recognized the potential of the simulant to provide more realistic models for medical personnel to practice surgical techniques. Most doctors, nurses and medical students currently practice on unrealistic, plastic body parts or expensive human cadavers.

The students, Sean Linehan and Dawn Savidge, worked with NSWC Crane to expand on the patented technology, as well as interviewed medical personnel to gain specific insight for transitioning the product.

"Our research has found nothing that comes as close to simulating human skin as this product," said Savidge. "We talked to several respected people in the medical field, including one doctor who recalled he had practiced his suturing skills on a towel wrapped around a sponge."

Called "Sim Skin," the product will come in various shades and thicknesses to represent human aging, and it can be molded around artificial limbs to create numerous body parts. The students created a model leg and are working with an industry partner to develop a better prototype of the leg, as well as other body parts.

The market for Sim Skin is extensive. The students' research shows that there are nearly 16,000 medical centers in the U.S.; and within Indiana, 19 colleges and universities have medical programs. Both students will graduate in 2011 and plan to create a startup company, Forefront Industries, soon after. Linehan and Savidge would like to see Sim Skin on the market by 2012.

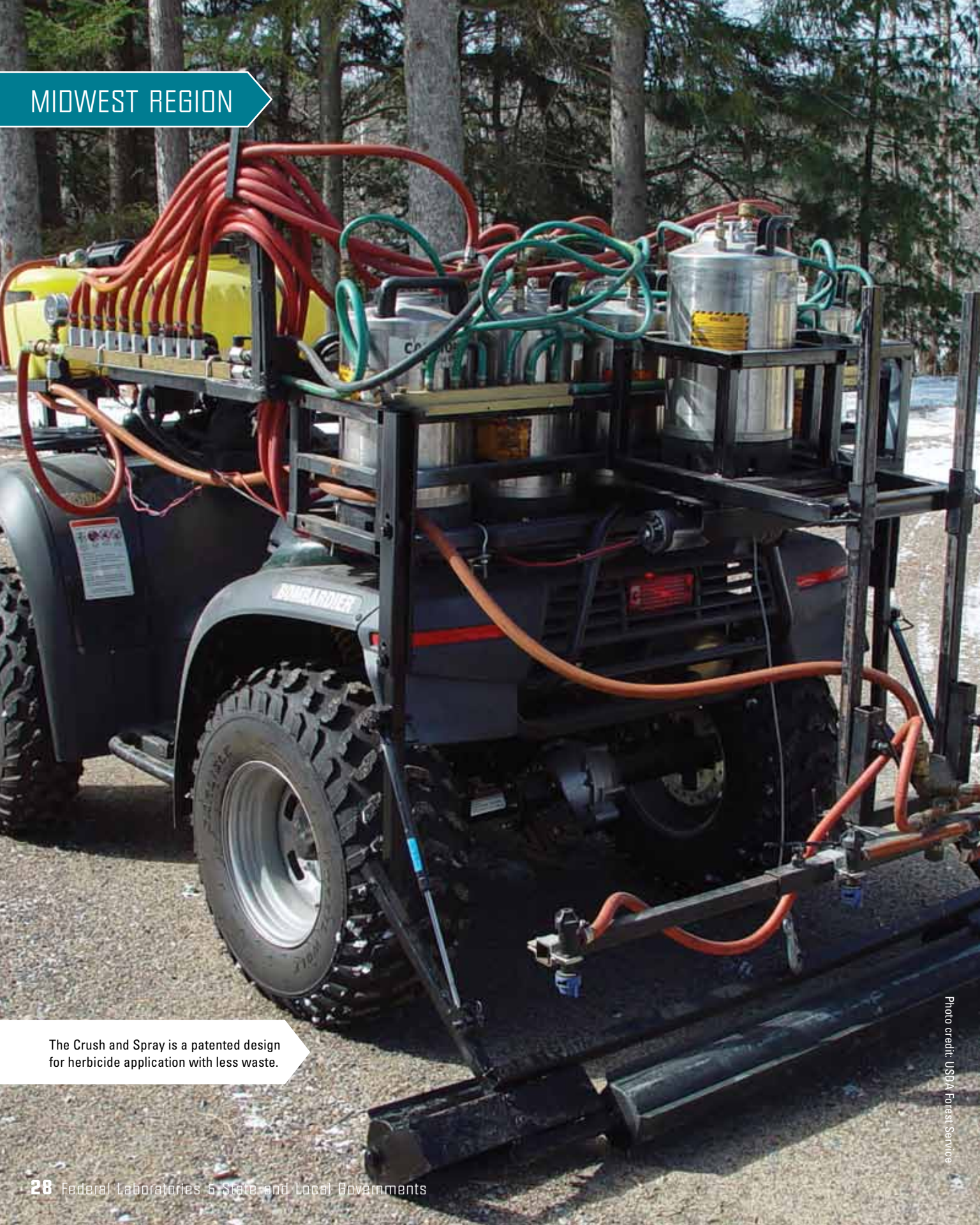
U.S. News & World Report ranks Ball State's entrepreneurship program as the No. 1 college class that impacts the outside world. The program includes a Military-2-Market (M2M) option where students research and identify commercial opportunities for technologies and IP developed for military use.

To fulfill the program's M2M option, Ball State looked to NSWC Crane for advanced military technologies. Through a technology transfer mandate that requires the exploration of shifting military innovations to the commercial market, NSWC Crane is able to provide access to previously patented technologies. As a result of the partnership, the Center receives a thorough assessment of a technology's commercialization potential, while students have real-world products on which to base their business plan and proposals.

> *"Our research has found nothing that comes as close to simulating human skin as this product."*
>
> Dawn Savidge

"This program not only benefits the students, but the licensing and production of new technologies from previous Crane work is truly remarkable," said NSWC Crane Technology Transfer Program Manager John Dement. "Working with Ball State has already resulted in several leading-edge ideas; I am excited to see what is next."

As a federal research laboratory leader, NSWC Crane offers access to its expertise and state-of-the-art facilities for economic development and job creation. NSWC Crane's research and development efforts support the warfighter by providing capabilities and resources to advance technologies for both military and commercial use.



The Crush and Spray is a patented design for herbicide application with less waste.

Photo credit: USDA Forest Service

University Market Research Supports Forest Products Commercialization in Wisconsin

WISCONSIN

Since 1980, the Wisconsin Innovation Service Center (WISC) at the University of Wisconsin-Whitewater (UW-W) has supported new product development and commercialization by providing top-notch market research to inventors and manufacturers.

WISC conducts market research for seven to ten U.S. Department of Agriculture (USDA) Forest Service projects a year. According to WISC market research manager Sandra Beccue, "Forest Service projects are always intriguing and fun to work on because the investigators at the labs have really good ideas for innovative products."

Turning research results into marketable products for the benefit of society is the ultimate goal for Forest Service research laboratories; however, it presents a challenge. Market information and patents needed to bring new products to market successfully can be difficult and expensive to obtain. The market research conducted by WISC benefits the Forest Service patent review committee, which is charged with making patenting decisions for each new Forest Service invention.

According to Janet Stockhausen, patent advisor for the Forest Service's Patent & Licensing Program, "The New Product Assessments prepared by WISC have helped the Patent Committee to make better decisions regarding which inventions have the potential to succeed in the marketplace."

WISC managers also advise students in the UW-W Small Business Consulting Class taught by WISC director Ronald "Bud" Gayhart. Students in this class complete experiential learning projects that provide valuable assistance at no cost to the client. This year, a student team provided commercialization research on two USDA Forest Service inventions.

Aware of the USDA Agricultural Research Service's success in working with university students, Stockhausen contacted Jack Heinemann, director of the Wisconsin Security Research Consortium (WSRC). WSRC focuses on matching federal research developments with businesses that can use them.

"Our goal is to commercialize technologies developed by federal laboratories by getting them into production at an existing company or by starting a new company," said Heinemann. "By working with university classes, students get the opportunity to work directly with researchers and scientists."

Heinemann connected Stockhausen with UW-Whitewater Small Business Consulting class instructor Bud Gayhart, who arranged for a student team to conduct market research and identify potential licensees for two patented Forest Service technologies.

According to Gayhart, such collaborations are widely beneficial. "There is so much intellectual property coming out of federal labs. We're looking to accelerate the process of finding pathways to the marketplace and growing businesses while also affording students the opportunity to learn firsthand the challenges that businesses face."

Commercializing patented technology developed in federal labs provides the opportunity for business growth as well as providing a return on the taxpayers' investment. As a result of the students' research this year, several manufacturers interested in collaboration and exploring licensing options were identified. Contact information for those companies was provided to the Forest Service for followup. Stockhausen anticipates increased success finding potential licensees for Forest Service inventions.

The Accessible Handpump for campgrounds operates with no more than five pounds of force.

Photo credit: USDA Forest Service

ILLINOIS

Argonne Teams With the Illinois Tollway to Study Fuel Use

A partnership between Argonne National Laboratory (ANL) and the Illinois Tollway Authority (ITA) has been formed to study fuel consumption reductions across the ITA's fleet of vehicles. ITA, which is providing $150,000 toward the study, aims to reduce the state's fuel use and costs, as well as maximize the efficiency and sustainability of its roadway operations. The fleet consists of 725 vehicles, including the Illinois State Police District's 15 squad cars. ITA spends $2 million a year on gasoline, and reducing fuel use by 1 percent will save $20,000 annually.

This project involves a study of the state's police fleet to identify operations where gasoline consumption can be reduced in highway patrol cars. ANL will perform controlled laboratory studies in its Advanced Powertrain Research Facility to determine fuel usage for each operation. The study will use an unmarked patrol car outfitted with special sensors that measure electrical load from devices such as radios, emergency lights, onboard computers, video cameras and radar units. Further, the fuel used to power the cabin air conditioning and heat will be isolated and measured during idling in both hot and cold weather.

Concurrently, ANL researchers will install instrumentation in an equivalent patrol car on loan from Illinois State Police District 15, monitoring its daily operations on both rural and urban patrols, and gathering the same data measurements on critical ve-

Photo credit: Argonne National Laboratory

Eric Isaacs, ANL Lab Director, and Kristi LaFleur, Director for the Illinois Tollway Authority, discuss the new project to investigate fuel savings technologies for implementation on the Illinois Tollway fleet.

Photo credit: Argonne National Laboratory

Illinois Congressman Mike Quigley (left) peers into the engine of an Illinois Tollway vehicle that is being instrumented at Argonne's Advanced Powertrain Research Facility. District Director Aviva Gibbs (back, left), Legislative Director Lindsey Matese (back, right), and Argonne researcher Norm Peterson (back, center) look on.

hicle functions during actual service for later analysis. Data from both patrol cars will be compared and used to determine cost-effective fuel saving strategies that can be implemented without impairing police vehicle use.

Using the collected data, ANL will develop idling reduction technologies that will allow state troopers to use radar, communications, computers, and air conditioning with the engine turned off. Currently, patrol cars need to leave the engine idling in order to use heat, radar, and computers. Idling increases gasoline use and contributes to greenhouse gas emissions. Research results may also suggest other changes to vehicles or driver behavior that can reduce fuel consumption.

This research effort is also part of a strategy to develop a regional application for other municipal fleets. The project is expected to take a full year to allow testing of the patrol cars during all four seasons. The tools that ANL will develop will be far superior to available commercial auto manufacturers' tools and may benefit consumer vehicles in the future.

This is the first research project to come out of a three-year collaborative agreement between ANL and ITA, which was announced in November 2010. The agreement proposes four study areas, including energy, fleet, intelligent transportation systems, and the environment. The partnership combines the expertise of both organizations to accomplish transportation sustainability goals, utilize specialized knowledge and facilities, and increase interagency cooperation.

"ITA spends $2M a year on gasoline, and reducing fuel use by 1 percent will save $20,000 annually."

