Maryland

Maryland Commerce, Aberdeen Proving Ground, and County Partners Open and Expand Defense Technology Center

U.S. Department of Defense | U.S. Army Combat Capabilities Development Command Chemical Biological Center

Maryland has more federal labs than any other state—74 to be exact. The Chesapeake Science & Security Corridor (CSSC), the Northeast Maryland communities surrounding Aberdeen Proving Ground (APG), has been honored as a "Great American Defense Community" by the Association of Defense Communities (ADC). While the region has been praised for its support of service members and military families, the Maryland Department of Commerce (MDC) recognized that counties were heavily dependent on defense spending and in need of economic diversification.

The Maryland Defense Technology Commercialization Center (DefTech Center) and initiative were founded in February 2018 as a 13-month pilot program funded by the Department of Defense (DoD) Office of Economic Adjustment (OEA). To help the county economies grow and use their proximity to advanced defense technology to the region's advantage, MDC's Office of Military and Federal Affairs and its federal lab partners built this innovative program to support transferring technology out of federal labs and helping companies commercialize viable products.

Originally, the partnership included MDC, Harford and Cecil Counties, the U.S. Army Research Lab (ARL), the Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR, formerly CERDEC) Center, and the Chemical Biological Center (CBC, formerly ECBC) under supervision of the U.S. Army Combat Capabilities Development Command (CCDC). Howard County, Anne Arundel County, Frederick County, and the City of Frederick joined at the end of 2018, along with the U.S. Army Medical Research and Development Command (USAMRDC) at Fort Detrick and the National Security Agency (NSA) at Fort Meade. Via a competitive bidding process, Axcel Innovation, LLC, under the leadership of Dr. Gary Evans, was selected as the third-party contracted vendor to implement the agreed-upon scope of work. The Army Alliance (Harford County), Fort Meade Alliance, and Fort Detrick Alliance joined as official partners, along with three private partners—Early Charm Ventures, Altus Engineering, and Maryland TEDCO.

In the short year and a half of its existence, DefTech has created a state-specific database of defense-related patents and identified 156 patents for business mentees this year alone. DefTech's 2.5-person full-time staff has provided training, support and mentoring to 35 companies, two of which have executed Patent License Agreements (PLAs) and Collaborative Research and Development Agreements (CRADAs). Five more companies are presently engaged in negotiations for either PLAs or CRADAs.

Initially situated within close proximity to Aberdeen Proving Ground, the program expanded to include Fort Detrick and Fort Meade at the end of the first 12 months of the pilot program. DefTech has achieved significant public gains by garnering strong support from government, industry, and academia since its launch. The DefTech initiative has been endorsed by the governor of Maryland and both its U.S. senators. Because of DefTech's early success in the pilot program, additional funding of $750,000 by the Federal Economic Development Administration under its 16 grant program was awarded in December 2018 to continue geographical expansion. DefTech provides a practical and scalable model of successful technology transfer and commercialization for other states and regions to replicate.

The ribbon cutting ceremony opening the DefTech Center in Maryland.

Photo courtesy of Harford County Office of Community and Economic Development

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California

EPA Collaborates with California on Tire Crumb Rubber Exposure Research

U.S. Environmental Protection Agency | Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry (CDC/ATSDR)

In 2016 a multi-agency research effort under the Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds was launched by the EPA, the Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry (CDC/ ATSDR), and the Consumer Product Safety Commission (CPSC) to address concerns raised by the public about soccer players and the safety of recycled tire crumb used in playing fields and playgrounds. The research activities represent a collaborative federal effort to increase knowledge and available information about synthetic turf fields by developing exposure information (what is in the material and how people come in contact with the material).

Researchers at the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (CalEPA OEHHA) are also conducting research aimed at reducing data gaps for tire crumb rubber constituents and human exposures. Federal researchers collected tire crumb rubber samples from 9 tire recycling plants and 40 synthetic turf fields across the U.S., and OEHHA collected samples from California. Under a Materials Cooperative Research and Development Agreement (CRADA), the EPA regularly consults OEHHA scientists to coordinate. The federal and state researchers are identifying and implementing methods and approaches that will, where feasible, produce comparable data. This could effectively expand the overall U.S. research sample size and provide additional insight into potential exposure variability. There are also important differences between the federal and OEHHA studies that will provide complementary data for improved exposure assessment.