34

36

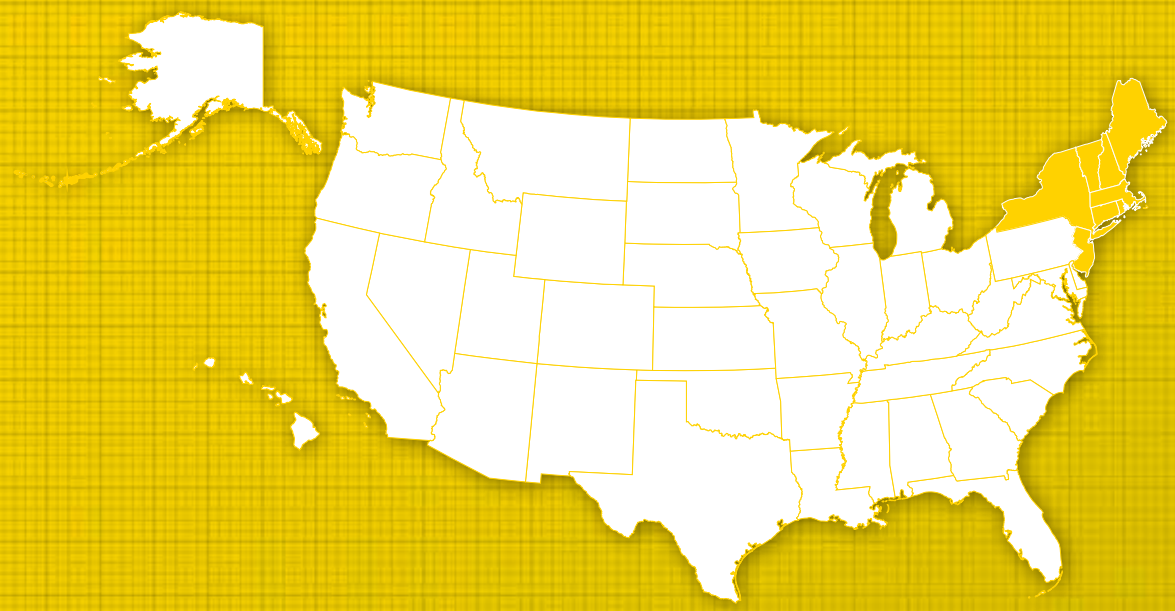
38

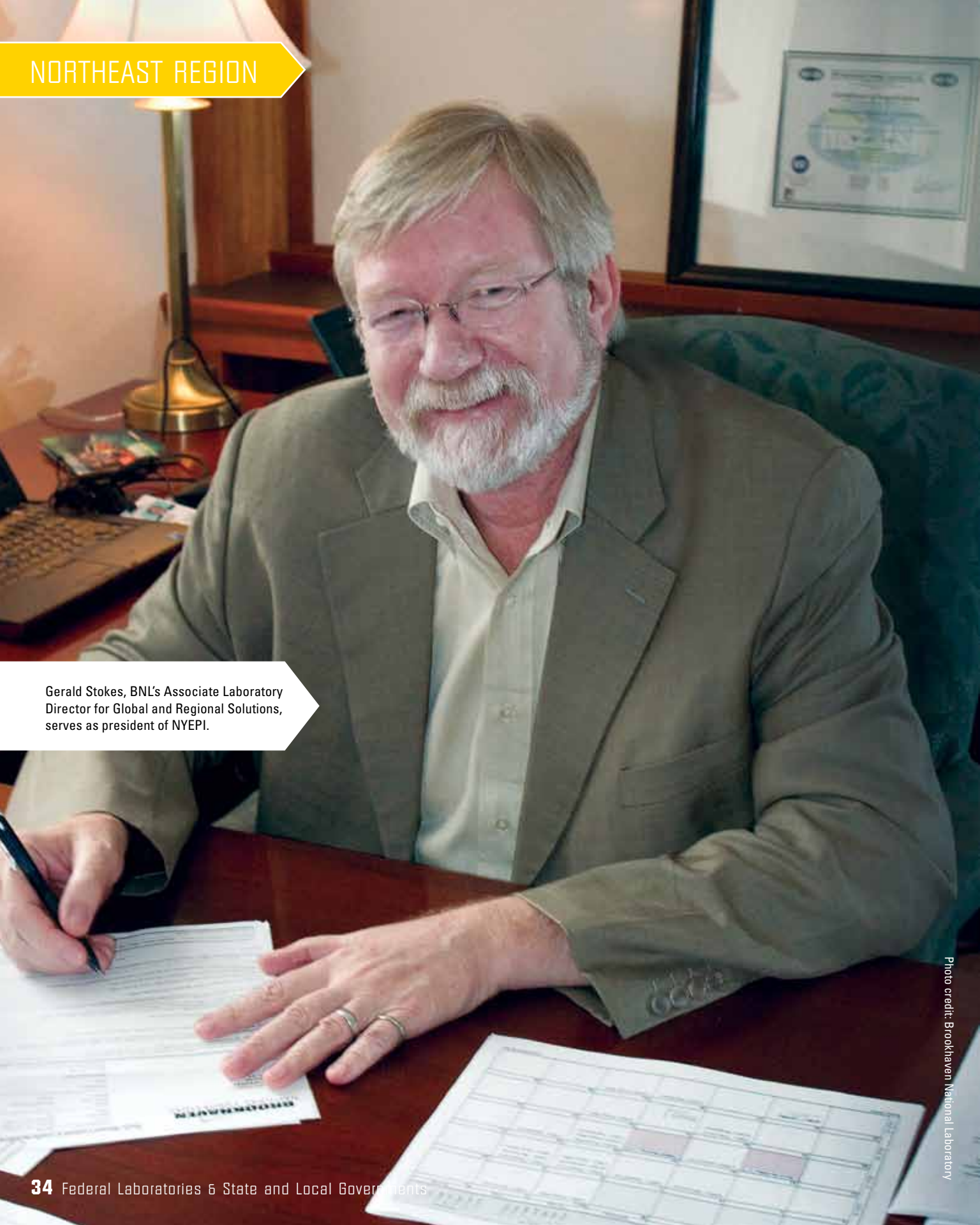
40

42

NORTHEAST REGION

The Northeast Region consists of Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, and Puerto Rico. The Region includes approximately 35 member laboratories that represent a variety of agencies (e.g., Departments of Commerce, Energy, Defense, Transportation, etc.) and nearly 16% of the 2006-2008 federal R&D obligations. The Northeast's mission is to add value to federal agencies, laboratories, and their partners to accomplish the rapid integration of research and development resources within the mainstream of the U.S. economy. Success stories in this region highlight advanced energy research, including new smart grid technology implemented in the State of New York.





Gerald Stokes, BNL's Associate Laboratory Director for Global and Regional Solutions, serves as president of NYEPI.

Photo credit: Brookhaven National Laboratory

Brookhaven National Laboratory Partners With New York State Government to Study Energy Policy

NEW YORK

With a longstanding interest in energy policy, Brookhaven National Laboratory (BNL) has developed a strategic role in New York State through its participation in the New York Energy Policy Institute (NYEPI).

NYEPI assists state government agencies and officials with critical energy decisions through collaboration with BNL and 17 universities statewide. Led by Syracuse University and Rensselaer Polytechnic Institute (RPI), the schools will contribute the expertise of some 400 experts in economics and political science, as well as energy-related scientific and engineering disciplines. NYEPI is administered by the Advanced Energy Research and Technology Center headquartered at Stony Brook University, and its work is funded by the New York State Energy Research Development Authority (NYSERDA).

Gerald Stokes, BNL's Associate Laboratory Director for Global and Regional Solutions, serves as president of NYEPI, and Pat Looney, chairman of the Sustainable Energy Technologies Department, sits on its advisory council.

NYEPI has initiated several major efforts, including a quick response program to help policy makers who need immediate advice on energy policy and technologies; a longer-term research program to study energy issues and responding strategies that require the involvement of multiple experts over a long time; an energy policy research clearinghouse; and workshops and policy briefings on current and emerging energy issues. The team is currently identifying energy experts in partnering institutions and compiling the information in a database, and also evaluating energy technology gaps in an effort to identify and prioritize innovation efforts with the potential to close those gaps. Projects that NYEPI is supporting include the so-called "80 by 50" plan that aims to reduce greenhouse gases 80 percent by 2050. Also under consideration is a project to examine the role of natural gas in New York State's future energy portfolio.

> *"This is a challenging time for the state as it seeks to frame its strategy and select policies that will create a 21st century energy system that will sustain and enhance its economic, social and environmental well-being."*
>
> Gerald Stokes
>
> BROOKHAVEN NATIONAL LABORATORY

"Our entire team was pleased and honored to be selected to establish this new institute in the service of the State of New York," said Stokes. "This is a challenging time for the state as it seeks to frame its strategy and select policies that will create a 21st century energy system that will sustain and enhance its economic, social and environmental well-being. We are looking forward to working with our talented colleagues around the state in support of NYSERDA and the rest of the state's leadership in achieving our vision for the state's energy future."

Advanced Energy Research & Technology Center, a LEED Platinum Building. Located at the Stony Brook University Office Park, Stony Brook, N.Y.

NEW YORK

New York State Utilities Witness Smart Grid Technology Demonstration at Brookhaven National Laboratory

Brookhaven National Laboratory (BNL) is the only multi-program lab in the northeast United States, which has some of the most pressing electric grid problems in the country due to its large population and aging infrastructure. With a long history of research in energy technologies, BNL has developed a strategic role in New York State through its participation in the New York State Smart Grid Consortium (NYSSGC).

The consortium, made up of government, industry, utilities, universities and BNL, provides important validation of needs in the energy sector.

The United States' electrical transmission and distribution system currently sees losses that range from 8 to 11 percent, most of which occur in the distribution system—the part that delivers electricity to homes, commercial businesses, and industry. One goal of the emerging "Smart Grid" efforts under development at BNL and elsewhere is to reduce those losses by 50 percent.

At a recent meeting of BNL's Smart Grid management team, representatives from the New York State Energy Research & Development Authority (NYSERDA), Orange and Rockland Utility, Central Hudson Gas and Electric, Pepco Holdings, and the Long Island Power Authority were among those who received a demonstration of a new modeling technology—already being used in several locations—that will reduce losses in the distribution system.

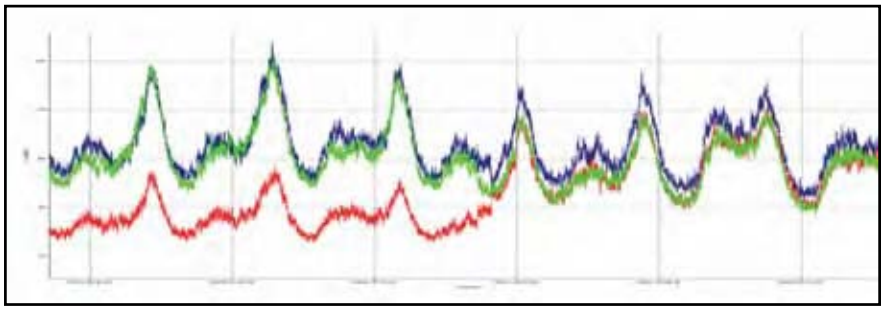
The technology, the Integrated System Model/Distributed Engineering Workstation (ISM/Dew) was developed by Robert Broadwater of Virginia Tech

Participants at BNL Smart Grid management team meeting

Photo credit: Brookhaven National Laboratory

Photo credits: Brookhaven National Laboratory

Associate Laboratory Director Gerald Stokes details BNL's Smart Grid program. At left foreground is Robert Broadwater, who developed the ISM/Dew modeling technology.



Balancing of Phase A current with Phases B and C currents for improved efficiency

University through electrical distribution design. During the meeting, Broadwater demonstrated the capabilities of the technology through simulations of various utility scenarios.

Stephanie Hamilton, manager of BNL's Smart Grid R&D program, explained that "the ISM/Dew technology allows the grid to move from a static mode, where you plan around a single data point, to having 8,760 of them—which is every hour, 24 hours a day for a full year. This technology can compile the data very quickly, taking into account all the different components on the utility grid, including poles and wires."

A primary purpose of the Smart Grid meeting was for New York State utilities to hear from others already using the technology. Representatives from Orange and Rockland counties in New York, using ISM/Dew under a U.S. Department of Energy grant, and Silicon Valley Power in California both detailed how the modeling program has helped them improve reliability and reduce losses.

BNL is currently assessing the technology for the Smart Grid, and is actively trying to engage local utilities in the conversation.

"If you want to add new components to the system or move a large customer from one circuit to another, this can help you anticipate what the effect is going to be on the overall grid," Hamilton said. "It will allow utilities to go in and tweak their systems to bring them into balance and reduce their losses. Its ability to provide hourly data points for the entire year and its computational speed are the principal reasons why it may be a technology that will help the grid become 'smarter.' "

Hamilton noted that Silicon Valley Power, which services companies like Google and Yahoo, has the highest reliability in the U.S. for a utility—the least number of hours out of power in its transmission and distribution area.

Photo credit: Brookhaven National Laboratory

Brookhaven National Laboratory Contributes Scientific Expertise to Energy Storage

NEW YORK

Brookhaven National Laboratory (BNL) is a key contributor in a collaboration studying energy storage—the New York Battery and Energy Storage Technology Consortium (NYBEST). The consortium is a private-public coalition of academic, corporate, and federal partners building a New York-based advanced battery and energy storage sector—from research and development to engineering, manufacturing, and commercialization. Established with $25 million in state funding and administered through the New York State Energy Research and Development Authority (NYSERDA), NYBEST aims to transform the battery and energy storage industry.

BNL scientists have launched a concerted effort of basic and applied research for the development of improved energy-storage materials and systems with high energy densities, fast cycling rates, and long cycling lifetimes in efficient, economical and safe media. The overall goal is to establish a comprehensive, cross-disciplinary, energy-storage program that includes basic and applied experimental and theoretical efforts on energy storage for mobile and stationary applications.

Under NYBEST, the Energy Storage Group at BNL has teamed up with researchers at the State University of New York at Binghamton and the University of Buffalo to explore new systems for stationary and grid-scale energy storage. The vast majority of recent battery research has focused on the important problem of electrical energy storage for transportation applications. The successes of these investments and electric vehicle development will shift substantial transportation energy demand from oil-supplied to grid-supplied, and will consequently put even further stress on the already overstressed electrical grid. Stationary storage would alleviate this stress and also provide an important tool for the integration of intermittent renewable generation sources such as wind and solar.

In this effort, BNL will work with university colleagues on the development of new battery chemistries and materials for stationary electrical energy storage applications with enhanced cycling, deep discharge capabilities, safety, and low cost. This partnership will also involve the development and application of advanced experimental techniques to characterize these materials utilizing the National Synchrotron Light Source (NSLS) and the Center for Functional Nanomaterials at BNL.

"BNL will work with university colleagues on the development of new battery chemistries and materials for stationary electrical energy storage applications with enhanced cycling, deep discharge capabilities, safety, and low cost."

BNL is home to the NSLS, one of the world's most widely used facilities, with 2100 academic, federal, and corporate researchers conducting projects each year, and the future NSLS-II, which will allow researchers to study materials at the nanoscale. BNL also houses New York Blue, one of the world's most powerful supercomputers available for industry and academic use in energy storage modeling.

New York Battery and Energy Storage Technology Consortium NY BES+

NEW YORK

Jet Propulsion Laboratory Addresses Need for Health Monitoring Steam Pipes for Large Cities

Steam pipe systems are used in major cities as a district heating system. They carry steam from central power stations under the streets to support heating and cooling systems or supply power to high-rise buildings and businesses. Consolidated Edison Company of New York (Con Ed) operates the largest commercial steam system in the world, with over 100 miles of pipes serving a variety of public, private and residential needs. Health monitoring of these systems is critical to assure their safe operation and to provide preventative assurance against potential accidents and system failures.

Excessive rises in the levels of water condensation inside the steam pipes is a source of concern; possible excitation of water hammer effects may lead to serious damage to vents, traps, regulators and piping. The water hammer effect is caused by an accumulation of condensed water trapped in horizontal portions of the steam pipes. Scientists at NASA's Jet Propulsion Laboratory are partnered with Con Ed and have developed an ultrasonic method of measuring the height of the condensed water through the pipe wall. The developed method involves using an ultrasonic transducer that can sustain the high temperature of up to 250°C, as expected on the surface of the pipe inside the city's manholes.

The developed test method is based on an ultrasonic pulse-echo approach, which consists of acquiring the wave reflections received from the various interfaces along the wave path from the transducer to the surface of the water and back. These reflections are processed by an autocorrelation analysis to de-

Steam main configuration in street

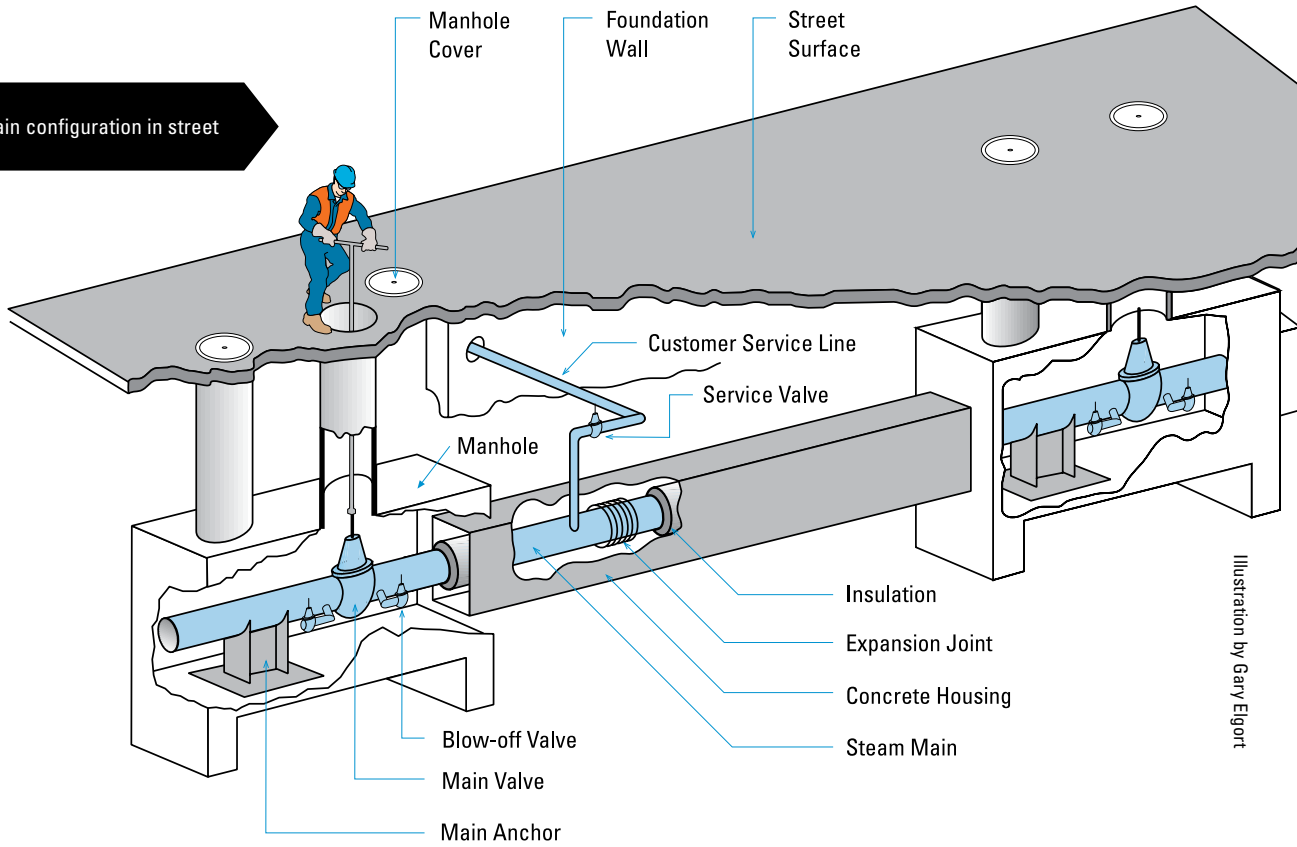


Illustration by Gary Elgort

Photo credit: Con Edison

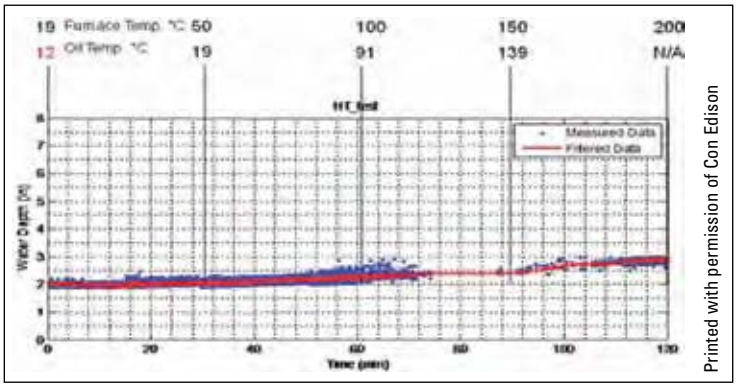
Crewmember in a steam excavation

termine the wave time-of-flight between the bottom of pipe inner side and the surface of the water. To prove the feasibility to measure the height, the water in the pipe was drained and it was found that the measurements were quite accurate and effectively tracked the height in real time. Subsequently, tests were performed to determine the effect of water surface disturbances and the presence of bubbles, simulating the expected conditions inside the pipe in field conditions. These tests were successful in spite of the surface perturbations.

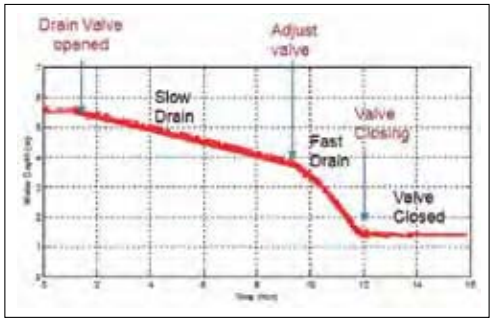
In a follow-on study, a plan to enhance the amplitude of the measured signals and the data acquisition process will result in acquiring reflections that will provide an automated monitoring capability at 250°C.

The Jet Propulsion Laboratory (www.jpl.nasa.gov) is managed for NASA by the California Institute of Technology.

The measured height as a function of time and the recorded temperatures. The blue dots are the readings, and the red line is the running-average of the determined data.



Printed with permission of Con Edison



The ultrasonic measurements of the water height during fast and slow draining

NEW YORK

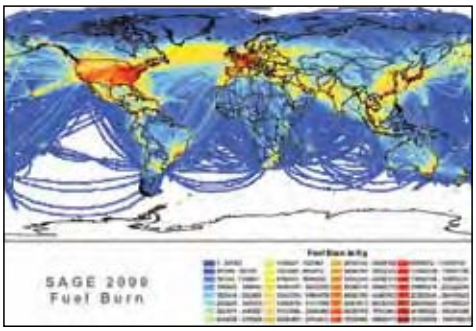
USDOT Volpe Center Produces Recommendations to Reduce Delays at JFK Airport

Photo credit: Volpe Center Image

In preparation for the March 1, 2010, closure of Bay Runway 13R-31L at John F. Kennedy International Airport (JFK), the Port Authority of New York and New Jersey (PANY&NJ) sought expertise from the Federal Aviation Administration (FAA) on the issue known as "jet blast," which was identified as a concern since traffic was to be redirected to the remaining runways. Jet blast is the term for the exhaust plume from an airplane's engines that can be hazardous if an arriving aircraft passes closely behind the path of a departing aircraft with engines at takeoff thrust. To avoid any potential jet blast behind a departing aircraft, the departing aircraft is held on the ground until the arriving aircraft is out of the vicinity. Closing the Bay Runway would result in potential holds on departing flights, causing delays and congestion in the air traffic system.

The FAA turned to the John A. Volpe National Transportation Systems Center (Volpe Center) of the U.S. Department of Transportation's Research and Innovative Technology Administration for its expertise and experience conducting a jet blast testing and analysis. Volpe Center evaluated hold times for departures at JFK to determine if they could be safely reduced to alleviate congestion.

Volpe Center developed a model that could be used for any given intersecting runway geometry and aircraft combination at JFK. Upon completion of the analysis, the Center determined that the jet blast hold time could be significantly reduced while maintaining safety. Recommendations were made to the PANY&NJ and FAA regarding changes that could be made to standard operating procedures (SOPs) for the specific intersections of interest. These recommendations enabled more efficient use of the remaining runways during construction, and the changes continue to be utilized today.