"The U.S. EPA study complements and strengthens what we are doing in California. Consultations with the U.S. EPA scientists benefit our project team and help to improve the quality of the California synthetic turf study."—CalEPA OEHHA Senior Toxicologist Dr. Patty Wong

Taking samples of tire crumb rubber from a turf field.

Photo credit: EPA

www.epa.gov /EPA @EPA

EPA MST Technologies

U.S. Environmental Protection Agency

Virginia

According to the Environmental Protection Agency's (EPA) National Water Quality Inventory Report to Congress, fecal bacteria are one of the leading causes of U.S. surface water impairment.

EPA scientists recently sought an innovative approach to monitor fecal pollution through the study of fecal bacterial communities at a molecular level. The result was the development of novel genetic-based technologies that can measure human and cattle fecal pollution levels in surface water samples. These patented microbial source tracking (MST) methods are technologies aimed at identifying and, in some instances, quantifying fecal animal sources of contamination in environmental waters.

Due to nationwide fecal pollution concerns there is a growing demand by academic, state, and municipal government laboratories to implement EPA MST technologies. To accommodate interest from nonprofit entities, the EPA developed non-commercial licenses for government agencies and universities. One government licensee of this technology is the Hampton Roads Sanitation District (HRSD), which protects water in 18 cities and counties in southeastern Virginia. In its first two years using EPA's technology, HRSD has found great success applying the technology to monitor open water bodies and stormwater discharge.

HRSD has begun an effort to reduce bacteria contamination in local waterways by proactively identifying and repairing ailing and failing sewer infrastructure sources of human fecal contamination. The district has been using a variety of microbial source tracking tools to accomplish this mission, including utilization of EPA's patented technology.

HRSD is focusing its efforts on identifying ailing and failing sewer infrastructure throughout its system. Their approach has been to target potential conduits of human fecal contamination using human-associated markers. Any stormwater outfalls that are found to be positive for a common human MST marker are investigated further by systematically sampling the upstream stormwater conveyance system at key access locations. Each time a branch point is encountered in the network, samples are collected upstream in each reach. In this way, the human-associated marker signal is traced through the stormwater infrastructure. When the extent of the signal has been demarcated in the stormwater conveyance system, adjacent sections of the sewer infrastructure are assessed for potential failure mechanisms. The initial effort uses one readily available human-associated marker (HF183); however, repairs to the sewer conveyance system are confirmed with the more specific markers developed by EPA.

One case study in HRSD's jurisdiction involves Wayne Creek. HRSD personnel completed a downstream to upstream stormwater pipe network investigation, sampling every tributary stormwater outfall intersecting the stormwater network of interest. After delineating the problem area, the City of Norfolk identified a leaking sewer pipe in the Wayne Creek sub-watershed. Sampling conducted one month after the repair confirmed that there was no remaining human fecal contamination at the sampling sites.

Through its use of EPA's licensed MST technology in concert with related MST technologies, HRSD is able to provide a healthier water system for its constituents.

Water runoff from aging infrastructure.

Photo by Eric Vance, U.S. EPA.
(Photo credit: U.S. EPA)