Beta Versions of New Aviation Environmental Tool Released

The FAA Office of Environment and Energy (AEE), with support from Volpe Center, is developing a new suite of tools that will enable the analysis of interdependencies of aviation fuel burn, noise, and emissions. In 2010, Volpe Center led the development, integration, and testing of three beta versions of the Aviation Environmental Design Tool (AEDT), which were released to a Design Review Group (DRG) comprised of consultant, industry, and academia stakeholders.

Preserving Natural and Cultural Resources in U.S. National Parks

In recognition of the potential negative impacts from aircraft noise, the FAA and the National Park Service (NPS) are developing Air Tour Management Plans (ATMPs) for approximately 80 national parks where commercial air tours operate. ATMPs provide acceptable and effective measures to mitigate or prevent significant adverse impacts of commercial air-tour operations on natural and cultural resources, visitor experiences, and tribal lands. The U.S. Department of Transportation's (DOT) Volpe Center Environmental and Energy Systems Center of Innovation (COI) supports ATMP implementation, including the monitoring of ambient sound levels in the parks to establish a baseline for use in impact assessment. Over the course of the year, acoustic specialists have gathered data in 21 parks across 5 states.

Photo credit: Volpe Center Images

Providing Traffic Noise Modeling Support to FHWA

Dr. Judy Rochat and Michael Lau of the Volpe Center's Environmental Measurement and Modeling Division participated in an on-board sound intensity comparison study on North Carolina highways near Charlotte. The tire/pavement noise-measurement data that were collected will assist in implementing the effects of various pavement types in the Traffic Noise Model (TNM), which the Volpe Center developed and currently maintains for the Federal Highway Administration's (FHWA) Office of Natural and Human Environment. FHWA's Office of Pavement Technology has joined with that office to support the study. The Volpe Center is assisting FHWA and other government agencies in developing measurement and modeling techniques pertaining to the mitigation of transportation-related noise and exhaust emissions (sponsored by FHWA).

Developing International Standards for Alcohol Countermeasures Program

The DOT's Volpe Center Alcohol Countermeasures Program has continually assisted the National Highway Traffic Safety Administration (NHTSA) and other sponsors, such as the Office of the Secretary of Transportation and the Federal Transit Administration, with designing and developing devices and programs that can accurately detect the presence of alcohol in transportation drivers and operators.

One of the program's major activities is its participation in the International Organization of Legal Metrology (OIML). Volpe Center staff are part of the OIML working group that is drafting recommended international standardized procedures and testing for evaluating breath-alcohol testing and screening devices, or evidential breath testers (EBTs). At NHTSA's request, Volpe Center frequently provides expert testimony on the validity of breath-alcohol tests and testing devices for pretrial hearings, court appearances, telephone testimony, depositions, and affidavits.

46

48

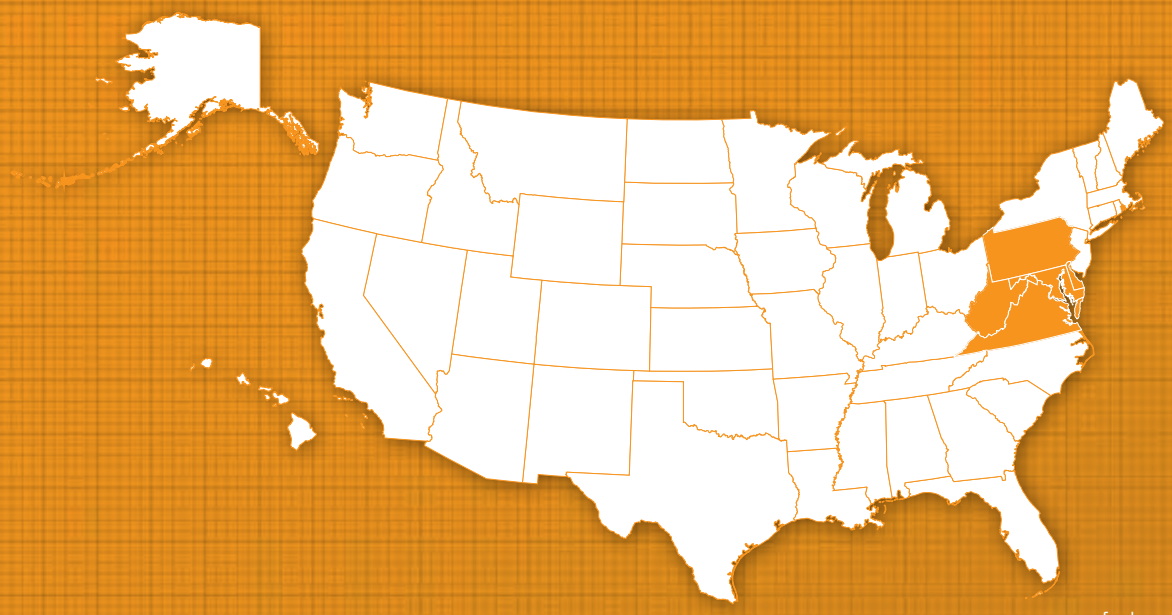
50

52

54

MID-ATLANTIC REGION

The Mid-Atlantic Region focuses on federal R&D assets located in Pennsylvania, Delaware, Maryland, Virginia, West Virginia and the District of Columbia. During 2007-2008, 27% of the federal R&D obligations stemmed from this region. The Mid-Atlantic Region is comprised of over 70 federal laboratories and agencies. Reaching across agency lines, the Region links to federal technology, technical expertise and R&D assets, and provides gateway services, networking opportunities, conferences, publications, training, and technology finder assistance. The Mid-Atlantic Region partners aggressively with key regional organizations like the Maryland Technology Development Corporation (TEDCO)—created in 1998 by the Maryland State Legislature to foster the development of a technology-driven economy.



MID-ATLANTIC REGION

Aerial view of the Jefferson Laboratory accelerator site in Newport News, Va., the venue for the MAR co-sponsored Biomedical Partnership Forum on June 15, 2010.

MID-ATLANTIC REGION

FLC Mid-Atlantic Region Fosters Technology Transfer

Technology innovation is one of the key drivers of local economies, and it originates from a variety of sectors within a region. In order to harness the maximum impact of a region's technological capabilities, it is necessary to foster an atmosphere of collaboration among these sectors. The FLC Mid-Atlantic Region has been actively involved in organizing forums for state and local governments, federal technology-based agencies, universities, industry, and economic development agencies for the purpose of showcasing the various partnering opportunities, technologies, and services available from each sector. During the past year, the Mid-Atlantic Region has organized three conferences designed to take full advantage of the vast technology resources it has available.

In June 2010, the Mid-Atlantic Region co-sponsored the Biomedical Partnership Forum at the Thomas Jefferson Laboratory accelerator site in Newport News, Va. The event featured presentations by a variety of organizations engaged in biomedical research and covered a broad range of topics, including bioimaging, biotechnology standards, cancer treatment, and modeling/simulation for health care.

The National Institute of Standards and Technology (NIST) in Gaithersburg, Md., was the venue for the September 2010 Nanotechnology Partnership Forum. The event focused on three main disciplines of nanotechnology research—biomedical applications, advanced materials, and electronics—and was organized to promote discussions on how these areas overlap and how cross-pollination can occur for the purpose of developing novel nanotechnology-based solutions to a variety of problems.

In April 2011, the Energy Partnership Forum at The College of William and Mary brought together members of the southeastern Virginia energy community to discuss the current and future state of energy in the region, and how local technologies can be utilized to impact energy policy throughout the rest of the world.

Although the topics covered have significant global impact, the forums were created to encourage broad involvement of the relevant sectors of the local community and, at the same time, to take full advantage of the technology strength of the respective areas within the Mid-Atlantic Region. All of these events provided interactive forums highlighted by participation from all relevant stakeholders. Local universities and economic development agencies were well-represented, and they were given the opportunity to seek or provide assistance for various technology-related initiatives. This strategy had a synergistic effect, in that problems faced by members of one sector often could be addressed by technologies or solutions from another sector.

"During the past year, the Region has organized three conferences designed to take full advantage of the vast technology resources it has available."

To increase accessibility to these events and maximize participation from each sector, all of the forums charged modest registration fees and were one-day events at locations easily accessible to participants. The conferences have been well-received by members from all sectors. The success of these conferences will likely lead to similar events in the future as the Mid-Atlantic Region continues to facilitate the formation of regional partnerships by engaging local communities for the purpose of creating technology-based regional economic development.

Photo credits: Chris Hartlove, courtesy of University of Baltimore

L to R: Hamed Chahargbaghi, M.B.A. '11, and Jo-Anne Estelle Cheatom, M.B.A. '11, listen to fellow students' presentations to NASA Goddard representatives.

Nicholette Letersky, M.B.A. student, presents on a commercialization opportunity for her group's NASA technology.

NASA Goddard and the University of Baltimore Introduce MBA Students to Tech Transfer Business Practices

MARYLAND

NASA Goddard Space Flight Center (GSFC) and the University of Baltimore's Merrick School of Business are working together to educate MBA students about government technology transfer practices and resources, as well as GSFC's innovative business practices. The University of Baltimore MBA curriculum offers a "lab to market" course that is an application-based, skill-learning approach to learn and practice the skills necessary for creativity, opportunity analysis, and communication in the pre-planning stages of bringing a technology to the marketplace.

GSFC has developed many advanced technologies and processes that have significant commercial and/or partnership potential. The Center has invention disclosures, patents, and pending patents that may be used as candidate technologies/case studies by the MBA students and considered for patenting in order to transfer those technologies upon request for license.

The University of Baltimore students will be allowed to access GSFC patented technologies and basic non-enabling information on GSFC technologies that have not yet been patented. Additionally, the students will be able to reach out to GSFC scientific and technical personnel on a non-interference basis. GSFC will receive the results, reports and assessments from the program participants for all of their work related to any selected GSFC technologies. The assessments and market studies will be useful to GSFC in the pursuit of commercial licensees. GSFC and the University of Baltimore will both benefit from any successful marketing and licensing agreements that may stem from this initial agreement.

university of baltimore
KNOWLEDGE THAT WORKS

Aerial view of NASA Goddard Space Flight Center

Photos credit: NASA/GSFC

FlexEl is speeding commercialization of its advanced, ultra-thin batteries.

Photo credit: University System of Maryland

Army Research Laboratory Teams With University System to Accelerate the Commercialization of University-Developed Technologies

MARYLAND

U.S. research universities have rapidly escalated their involvement in technology commercialization through federal policies such as the Bayh-Dole Act, which gives universities the right to inventions funded with federal research dollars. Through university technology commercialization programs, states and regions hope to spawn new business and create new jobs. The State of Maryland is fortunate to be the home of not only many research universities, but also numerous federal laboratories. Teaming these federal and state resources for technology-based economic development is the mission of the Maryland Proof of Concept Alliance.

The University System of Maryland (USM) has teamed up with the U.S. Army Research Laboratory (ARL) to form the Maryland Proof of Concept Alliance. The Alliance accelerates the commercialization of new technologies for the public and private sectors, while at the same time creating new jobs and businesses by linking regional resources.

With $5.1 million in federal appropriations, the Alliance seeks to move the most promising technologies developed at USM institutions out of the lab and into the arms of potential investors—in this case, ARL is the initial buyer—to bring these innovations to market. The Alliance fosters a wide array of technologies, including a graphene replacement for silicon transistors; a new generation of powerful, ultra-thin batteries; lasers that can sniff out dangerous gasses from a distance; a new, powerful class of antibiotics; and a commercial technique for producing biofuels from trash.

Proposals were solicited from USM faculty and companies with USM technology licenses or USM equity interest. The proposals were reviewed by impartial analysts to identify those technologies that not only had a promise of commercial success, but supported Army technology needs; awards amounted to a maximum of $140,000 per project. The ARL award provides the funding and the technical support to cross the "Valley of Death" for researchers and companies, giving time to find other partner funding.

Some Proof of Concept Alliance researchers have also received venture accelerator support from state, private, and federal sources to leverage the ARL funding. FlexEl, for example, is speeding commercialization of its advanced, ultra-thin batteries. Based on its first-round award, FlexEl signed a confidential agreement with a Fortune 100 company, receiving $500,000 for the first increment. FlexEl has also received a $750,000 Small Business Innovation Research (SBIR) award from the Department of Homeland Security and funding from the Maryland Technology Development Corporation (TEDCO). Other awardees have already formed companies to scale-up their techniques to commercial production levels, such as Zymetis, Inc.—a company formed by University of Maryland scientists who discovered a bacterium highly efficient at converting trash and other organic material to biofuels. Zymetis received Maryland funding and was just acquired by a major biofuels firm. Linking ARL technology interests with university technology transfer, the regional economic impact of this program is significant, while at the same time addressing some of the nation's critical security needs.