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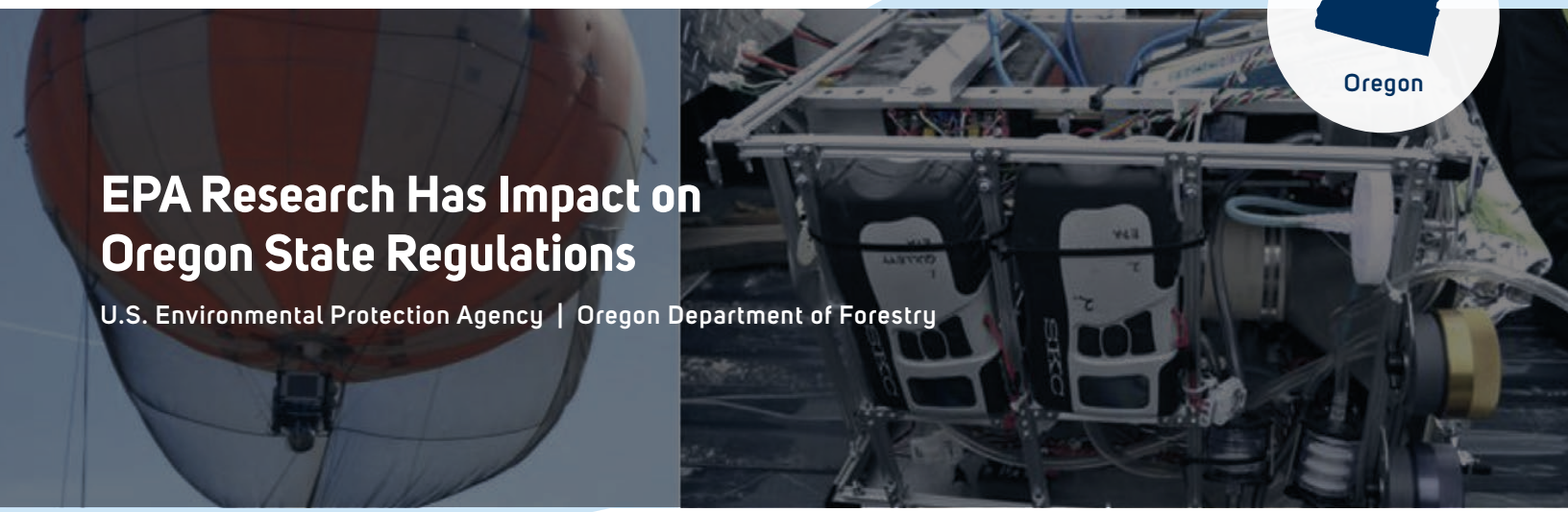

Oregon

EPA Research Has Impact on Oregon State Regulations

U.S. Environmental Protection Agency | Oregon Department of Forestry

To reduce wildfire risk and to improve timber forest productivity and health, woody biomass fuels from selective thinning and timber harvests are mechanically treated and piled for burning. Pile burning mitigates concerns about fire safety and air quality as it allows managers to burn under optimal weather conditions and with reduced staffing levels. To promote pile combustion, the biomass is preferably dry, resulting in faster, hotter, and more efficient burns, presumably with less pollutants. Common practice involves covering these large piles with polyethylene (PE) film to prevent moisture saturation during the rainy season. However, this practice has raised some questions about emissions from the burning plastic film.

In 2015, EPA entered into a Cooperative Research and Development Agreement (CRADA) with the Oregon Department of Forestry to study the effect of covering and burning timber slash piles with PE sheeting. Sampling of the burn piles was conducted using an EPA-developed instrument platform termed the "Flyer" that was lofted into the plume using a tether-controlled, helium-filled aerostat, or balloon. The platform sampled for emissions of pollutants, including carbon monoxide, carbon dioxide, methane, particulate matter, and black carbon to determine emissions factors and the amount of pollutant formed per amount of biomass burned. The aerostat was connected to two winch-equipped all-terrain vehicles (ATVs) with two tethers. The Flyer was maneuvered into the burn pile plume by controlling tether length and the location of the ATV-mounted tether winches. Sampling periods consisted of both active flaming and smoldering emissions.

EPA's research indicated that burning dry piles, whether covered with PE or not, exhibited statistically significant lower emissions than wet piles due to better combustion efficiency. Variation of PE cover size and thickness showed no statistically significant difference in emissions factor for any of the pollutants, suggesting that the PE was not contributing significantly to any of the measured pollutants. As a result, Oregon modified its state guidelines for covering piles.

Aerostat with Flyer (left) and close-up of Flyer (right).

Photo credit: Brian Gullett

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New Jersey

FAA Technical Center Collaborates to Shape the Future of Aviation in South Jersey

U.S. Department of Transportation | Federal Aviation Administration

The FAA William J. Hughes Technical Center's newest laboratory, located in the National Aviation Research and Technology Park (NARTP), exemplifies a technology transfer partnership success story.