"The Alliance fosters a wide array of technologies, including a graphene replacement for silicon transistors; a new generation of powerful, ultra-thin batteries; lasers that can sniff out dangerous gasses from a distance; a new, powerful class of antibiotics; and a commercial technique for producing biofuels from trash."

NASA Goddard Space Flight Center has developed many cutting-edge technologies and processes in spacecraft, instruments and new technology to study the Earth, the sun, our solar system, and the universe.

Photo credits: NASA/GSFC/Chris Gunn

NASA Goddard and Maryland TEDCO Partner to Stimulate Economic Growth

MARYLAND

NASA Goddard Space Flight Center (GSFC) and the Maryland Technology Development Corporation (TEDCO) have formed a partnership to stimulate the economic growth of businesses in Maryland. GSFC has developed many cutting-edge technologies and processes that have significant commercial and partnership potential. The Center's invention disclosures, patents, and pending patents could be the start of new businesses and/or could enhance an already established business' technology portfolio.

The purpose of TEDCO, created in 1998 by the Maryland State Legislature under Annotated Code of Maryland, Economic Development Article, Title 10- Subtitle 4, is to foster the development of a technology-driven economy, and to promote business creation and growth through the commercialization of technology that will create and sustain businesses throughout Maryland. TEDCO serves as a valuable link between Maryland companies looking to benefit from the capabilities and technologies developed by and available from federal laboratories.

GSFC and TEDCO will both benefit from this partnership, which allows TEDCO to promote GSFC technologies, capabilities, and needs. This will be executed by way of organized efforts, including meetings with and between GSFC innovators and prospective businesses, with an expected outcome of potential collaborations and/or licenses of GSFC technologies and use of GSFC facilities.

Chief Science Officer (CSO) Development Training Certificate Program

MARYLAND

A novel training certificate program that teaches academic scientists the business and leadership management skills necessary to be successful in the technology transfer industry has been developed through a partnership among Montgomery County (Maryland) Economic Development, the Federal Laboratory Consortium for Technology Transfer Mid-Atlantic Region (FLC MAR), the Foundation for Advanced Education in the Sciences (FAES), the Graduate School at NIH, Montgomery College, and Human WorkFlows, LLC.

Maryland is in an enviable position with regard to biotechnology-related resources that encourage and support entrepreneurial efforts. Johns Hopkins University, the University of Maryland, the National Institutes of Health, and the National Institute for Standards and Technology represent just a few of the many sources of highly skilled talent, as well as novel inventions that can stimulate new growth. The potential for human capital to support this entrepreneurial growth is further augmented by the number of graduate and postdoctoral programs available in the region. Ironically, a significant steady decrease in the availability of academic positions for new graduate and post-graduate level scientists has created an additional resource pool for new and existing biotechnology companies.

Despite significant human capital resources in the region, traditional academic graduate and post-graduate training do not focus on teaching business leadership and management, skills that are required to attain successful industry scientist-level positions. This was the catalyst for a unique and highly synergistic consortium to remedy this situation. The consortium partners consisted of federal laboratories, educational institutions, economic development organizations, and small businesses. They combined forces to develop a novel training certificate program that focused on teaching academic and research scientists the business leadership and management skills necessary to be successful in industry. The program consists of 36 credit hours offered through a 12-week course that teaches the skills valued by industry. A self-assessment instrument to determine a student's mastery of each of these skills is included, and focused business classes are provided for further development of these skills. The primary focus is on leadership, negotiation, line management, finance, project management, and communications, all geared toward developing scientist leaders who can fast-track in industry positions regardless of whether they choose a management or research track.

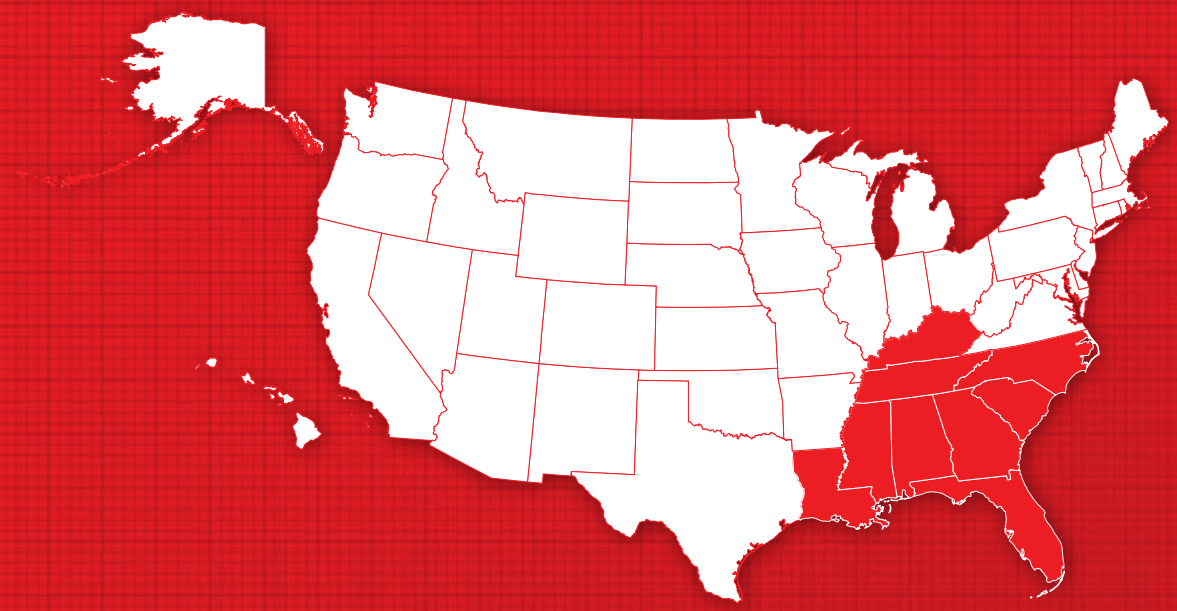
"They combined forces to develop a novel training certificate program that focused on teaching academic and research scientists the business leadership and management skills necessary to be successful in industry."

60

62

SOUTHEAST REGION

The Southeast Region encompasses more than 40 federal laboratories in nine states and nearly 10% of the federal R&D obligations for 2006-2008. The Region includes Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. The Southeast Region is a one-stop shop for access to the technology resources available in these states' facilities. In addition, the Region (as well as the others) can connect you with more than 700 federal laboratories nationwide.



TENNESSEE

New UT/ORNL Center: Taking on the World's Energy Problems and Translating Intellectual Capital Into Economic Investment

The University of Tennessee, Knoxville (UTK), in partnership with Oak Ridge National Laboratory (ORNL), is launching an academic unit that seeks to transform the energy industry in our country and the world, as well as state and local economies.

Called the UTK/ORNL Center for Interdisciplinary Research and Graduate Education (CIRE), the Center will train scientists to take on the world's most challenging energy problems by working with teams of researchers making scientific breakthroughs that could become thriving business enterprises. In January 2011, CIRE had its unique doctoral degree in energy science and engineering approved by the Tennessee Higher Education Commission, named its first group of faculty, and began the process of naming its inaugural class.

Officially opened in August 2011, CIRE offers one of the country's first interdisciplinary doctoral degrees in energy science and engineering, which will educate students in energy-related fields that are increasingly important to the state, country, and world.

UTK and ORNL recruited the inaugural class at some of the most prestigious universities in the nation, yielding candidates from the University of Virginia, the University of Michigan, Northwestern University, California Institute of Technology, University of North Carolina at Chapel Hill, Ohio State University, and Purdue University, among others. The curriculum was developed with input from leaders of energy-related companies, such as Chevron, DuPont, Siemens, and Exxon Mobil.

The program will focus on six areas of research that address ten of the grand challenges the country faces in the energy arena: nuclear energy, bioenergy and biofuels, renewable energy, energy conversion and storage, distributed energy and grid management, and environmental and climate sciences related to energy.

"The program will prepare students to meet the needs of energy-related industries in the country and in the state," said Lee Riedinger, CIRE director. "There is overlap in CIRE's coursework and the emphases of these expanding industries in Tennessee, so we will be producing PhDs to work in research and development and in management in these industries."

The Center presents highly motivated doctoral-candidate students the opportunity to work with faculty drawn from both ORNL and UTK. Students will have immediate immersion and strong integration into ORNL's Department of Energy research programs, with simultaneous engagement in student activities and a home department at UTK.

CIRE continues a longstanding partnership between UTK and ORNL. The two institutions have collaborated for more than 50 years and currently share more than 50 appointments, 5 institutes, and successful Governor's Chair and Distinguished Scientists programs. In 2010, the U.S. Department of Energy extended the $1.6 billion contract for UT and Battelle Memorial Institute to co-manage ORNL for another five years, ensuring that Tennessee will be well-positioned to continue attracting research investments and other economic benefits generated by ORNL.

The Cray XT Jaguar supercomputer features more than 224,000 processing cores, each with 2 gigabytes of local memory.

Photo credit: ORNL

TENNESSEE

Y-12 Proves the Power of Partnerships

Research and innovation are the lifeblood of the Y-12 National Security Complex. Charged with maintaining the safety, security, and effectiveness of our nation's nuclear weapons stockpile and reducing the global threat posed by nuclear proliferation and terrorism, the company is often faced with unique challenges. To conquer or preclude these challenges, it turns to research and innovation.

Many of the resulting technologies developed at Y-12 have potential for wider use. Several technologies have been validated in a relevant environment and are ready to be commercialized. For security purposes, however, access to Y-12's activities has been limited since the facility's inception. Y-12's relationship with two partners is making possible the transfer of some of Y-12's newest technologies for use outside its gates.

The Tennessee Technology Development Council (TTDC) is a not-for-profit corporation created and empowered by the state legislature to foster innovation and create high-wage jobs in Tennessee, capitalizing on the state's renowned public and private research network. Technology 2020 (Tech 2020) is a not-for-profit, public-private partnership located in Oak Ridge, Tenn., that uses the unique technology capabilities of East Tennessee to create new businesses and new jobs.

When Y-12's technology known as "Pro-Ox Nano" came to the attention of Tech 2020, one of Tech 2020's private-sector firms became interested in commercializing it. Knowing that a TTDC Technology Maturation Fund grant—which is designed to help resident scientists, inventors, and entrepreneurs realize the commercial potential of innovative technologies that solve existing problems—could make the commercialization possible, Tech 2020 decided to pursue one. Tech 2020's Center for Entrepreneurial Growth analyzed markets and opportunities, and proved that Pro-Ox Nano had commercial potential. In 2009, Tech 2020 received a $100,000 Technology

Code 4 Armor™, a customizable armor technology that is thinner and lighter than traditional armor, is easily tailored to various applications such as military vests and vehicle door armor.

Photo credit: US Department of Defense, Y-12

Maturation Fund grant issued by TTDC in its initial round of this competitive funding opportunity.

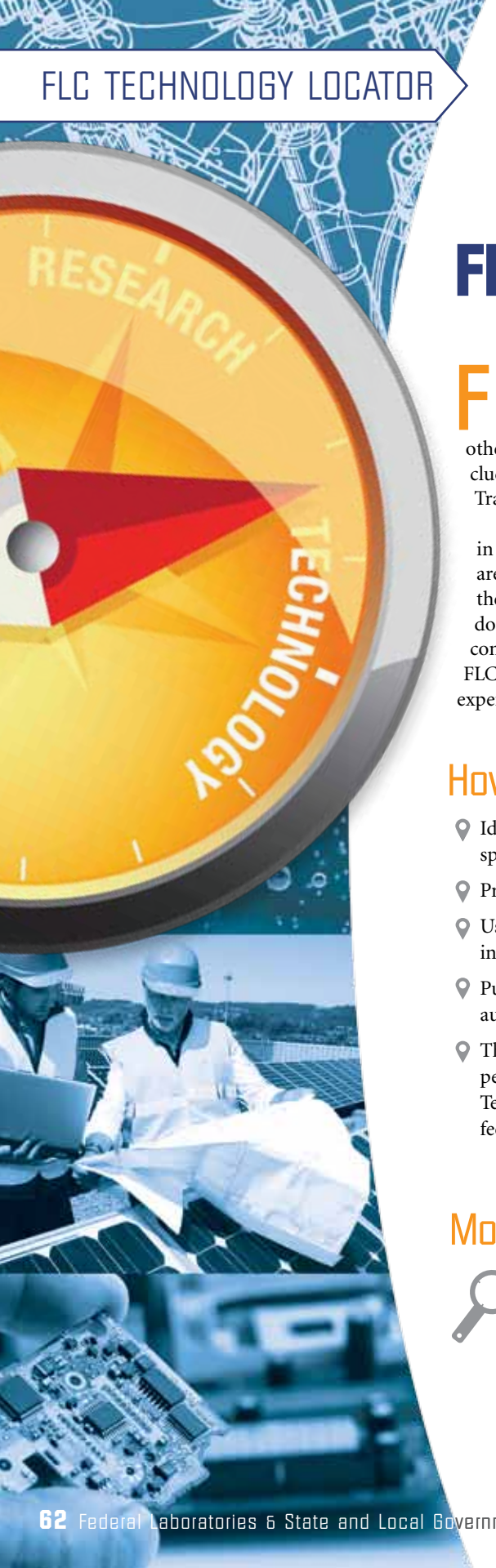
With the award in hand, Tech 2020 worked with Y-12's Office of Technology Commercialization and Partnerships to put a Cooperative Research and Development Agreement (CRADA) into place. The CRADA allowed for the identification of specific tasks for each partner to demonstrate Pro-Ox Nano, a carbon nanotube production method that delivers quantum improvements in product strength and weight. The commercial partner, one of Tech 2020's Tennessee Valley Technology Council members, replicated and enhanced the production method in an incubator lab located in space provided by Tech 2020 and proved the method worthy of commercialization. The participants provided a final report to TTDC in March 2011.

In a subsequent round of TTDC Technology Maturation Fund grant applications, Venture Incite, a Tech 2020 member, won funding to move Y-12's Code 4 Armor™ technology into proof-of-concept stage, the first step to full commercialization. This technology's applications include next-generation body armor, which will provide greater protection with less weight; lighter and stronger exterior shielding for air and land vehicles; and stronger fuel tanks and sniper shields. Another CRADA was signed in May 2011, and proof-of-concept activities are now underway.

The benefits from partnerships involving Y-12, TTDC, and Tech 2020 are clear. Technologies are farther down the path to commercialization than they were before the partnerships began, and the average citizen benefits, as well. Many technologies once limited to use within the confines of the Y-12 National Security Complex will likely be made available to the general public and subsequently used to save lives, improve the quality of goods, and create jobs.

External view of the reaction chamber installed in the commercial partner's incubator lab for the production of carbon nanotubes.

Photo credit: Shawn Carson



FLC Technology Locator

For industry and other technology seekers, the FLC Technology Locator Network serves as a point of entry to federal laboratory expertise and technology. In meeting this need, the network also handles requests from other organizations working with the private sector. These organizations include NASA's Regional Technology Transfer Centers, the National Technology Transfer Center, and state-funded economic development centers.

Through its network of representatives, the FLC puts a potential partner in contact with a federal laboratory with expertise and capability in a specific area of interest. Once the FLC identifies the contact, the arrangements for the technical exchange are between the user and the laboratory. The network does best when the user makes the request as specific as possible and identifies considerations such as technical need, constraints, and intended use. A central FLC Technology Locator helps the network match user technical requests for expertise and facilities with appropriate federal laboratory capabilities.

How It Works

- Identifies laboratory technical resources that can respond to specific requests
- Provides referrals to other federal resources
- Uses an FLC Technical Specialist System to complement information sources and network expertise
- Publishes directories that focus on special needs such as automotive materials or defense conversion partnerships
- The unique network structure of the FLC, the person-to-person technical linkages, and the central FLC Technology Locator are vital factors in linking user needs to a federal laboratory person with a special expertise or capability.

More Information

Frank Koos
856-667-7727
fkoos@utrs.com
www.federallabs.org/locator

Sample Successes of the FLC Technology Locator

The FLC Technology Locator Service helps potential collaborators take advantage of the vast reservoir of technology and expertise located within federal laboratories.

A global specialty materials manufacturing company is in contact with several federal laboratories to identify new materials applicable to the automotive and electronics industries that will improve overall system capability. Properties for materials being sought include improved product quality, reliability, safety, and environmental characteristics.

"The FLC Technology Locator was instrumental in providing us with points of contact at several federal laboratories to help identify technologies that have potential to be included in our product line." —Senior Technology Scout

A world class manufacturer of custom tailored materials requested assistance identifying new materials with specific characteristics that were developed at federal laboratories and are available for licensing.

"The Technology Locator identified federal laboratories with material development capabilities in our areas of interest. We started the nondisclosure process and are currently negotiating with federal laboratories for new materials with tailored properties for use in manufacturing products related to the automotive, petroleum production, and consumer products industries." —Director, Technology

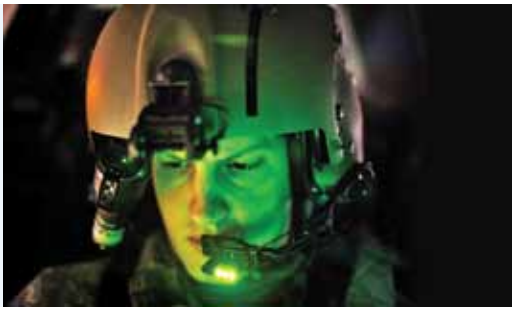
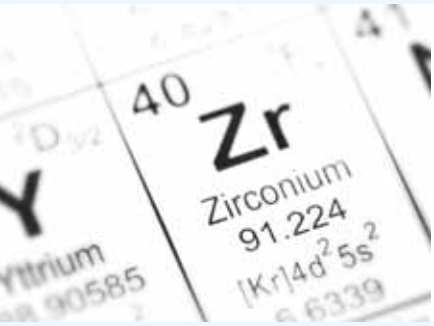


Photo credit: US Army

Apache Helicopter, Redstone Arsenal, Alabama, requested assistance identifying federal laboratory sources knowledgeable in speech, eye, and body-movement recognition useful to pilots in performing multi-task flight operations.

"The response from several federal laboratory representatives provided valuable insight to equip helicopter pilots with best-in-the-fight tools to execute the vital mission tasks during combat operations." —Earl R. Tillman, Electronics Engineer



The Naval Surface Warfare Center, Corona Division, was tasked by the Department of Defense (DOD) with conducting a study to determine the uses of zirconium oxychloride (ZOC). Several questions were asked of ZOC users throughout the federal laboratory system; their responses were needed to complete the DOD study.

"The FLC Technology Locator identified points of contact at other federal laboratories that were working with zirconium products. The input we received from other federal laboratories contributed to the successful completion of the study." —Project Leader, Naval Surface Warfare Center, Corona Division

Researchers from the University of Rio de Janeiro, Brazil, were interested in collaborating with the U.S. Forest Service regarding technologies used to extinguish forest fires, and clothing and equipment used by U.S. firefighters.

"Representatives from the U.S. Forest Service and the University of Rio de Janeiro are in the process of exchanging information regarding firefighting techniques used to control and extinguish forest fires, and the clothing and equipment used by the firefighters in their respective countries." —John Fehr, Forest Service - San Dimas Technology and Development Center

ALABAMA

Aeromedical Research Laboratory
Dept. of Defense - Army
www.usaarl.army.mil

Air Force Logistics Management Agency (AFLMA)
Dept. of Defense - Air Force
www.aflma.hq.af.mil

Alabama Water Science Center
Dept. of Interior
http://al.water.usgs.gov

Army Aviation and Missile Research, Development, and Engineering Center
Dept. of Defense - Army
www.redstone.army.milamrdec/

Marshall Space Flight Center
NASA
www.nasa.govcenters/marshall/home/index.html

Redstone Technical Test Center
Dept. of Defense - Army
www.rttc.army.mil

U.S. Army Space and Missile Defense Command
Dept. of Defense - Army
www.army.

ALASKA

Alaska Science Center
Dept. of Interior
http://alaska.usgs.gov

National Energy Technology Laboratory - Fairbanks
Dept. of Energy
www.netl.doe.gov

ARIZONA

Arizona Water Science Center
Dept. of Interior
http://az.water.usgs.gov

Astrogeology Research Program
Dept. of Interior
http://astrogeology.usgs.gov

Electronic Proving Ground
Dept. of Defense - Army
www.epg.army.mil

Yuma Proving Ground
Dept. of Defense - Army
www.yuma.army.mil

ARKANSAS

Arkansas Water Science Center
Dept. of Interior
http://ar.water.usgs.gov

National Center for Toxicological Research
Dept. of Health and Human Services
www.fda.govnctr/

CALIFORNIA

AMRDEC - Aeroflightdynamics Directorate
Dept. of Defense - Army
www.redstone.army.milamrdec/directorates/afdd/index.htm

ARS - Pacific West Area
Dept. of Agriculture
www.ars.usda.gov/main/site_main.htm?modecode=53-00-00-00

Air Force Flight Test Center
Dept. of Defense - Air Force
www.edwards.af.mil

Ames Research Center
NASA
www.arc.nasa.gov

Biological Resources Discipline - Western Regional Office
Dept. of Interior
http://biology.usgs.govwro/

California Water Science Center
Dept. of Interior
http://ca.water.usgs.gov

Defense Language Institute Foreign Language Center
Dept. of Defense
www.dliflc.edu

Defense Microelectronics Activity
Dept. of Defense
www.dmea.osd.mil

Dryden Flight Research Center
NASA
www.nasa.govcenters/dryden/home/index.html

FS - San Dimas Technology and Development Center
Dept. of Agriculture
www.fs.fed.us/eng/techdev/sdtdc.htm

Jet Propulsion Laboratory
NASA
www.jpl.nasa.gov

Lawrence Berkeley National Laboratory
Dept. of Energy
www.lbl.gov

Marine Corps Installations West
Dept. of Defense - Navy
www.mciwest.usmc.milindex.htm

NNSA - Lawrence Livermore National Laboratory
Dept. of Energy
www.llnl.gov

NNSA - Sandia National Laboratories - California
Dept. of Energy
www.ca.sandia.gov

Naval Air Warfare Center - Weapons Division - China Lake and Pt. Mugu
Dept. of Defense - Navy
www.navair.navy.milnawcwd/

Naval Facilities Engineering Service Center
Dept. of Defense - Navy
https://portal.navfac.navy.mil

Naval Health Research Center
Dept. of Defense - Navy
www.nhrc.navy.mil

Naval Medical Center - San Diego
Dept. of Defense - Navy
www.med.navy.milsites/nmcsd/Pages/default.aspx

Naval Postgraduate School
Dept. of Defense - Navy
www.nps.edu

Naval Surface Warfare Center - Port Hueneme Division
Dept. of Defense - Navy
www.navsea.navy.milnswc/porthueneme/default.aspx

Space and Naval Warfare Systems Center - Pacific
Dept. of Defense - Navy
www.spawar.navy.mil

Stanford Linear Accelerator Center
Dept. of Energy
www.slac.stanford.edu

UCLA - Laboratory of Structural Biology and Molecular Medicine
Dept. of Energy
www.doe-mbi.ucla.edu

COLORADO

ARS - Northern Plains Area
Dept. of Agriculture
www.ars.usda.govmain/site_main.htm?modecode=54-00-00-00

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

Biological Resources Discipline - Central Regional Office
Dept. of Interior
http://biology.usgs.govcro/

Boulder Laboratories
Dept. of Commerce
www.boulder.nist.gov

Bureau of Reclamation
Dept. of Interior
www.usbr.gov

Colorado Water Science Center
Dept. of Interior
http://co.water.usgs.gov

Earth System Research Laboratory
Dept. of Commerce
www.esrl.noaa.gov

FRA - Transportation Technology Center
Dept. of Transportation
www.aar.com/

FS - Rocky Mountain Research Station
Dept. of Agriculture
www.fs.fed.us/rm/

Mid-Continent Ecological Science Center
Dept. of Interior
www.mesc.usgs.gov

NTIA - Institute for Telecommunication Sciences
Dept. of Commerce
www.its.bldrdoc.gov