The NARTP is an auxiliary organization of Stockton University that establishes high-technology aviation facilities and provides opportunities to promote aviation-related applications.

The FAA worked together with the NARTP, the Atlantic County government, the State of New Jersey Economic Development Agency and several nonprofit entities to bring this laboratory to fruition. This new facility positions Atlantic County and the state of New Jersey to impact the future of aviation through innovation, research, development, testing, evaluation, and the transfer and commercialization of cutting-edge global aviation technologies.

"The construction of the first of seven buildings was made possible through focused efforts, willing partners, dedicated individuals, and good timing," said Technical Center Director Shelley Yak.

The FAA laboratory will:

- Serve with other FAA labs as a foundation for Cooperative Research and Development Agreements, and for the transfer of technologies and intellectual property to the marketplace.
- Support research in the areas of artificial intelligence, autonomy, SMART airports, data analytics and as-yet-unimagined aviation innovation.
- Promote Aviation Science, Technology, Engineering, and Mathematics (AvSTEM).
- Foster innovation and facilitate implementation of SMART airport technologies at the Atlantic City International Airport.

This new laboratory will use the Agency and the NARTP resources (people and labs) to further capitalize on new as well as existing partnerships with academia to grow the future aviation workforce. Atlantic Cape Community College, Stockton University, New Jersey Institute of Technology, Rowan University, and Embry Riddle Aeronautical University are already onboard.

The FAA's laboratory will also:

- Provide internships.
- Support AvSTEM studies to students ranging from elementary school to college.
- Foster education and job programs.
- Facilitate collaboration between small companies and the FAA.

This regional investment started with a vision when the FAA Technical Center began seeing a convergence of trends towards public-private partnerships, fiscal reallocation, innovation, and information technology. The aviation research community determined then that to maintain global prominence in aviation research and innovation, the FAA, industry and academia needed to work together.

To make this laboratory a reality, the FAA leased 58 acres to the NARTP, and the Atlantic County Improvement Authority financed, constructed and now operates the building. New Jersey Governor Phil Murphy said the project shows how the state will lead in the aviation innovation economy. New Jersey Senate President Steve Sweeney said Atlantic County Executive Dennis Levinson's leadership in championing the construction of the Park made "all the difference."

The ribbon cutting of this new laboratory caps a decades-long quest to develop an aviation hub near the Technical Center and the airport. The successful effort can be attributed in part to the FAA's leadership and progressive thinking.

The future of aviation begins here at the FAA William J. Hughes Technical Center's newest laboratory with the end goal of commercializing research and technology products.

Shelley Yak, Director, FAA Technical Center (2nd from left), Chris Brown, state senator (4th from left), Philip D. Murphy, New Jersey governor (center), Dennis Levinson, Atlantic County Executive (2nd from right), and NJ Senate President Steve Sweeney (far right) cut the ribbon to the National Aviation Research and Technology Park.

Photo Courtesy of FAA

www.faa.gov

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California Partners with Lawrence Livermore National Lab to Mitigate the Impact of Droughts

U.S. Department of Energy | Lawrence Livermore National Laboratory

California

Like much of the western United States, California has experienced the realities and challenges that accompany large-scale severe drought. From 2011 to 2017, California experienced some of the severest drought conditions dating back to the late 1800s. The need to address the state's susceptibility to drought with cutting-edge water and energy innovations became a priority.

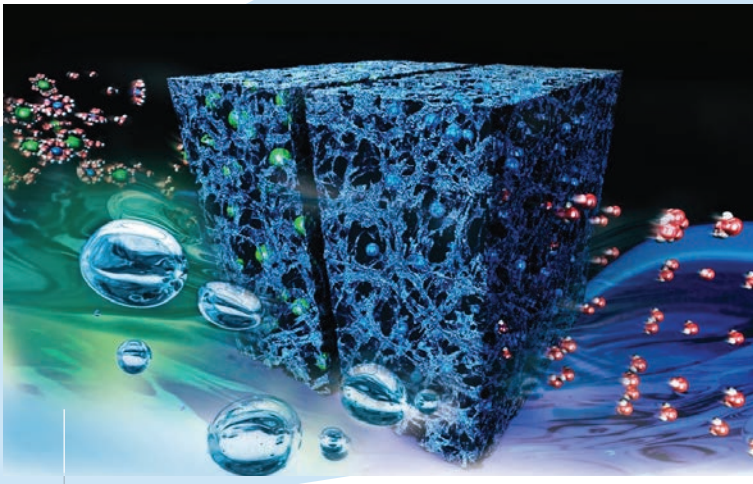
The California Energy Commission (CEC), through its Electric Program Investment Charge (EPIC), supports new energy solutions by fostering regional innovation and bringing clean energy ideas to the marketplace to benefit California's electric utility ratepayers. EPIC funded an effort by Lawrence Livermore National Laboratory (LLNL) to find a new solution that would reduce the cost of water desalination and increase water reuse.

Using reverse osmosis (RO) technology to desalinate water has been around for decades. However, current methods require an extensive infrastructure, are energy-intensive, and expensive to operate. It requires energy to produce the pressure needed to push the water through the filtering membranes. Can desalination be achieved through a more cost-effective method? LLNL researchers believe they have done just that. They have developed a new capacitive desalination (CD) technique that could ultimately lower the cost and time of desalinating water.

With more traditional capacitive desalination, a voltage is applied between two porous electrodes to adsorb ions onto the electrode surface and thus remove them from the feed stream. Due to the small pore sizes of the electrodes, the feed stream flows between the electrodes and through a dielectric porous separator. However, the new technique, called flow-through electrode capacitive desalination (FTE CD), uses new porous carbon materials with a hierarchical pore structure, which allows saltwater to easily flow through the electrodes themselves. Flowing through an electrode rather than between two electrodes allows for several significant advantages, including faster desalination, more salt removed for each charge of the capacitor, and more energy-efficient desalination.

FTE CD has several advantages over RO. FTE CD requires no membrane components and can operate at low pressures and temperatures; and energy recovery is performed with a solid-state circuit, which is more scalable and cost-efficient than the turbines used for energy recovery in RO. FTE CD can also be tuned to remove other targets such as nitrates, calcium, magnesium and more.

LLNL researchers will be demonstrating the FTE CD technology at the Delta Diablo water treatment facility in Antioch, California. The goal is to take tertiary treated water from the plant and remove salt and nutrients so that it can be used in the plant's cooling tower without requiring extensive chemical treatment.



Flow-through electrode capacitive desalination (FTECD) uses hierarchical porous carbon in a device where a stream passes through the electrodes, resulting in salt-removal rate improvements. In this rendering, saltwater enters the carbon aerogel electrodes (left) leaving behind sodium (green dots) and chloride (blue dots) ions. Clean water exits on the right.

Photo rendering by: Kwei-Yu Chu

Lawrence Livermore National Laboratory

FLC Feature on C-Suite, LTTO and NASA/SSC

National Aeronautics and Space Administration - John C. Stennis Space Center | Louisiana State University

Louisiana

Over two decades ago, a small group of individuals working to enhance the culture of technology and innovation in Louisiana, approached their governor with a unique concept—a state office located at a federal city located in a border state (Mississippi). From this idea came the Louisiana Technology Transfer Office (LTTO), a component of the Louisiana Business & Technology Center (LBTC) at the Innovation Park, Louisiana State University, Baton Rouge, LA. The LTTO has maintained a technology transfer office at the NASA John C. Stennis Space Center (SSC), Mississippi, for over 25 years, the last 19 staffed full-time as a Resident Agency at SSC. Through the LTTO, the state of Louisiana has enjoyed a unique and successful partnership with NASA Stennis via a Memorandum of Understanding between the governor and the NASA Stennis Center director.

LTTO provides an avenue for universities and small businesses in Louisiana to have access to the resources of federal labs, like NASA, including Stennis Space Center and the Michoud Assembly Facility, New Orleans. It also supports NASA mission-critical needs by leveraging resources available in Louisiana. One unique method to accelerate/simplify the flow of R&D dollars from federal labs at Stennis to universities and research institutions in Louisiana is a multiyear, task order type of procurement mechanism known as the Louisiana Research Consortium (LRC). The Louisiana Board of Regents is a signatory, and NASA is the single entity acting as fiscal agent for the universities. The current LRC is for a five-year period at $15,000,000. "The Louisiana Technology Transfer Office at Stennis has proven to be a very valuable resource for our state, providing an avenue for our universities and small businesses to access the resources of federal labs like NASA, engage with large industry on-site, and create jobs for Louisiana residents," according to Don Pierson, Secretary at Louisiana Economic Development.