National Renewable Energy Laboratory
Dept. of Energy
www.nrel.gov

WS - APHIS - National Wildlife Research Center
Dept. of Agriculture
www.aphis.usda.govwildlife_damage/nwrc/

CONNECTICUT

Naval Submarine Medical Research Laboratory
Dept. of Defense - Navy
www.nhrc.navy.milnsmrl

U.S. Coast Guard Research and Development Center
Dept. of Homeland Security
www.uscg.milhq/cg9/rdc/

DISTRICT OF COLUMBIA

Center for Food Safety and Applied Nutrition
Dept. of Health and Human Services
www.cfsan.fda.govlist.html

Missile Defense Agency
Dept. of Defense
www.mda.mil

National Center for Environmental Research
Environmental Protection Agency
http://epa.govncer/

Naval Facilities Engineering Command
Dept. of Defense - Navy
https://portal.navfac.navy.mil

Naval Research Laboratory
Dept. of Defense - Navy
www.nrl.navy.mil

Office of Science Policy
Environmental Protection Agency
www.epa.govosp/

U.S. Naval Observatory
Dept. of Defense - Navy
www.usno.navy.mil

FLORIDA

AFRL - Munitions Directorate
Dept. of Defense - Air Force
www.eglin.af.milafrl_mn/

Air Force Civil Engineer Support Agency
Dept. of Defense - Air Force
www.afcesa.af.mil

FISC - Center for Coastal and Watershed Studies
Dept. of Interior
http://coastal.er.usgs.gov

FISC - Water Resources of Florida - Tallahassee
Dept. of Interior
http://fl.water.usgs.gov

Florida Integrated Science Center
Dept. of Interior
http://fisc.er.usgs.gov

Hemispheric Center for Environmental Technology
Dept. of Energy
www.arc.fiu.edu

Kennedy Space Center
NASA
www.nasa.govcenters/kennedy/home/index.html

National High Magnetic Field Laboratory
National Science Foundation
www.nhmfl.gov

Naval Aerospace Medical Research Laboratory
Dept. of Defense - Navy
www.med.navy.milsites/nhrc/namrl

Naval Air Warfare Center Training Systems Division
Dept. of Defense - Navy
http://nawctsd.navair.navy.mil

Naval Surface Warfare Center - Panama City Division
Dept. of Defense - Navy
http://nswcpc.navsea.navy.mil

RDECOM - Simulation and Training Technology Center
Dept. of Defense - Army
www.rdecom.army.milSTTC/

GEORGIA

ARS - South Atlantic Area
Dept. of Agriculture
www.ars.usda.govMain/site_main.htm?modecode=66-00-00-00

Centers for Disease Control and Prevention
Dept. of Health and Human Services
www.cdc.gov

Experimentation Division (Battle Command Battle Lab - Gordon)
Dept. of Defense - Army
www.gordon.army.milbcblg/

Federal Law Enforcement Training Center
Dept. of Homeland Security
www.fletc.gov

Georgia Water Science Center
Dept. of Interior
http://ga.water.usgs.gov

Office of Infectious Diseases
Dept. of Health and Human Services
www.cdc.govdiseasesconditions/

Warner Robins Air Logistics Center
Dept. of Defense - Air Force
www.robins.af.mil

HAWAII

NWHC - Honolulu Field Station
Dept. of Interior
www.nwhc.usgs.govhfs/Homepage.htm

IDAHO

Idaho National Laboratory
Dept. of Energy
www.inl.gov

Idaho Water Science Center
Dept. of Interior
http://id.water.usgs.gov

ILLINOIS

ARS - Midwest Area
Dept. of Agriculture
www.ars.usda.govmain/site_main.htm?modecode=36-00-00-00

Argonne National Laboratory
Dept. of Energy
www.anl.gov

Center for Advanced Cement-Based Materials
Dept. of Commerce
http://acbm.northwestern.edu

Fermi National Accelerator Laboratory
Dept. of Energy
www.fnal.gov

Illinois Water Science Center
Dept. of Interior
http://il.water.usgs.gov

New Brunswick Laboratory
Dept. of Energy
www.nbl.doe.gov

U.S. Transportation Command
Dept. of Defense
www.transcom.mil

USACE - ERDC - Construction Engineering Research Laboratory
Dept. of Defense - Army
www.cecer.army.mil

INDIANA

Indiana Water Science Center
Dept. of Interior
http://in.water.usgs.gov

Naval Surface Warfare Center - Crane Division
Dept. of Defense - Navy
www.navsea.navy.milnswc/crane

IOWA

Ames Laboratory
Dept. of Energy
www.ameslab.gov

Iowa Water Science Center
Dept. of Interior
http://ia.water.usgs.gov

KANSAS

Kansas Water Science Center
Dept. of Interior
http://ks.water.usgs.gov

TRADOC Analysis Center
Dept. of Defense - Army
www.trac.army.mil

KENTUCKY

Kentucky Water Science Center
Dept. of Interior
http://ky.water.usgs.gov

LOUISIANA

Louisiana Water Science Center
Dept. of Interior
http://la.water.usgs.gov

National Wetlands Research Center
Dept. of Interior
www.nwrc.usgs.gov

MAINE

Maine Water Science Center
Dept. of Interior
http://me.water.usgs.gov

MARYLAND

ARS - Beltsville 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.govBiologicsBloodVaccines

Center for Devices and Radiological Health
Dept. of Health and Human Services
www.fda.govcdrh/

Center for Drug Evaluation and Research
Dept. of Health and Human Services
www.fda.govcder/

Center for Environmental Health Research
Dept. of Defense - Army
http://usacehr.amedd.army.mil

Center for Information Technology
Dept. of Health and Human Services
www.cit.nih.govhome.asp

Center for Veterinary Medicine
Dept. of Health and Human Services
www.fda.govcvm/

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

DISA - Joint Interoperability Test Command
Dept. of Defense
http://jitc.fhu.disa.mil

Developmental Test Command
Dept. of Defense - Army
www.dtc.army.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

Goddard Space Flight Center
NASA
www.nasa.govcenters/goddard/

Institute for Systems Research
National Science Foundation
www.isr.umd.edu

Maryland-Delaware-District of Columbia Water Science Center
Dept. of Interior
http://md.water.usgs.gov

NSA - National Information Assurance Research Laboratory
National Security Agency
www.nsa.govresearch/ia_research/index.shtml

National Biodefense Analysis and Countermeasures Center
Dept. of Homeland Security
www.dhs.govxres/labs/gc_1166211221830.shtm

National Cancer Institute
Dept. of Health and Human Services
www.cancer.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 Geospatial-Intelligence Agency
Dept. of Defense
www1.nga.milPages/Default.aspx

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.gov

National Institute of Biomedical Imaging and Bioengineering
Dept. of Health and Human Services
www.nibib1.nih.gov

National Institute of Child Health and Human Development
Dept. of Health and Human Services
www.nichd.nih.gov

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 Naval Medical Center
Dept. of Defense - Navy
www.bethesda.med.navy.mil

National Security Agency
Dept. of Defense
www.nsa.gov

Naval Air Warfare Center - Aircraft Division - Patuxent River
Dept. of Defense - Navy
www.navair.navy.milnawcad/

Naval Explosive Ordnance Disposal Technology Division
Dept. of Defense - Navy
http://eodtechdiv.nswc.navy.mil

Naval Medical Research Center
Dept. of Defense - Navy
www.nmrc.navy.mil

Naval Surface Warfare Center - Carderock Division
Dept. of Defense - Navy
www.dt.navy.mil

Naval Surface Warfare Center - Indian Head Division
Dept. of Defense - Navy
www.navsea.navy.milnswc/indianhead

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

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

USAMRMC - Telemedicine and Advanced Technology Research Center
Dept. of Defense - Army
www.tatrc.org/

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

AFRL - Space Vehicles Directorate - Hanscom AFB
Dept. of Defense - Air Force
www.kirtland.af.mil/afrl_vs/

Electronic Systems Center
Dept. of Defense - Air Force
www.hanscom.af.mil

Massachusetts/Rhode Island Water Science Center
Dept. of Interior
http://ma.water.usgs.gov

Natick Soldier Research, Development & Engineering Center
Dept. of Defense - Army
http://nsrdec.natick.army.mil

Navy Clothing and Textile Research Facility
Dept. of Defense - Navy
www.navy-nex.com/command/nctrf/nctrf-index.html

RITA - Volpe National Transportation Systems Center
Dept. of Transportation
www.volpe.dot.gov

U.S. Army Research Institute of Environmental Medicine
Dept. of Defense - Army
www.usariem.army.mil

MICHIGAN

Great Lakes Science Center
Dept. of Interior
www.glsc.usgs.gov

Michigan Water Science Center
Dept. of Interior
http://mi.water.usgs.gov

Tank Automotive Research, Development and Engineering Center
Dept. of Defense - Army
http://tardec.army.mil

MINNESOTA

Minnesota Water Science Center
Dept. of Interior
http://mn.water.usgs.gov

MISSISSIPPI

ARS - Mid South Area
Dept. of Agriculture
www.ars.usda.govmsa

Engineer Research and Development Center (ERDC)
Dept. of Defense - Army
www.erdc.usace.army.mil

Mississippi Water Science Center
Dept. of Interior
http://ms.water.usgs.gov

Naval Meteorology and Oceanography Command
Dept. of Defense - Navy
www.navmetoccom.navy.mil

Stennis Space Center
NASA
www.nasa.govcenters/stennis/home/index.html

USACE - ERDC - Coastal and Hydraulics Laboratory
Dept. of Defense - Army
http://chl.erdc.usace.army.mil

USACE - ERDC - Environmental Laboratory
Dept. of Defense - Army
http://el.erdc.usace.army.mil

USACE - ERDC - Geotechnical and Structures Laboratory
Dept. of Defense - Army
http://gsl.erdc.usace.army.mil

USACE - ERDC - Information Technology Laboratory
Dept. of Defense - Army
http://itl.erdc.usace.army.mil

MISSOURI

Columbia Environmental Research Center
Dept. of Interior
www.cerc.usgs.gov

Missouri Water Science Center
Dept. of Interior
http://mo.water.usgs.gov

NNSA - Kansas City Plant
Dept. of Energy
www.honeywell.com/sites/kcp

MONTANA

FS - Missoula Technology and Development Center
Dept. of Agriculture
www.fs.fed.us/eng/techdev/mtdc.htm

Montana Water Science Center
Dept. of Interior
http://mt.water.usgs.gov

NEBRASKA

Air Force Weather Agency
Dept. of Defense - Air Force
www.afweather.af.mil

Nebraska Water Science Center
Dept. of Interior
http://ne.water.usgs.gov

NEVADA

NNSA - Nevada Site Office
Dept. of Energy
www.nv.doe.gov

Nevada Water Science Center
Dept. of Interior
http://nevada.usgs.govwater/

NEW HAMPSHIRE

New Hampshire/Vermont Water Science Center
Dept. of Interior
http://nh.water.usgs.gov

Portsmouth Naval Shipyard
Dept. of Defense - Navy
www.ports.navy.mil

USACE - ERDC - Cold Regions Research and Engineering Laboratory
Dept. of Defense - Army
www.crrel.usace.army.mil

NEW JERSEY

Air Mobility Battlelab
Dept. of Defense - Air Force
http://public.mcguire.amc.af.millibrary/factsheets/factsheet.asp?fsID=4066

Naval Air Warfare Center - Aircraft Division - Lakehurst
Dept. of Defense - Navy
www.navair.navy.millakehurst/nlweb/index-non-flash.asp

New Jersey Water Science Center
Dept. of Interior
http://nj.usgs.gov

Princeton Plasma Physics Laboratory
Dept. of Energy
www.pppl.gov

RDECOM - CERDEC - Command and Control Directorate
Dept. of Defense - Army
www.cerdec.army.mildirectorates/c2d.asp

RDECOM - CERDEC - Intelligence and Information Warfare Directorate
Dept. of Defense - Army
www.cerdec.army.mildirectorates/i2wd.asp

RDECOM - CERDEC - Software Engineering Directorate
Dept. of Defense - Army
www.cerdec.army.mildirectorates/sed.asp