The LTTO at Stennis worked with NASA/Stennis and C-Suite Services LLC, a small start-up technology-oriented company located outside of New Orleans in Metairie, Louisiana, to help coordinate and facilitate their interest in working with NASA. C-Suite has licensed five SSC patents—the Floating Piston Valve invented by Bruce Farner (NASA), the Cryogenic Cam Butterfly Valve invented by Kenny McCormack (S3), the Energy Harvesting Smart Sensor, the Field Deployable Piezoelectric Gravimeter, and the In-situ Monitoring of Piez oelectric Sensors invented by Scott Jensen (NASA).

Over the last three years, SSC's Test Technology Branch has used a multifaceted strategy to license the SSC patent portfolio, and the results have been phenomenal. In the last two years, SSC has signed almost as many patent licenses as the prior 20 years combined.

SSC worked closely with NASA's Technology Transfer (T2) Program to utilize the agency's enterprise tools, such as Technology Opportunities sheets, inventor profiles, NASA Tech Briefs, and the T2 portal (https://technology.nasa.gov), to make SSC technologies more discoverable. SSC also created its own technology website (https://technology.ssc.nasa.gov) to provide additional content.

Visit to the NASA John C. Stennis Space Center (SSC) (from left): Christopher Copelan, NASA/SSC Technology Transfer Administrator; Kevin Pollard of C-Suite Services, LLC, in Metairie, LA; Duane Armstrong, Chief, Test Technology Branch at NASA/SSC (holding the C-Suite-designed Floating Piston Valve); and Vic Johnson, Director, Louisiana Technology Transfer Office at SSC.

Photo credit: Louisiana Technology Transfer Office

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NSA and the University of Texas: Supporting National Security and Economic Development Through Innovative Research Partnerships

National Security Agency | University of Texas | University of Texas San Antonio

The National Security Agency (NSA) leads the U.S. Government in cryptology that encompasses both signals intelligence (SIGINT) and cybersecurity products and services, and enables computer network operations to gain a decision advantage for the nation and our allies under all circumstances. Cybersecurity is also a driving force of the San Antonio, Texas economy, home to the largest concentration of government and private-sector cybersecurity experts and leaders outside of Washington, D.C. While the NSA has long had a significant presence within this technology ecosystem at its Texas Cryptologic Center, the Agency has implemented a new model of a Cooperative Research and Development Agreement (CRADA) with the University of Texas (UT) System. This model now redefines and expands its relationship with the UT System, fostering significant research, workforce development, and economic benefits in critical technology areas vital to national security.

As part of its ongoing engagement with the University of Texas, NSA created in 2018 a first-of-its-kind CRADA that standardizes terms and conditions for specific joint work plans across the 14-institution UT System, resulting in significant improvements in the agility and responsiveness of collaborative research projects. Under the umbrella CRADA, joint work plans can now be structured and approved within weeks, allowing projects to be more responsive to Agency needs and more closely mirror the semester-by-semester cadence of higher education engagement.

Much of the work to date has been concentrated at the University of Texas San Antonio (UTSA), a national leader in cybersecurity that has fostered relationships with NSA and other federal agencies involved in intelligence and national security. Along with facilitating research within UTSA, NSA uses the umbrella CRADA to empower collaboration through the UTSA's National Security Collaboration Center (NSCC), a research center with more than 40 private and public-sector partners, to help a wide range of stakeholders meet shared national security needs. Many of these private and public partners specifically cited the importance of closer collaboration with NSA and other federal agencies in coordinating responses to shared threats and challenges.