RDECOM - CERDEC - Space and Terrestrial Communications Directorate
Dept. of Defense - Army
www.cerdec.army.mildirectorates/stcd.asp

RDECOM - Communications-Electronics Research, Development and Engineering Center
Dept. of Defense - Army
www.cerdec.army.mil

Transportation Security Laboratory
Dept. of Homeland Security
www.dhs.govxres/labs/editorial_0903.shtm

U.S. Army Armament Research, Development, and Engineering Command
Dept. of Defense - Army
www.pica.army.milPicatinnyPublic/index.asp

William J. Hughes Technical Center
Dept. of Transportation
www.faa.govabout/office_org/headquarters_offices/ato/tc/

NEW MEXICO

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

AFRL - Space Vehicles Directorate - Kirtland AFB
Dept. of Defense - Air Force
www.kirtland.af.milafrl_vs/

NNSA - Los Alamos National Laboratory
Dept. of Energy
www.lanl.gov

New Mexico Water Science Center
Dept. of Interior
http://nm.water.usgs.gov

Sandia National Laboratories
Dept. of Energy
www.sandia.gov

NEW YORK

AFRL - Information Directorate
Dept. of Defense - Air Force
www.rl.afrl.af.mil

Benét Laboratories
Dept. of Defense - Army
www.benet.wva.army.mil

Brookhaven National Laboratory
Dept. of Energy
www.bnl.govworld/

National Urban Security Technology Laboratory
Dept. of Homeland Security
www.nustl.st.dhs.gov

New York Water Science Center
Dept. of Interior
http://ny.water.usgs.gov

Plum Island Animal Disease Center
Dept. of Homeland Security
www.dhs.govxres/labs/editorial_0901.shtm

NORTH CAROLINA

ARL - Army Research Office
Dept. of Defense - Army
www.arl.army.milmain/main/default.cfm?Action=29&Page=29

FS - Southern Research Station
Dept. of Agriculture
www.srs.fs.usda.gov

National Center for Computational Toxicology
Environmental Protection Agency
www.epa.govcomptox/

National Exposure Research Laboratory
Environmental Protection Agency
www.epa.govnerl/

National Health and Environmental Effects Research Laboratory
Environmental Protection Agency
www.epa.govnheerl/

National Institute of Environmental Health Sciences
Dept. of Health and Human Services
www.niehs.nih.gov

North Carolina Water Science Center
Dept. of Interior
http://nc.water.usgs.gov

NORTH DAKOTA

North Dakota Water Science Center
Dept. of Interior
http://nd.water.usgs.gov

Northern Prairie Wildlife Research Center
Dept. of Interior
www.npwrc.usgs.gov

OHIO

AFRL - 711th Human Performance Wing
Dept. of Defense - Air Force
www.wpafb.af.milafrl/711HPW/

AFRL - Air Vehicles Directorate
Dept. of Defense - Air Force
www.wpafb.af.milafrl/rb/

AFRL - Materials and Manufacturing Directorate
Dept. of Defense - Air Force
www.wpafb.af.milafrl/rx/

AFRL - Propulsion Directorate
Dept. of Defense - Air Force
www.wpafb.af.milafrl/rz/

AFRL - Sensors Directorate
Dept. of Defense - Air Force
www.wpafb.af.milafrl/ry/

ARL - Vehicle Technology Directorate - Propulsion Program
Dept. of Defense - Army
www.arl.army.milvtd/vtcindex.html

Air Force - Aeronautical Systems Center
Dept. of Defense - Air Force
www.wpafb.af.milasc/index.asp

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

Air Force Research Laboratory
Dept. of Defense - Air Force
www.afrl.af.mil

Glenn Research Center
NASA
www.nasa.govcenters/glenn/home/index.html

National Homeland Security Research Center
Environmental Protection Agency
www.epa.govnhsrc/

National Institute for Occupational Safety and Health
Dept. of Health and Human Services
www.cdc.govniosh/

National Risk Management Research Laboratory
Environmental Protection Agency
www.epa.govnrmrl/

Ohio Water Science Center
Dept. of Interior
http://oh.water.usgs.gov

OKLAHOMA

FAA - Civil Aerospace Medical Institute
Dept. of Transportation
www.faa.govabout/office_org/headquarters_offices/avs/offices/aam/cami/

National Energy Technology Laboratory - Tulsa
Dept. of Energy
www.netl.doe.gov

Oklahoma City Air Logistics Center
Dept. of Defense - Air Force
www.tinker.af.milunits/

Oklahoma Water Science Center
Dept. of Interior
http://ok.water.usgs.gov

OREGON

FS - Pacific Northwest Research Station
Dept. of Agriculture
www.fs.fed.us/pnw/

Forest and Rangeland Ecosystem Science Center
Dept. of Interior
http://fresc.usgs.gov

National Energy Technology Laboratory - Albany, OR
Dept. of Energy
www.netl.doe.gov

Oregon Water Science Center
Dept. of Interior
http://or.water.usgs.gov

PENNSYLVANIA

ARS - North Atlantic Area
Dept. of Agriculture
www.ars.usda.govmain/site_main.htm?modecode=19-00-00-00

Advanced Technology for Large Structural Systems Center
National Science Foundation
www.atlss.lehigh.edu

FS - Northern Research Station
Dept. of Agriculture
www.nrs.fs.fed.us/

NIOSH - Pittsburgh Research Laboratory
Dept. of Health and Human Services
www.cdc.govniosh/im-prl.html

National Energy Technology Laboratory - Pittsburgh
Dept. of Energy
www.netl.doe.gov

Naval Surface Warfare Center - Carderock Division, Naval Ship Systems Engineering Station
Dept. of Defense - Navy
www.dt.navy.mil

Pennsylvania Water Science Center
Dept. of Interior
http://pa.water.usgs.gov

PUERTO RICO

Caribbean Water Science Center
Dept. of Interior
http://pr.water.usgs.gov

RHODE ISLAND

Naval Undersea Warfare Center - Division Newport
Dept. of Defense - Navy
www.navsea.navy.milnuwc/newport

Naval War College
Dept. of Defense - Navy
www.nwc.navy.mil

SOUTH CAROLINA

Savannah River National Laboratory
Dept. of Energy
http://srnl.doe.gov

South Carolina Water Science Center
Dept. of Interior
http://sc.water.usgs.gov

Space and Naval Warfare Systems Center - Atlantic
Dept. of Defense - Navy
www.spawar.navy.mil

SOUTH DAKOTA

Earth Resources Observation & Science Center
Dept. of Interior
http://edc.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

Tennessee Valley Authority
www.tva.gov

Tennessee Water Science Center
Dept. of Interior
http://tn.water.usgs.gov

Y-12 National Security Complex
Dept. of Energy
www.y12.doe.gov

TEXAS

ARS - Southern Plains Area
Dept. of Agriculture
www.ars.usda.govmain/site_main.htm?modecode=62-00-00-00

Air Force - 311th Human Systems Wing
Dept. of Defense - Air Force
www.brooks.af.mil

Air Force Center for Environmental Excellence
Dept. of Defense - Air Force
www.afcee.af.mil

Air Force Information Operations Center (AFIOC)
Dept. of Defense - Air Force
www.8af.acc.af.milunits/airforceinformationoperationscenter/index.asp

Air Force Intelligence, Surveillance and Reconnaissance Agency
Dept. of Defense - Air Force
www.afisr.af.mil

Center for AMEDD Strategic Studies
Dept. of Defense - Army
https://cass.amedd.army.mil

Institute for Fusion Studies
Dept. of Energy
http://peaches.ph.utexas.eduifs/

Johnson Space Center
NASA
www.nasa.govcenters/johnson/home/index.html

NNSA - Pantex Plant
Dept. of Energy
www.pantex.com/

Texas Water Science Center
Dept. of Interior
http://tx.usgs.gov

U.S. Army Clinical Investigation Regulatory Office
Dept. of Defense - Army
www.cs.amedd.army.milciro/

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
https://www.dugway.army.mil

Ogden Air Logistics Center
Dept. of Defense - Air Force
www.hill.af.mil

Utah Water Science Center
Dept. of Interior
http://ut.water.usgs.gov

VIRGINIA

AFRL - Air Force Office of Scientific Research
Dept. of Defense - Air Force
www.afosr.af.mil

ARL - Vehicle Technology Directorate - Structures Program
Dept. of Defense - Army
www.arl.army.milvtd/vtcindex.html

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.hqda.army.milari/

Aviation Applied Technology Directorate
Dept. of Defense - Army
www.aatd.eustis.army.mil

Defense Advanced Research Projects Agency
Dept. of Defense
www.darpa.mil

Defense Technical Information Center
Dept. of Defense
www.dtic.mil

FHWA - Turner-Fairbanks Highway Research Center
Dept. of Transportation
www.tfhrc.gov

Langley Research Center
NASA
www.nasa.govcenters/langley/home/index.html

Marine Corps Systems Command
Dept. of Defense - Navy
www.marcorsyscom.usmc.mil

Mine Safety and Health Administration
Dept. of Labor
www.msha.gov

Naval Air Systems Command
Dept. of Defense - Navy
www.navair.navy.mil

Naval Medical Center - Portsmouth
Dept. of Defense - Navy
www-nmcp.med.navy.mil

Naval Safety Center
Dept. of Defense - Navy
www.safetycenter.navy.mil

Naval Surface Warfare Center - Dahlgren Division
Dept. of Defense - Navy
www.navsea.navy.milnswc/dahlgren/default.aspx

Navy Warfare Development Command
Dept. of Defense - Navy
https://www.nwdc.navy.mil

Office of Naval Research
Dept. of Defense - Navy
www.onr.navy.mil

RDECOM - CERDEC - 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

USACE - 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

Cascades Volcano Observatory
Dept. of Interior
http://vulcan.wr.usgs.gov

DOE - Hanford Site
Dept. of Energy
www.hanford.gov

NIOSH - Spokane Research Laboratory
Dept. of Health and Human Services
www.cdc.govniosh/im-srl.html

Naval Undersea Warfare Center - Division Keyport
Dept. of Defense - Navy
www.navsea.navy.milnuwc/keyport/default.aspx

Pacific Northwest National Laboratory
Dept. of Energy
www.pnl.gov

Washington Water Science Center
Dept. of Interior
http://wa.water.usgs.gov

Western Fisheries Research Center
Dept. of Interior
http://wfrc.usgs.gov

WEST VIRGINIA

National Energy Technology Laboratory
Dept. of Energy
www.netl.doe.gov

West Virginia Water Science Center
Dept. of Interior
http://wv.usgs.gov

WISCONSIN

FS - Forest Products Laboratory
Dept. of Agriculture
www.fpl.fs.fed.us/

National Wildlife Health Center
Dept. of Interior
www.nwhc.usgs.gov

Upper Midwest Environmental Science Center
Dept. of Interior
www.umesc.usgs.gov

Wisconsin Water Science Center
Dept. of Interior
http://wi.water.usgs.gov

WYOMING

Rocky Mountain Oilfield Testing Center
Dept. of Energy
www.rmotc.doe.gov

Wyoming Water Science Center
Dept. of Interior
http://wy.water.usgs.gov

Editorial Staff
Belinda Padilla
Denise A. Bickmore
Tom Brown
Tara Rider

Contributors
Carolyn Andrews
Josephine Aromando
Linda von Boetticher
Dr. Aviva Brecher
Kay Cordtz
Brian P. Darmody
John Dement
Cynthia L. Dreibelbis
Steve Ferguson
Kristina A. Fowler
Indrani Graczyk
Diana Hoyt
Robert S. Leonardi
Randy Montoya
Robin M. Orans
Dr. Mark Reeves
Charles Salahuddin, J.D.
Mark J. Surina
Cynthia E. Wlodarski

Design
James Benson

FLC Headquarters
1001 Connecticut Ave., NW, Suite 735
Washington, DC 20036

FLC Management Support Office
950 North Kings Highway, Suite 208
Cherry Hill, NJ 08034
856-667-7727
856-667-8009 fax
www.federallabs.org

This document was prepared as an account of the work sponsored by agencies of the United States Government. Neither the U.S. Government, the Federal Laboratory Consortium for Technology Transfer, nor any associated employees or contractors makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, product, or process in this publication. The material presented in this publication is based on information provided by FLC member laboratories and their industrial partners.