The UTSA NSCC has provided a $100-million boost to the local technology ecosystem, which includes an excess of 1,000 technology businesses, 35,000 information technology workers, and an annual economic impact of approximately $12 billion. Federal agency collaboration is a vital part of this ecosystem, with current federal cyber operations in San Antonio accounting for over 7,000 military and civilian jobs. It also supports broader regional and statewide economic development objectives, which identify cybersecurity as a key economic driver throughout the I-35 corridor.

The umbrella CRADA and the collaborations it has facilitated also resulted in significant workforce benefits for NSA and the cybersecurity sector. Throughout the long term strategic relationship, more than 50 UTSA graduates have gone on to become NSA employees, and the Agency partnered with UTSA to create accelerated degree plans in cybersecurity and modern languages. Together, these efforts have helped the Agency and its federal and private sector partners "tackle some of America's toughest problems," said NSA Texas Commander Col. Gregory J. Gagnon.

This graphic is an illustration of the NSA - University of Texas partnership and how it fosters research, workforce development, and economic benefits in critical technology areas vital to national security.

Illustration courtesy of NSA Technology Transfer Program

NATIONAL SECURITY AGENCY
TECHNOLOGY TRANSFER PROGRAM
Office of Research & Technology Applications

TEXAS The University of Texas at Austin UTSA

www.nsa.gov/techtransfer /NSAUSGov @NSAGov

California

Research on Digital Twins for Modernized In-Service Engineering and Naval Maintenance

U.S. Department of Defense | Naval Surface Warfare Center - Port Hueneme

The great races of the world are not necessarily those of speed, but rather those of a dominance of ingenuity. Consider the pre-Great War arms race or the space race under President Kennedy. What the victors of those historic events have in common is how swiftly and completely they capitalized on emerging technologies.

Our contemporary race entails the military applications of unmanned aerial systems (UASs) and the utilization of their collected data. The Naval Surface Warfare Center located at Port Hueneme, California (NSWC PHD) has taken great strides in the recognition of UAS applications through efforts with Aerial Alchemy under a Cooperative Research and Development Agreement (CRADA) signed in June 2018. Aerial Alchemy is a UAS data collection service company familiarized with Navy requisites through participation in multiple Advanced Naval Technology Exercise (ANTX) iterations. Their work on power substations across California succeeded in beginning to modernize engineering methods of public utility infrastructure in the same way it could bring comparable modernization to the Navy. In the agreement's terminology, the research's prescribed purpose is to "investigate the feasibility of utilizing [UASs] in the realm of naval and shipboard repair, maintenance and special use situations to ensure the readiness of naval and combat systems" (NCRADA-NSWC PHD-18-0004).

Digital Engineering was dubbed a Department of Defense (DoD) initiative the same month this CRADA took effect, and this research fulfils all five points of the DoD's Digital Engineering Strategy, most notably, to "formalize the development, integration, and use of models to inform enterprise and program decision making" (Digital Engineering Strategy, 2018).

Unlike blueprints, ship scans demonstrate true status via time-based, geotagged, metadata-dense models, which are far more actionable data sets. Aboard the Navy research vessel, M/V Independence, Aerial Alchemy produced a digital twin using aerial and onboard photogrammetry with lidar (light detection and ranging), in such exceptional detail that individual flakes of rust become visible. This lends itself to Navy preventative maintenance needs by allowing maintenance personnel to compare scans and observe corrosion degradation to key combat (or other) systems with unprecedented clarity. Research has insofar shown the potential to reduce maintenance costs and human error by producing more reliable, remotely viewable data for experts who can call for repairs on any identified quandary before its degradation to the point of failure.

Perhaps the consequential race of our day is indeed that for mastery of UASs and their digital twin outputs. The full advantage this gives the Navy and DoD has yet to be seen in its entirety, yet the experimentation under this CRADA benefits the United States by manifesting the beginnings of an effective long-term, cost-reducing, maintenance system. The accurate corrosion tracking and digital twins generated stand to be among the most innovative new capabilities in the fleet. In conclusion, consider this quote from the Office of the Undersecretary of Defense and its relevance to this undertaking: "By providing a more agile and responsive development environment, digital engineering supports engineering excellence and provides a foundation to fight and win the wars of the future."

A 3-D model resulting from combined aerial photography and handheld lidar is loaded with vital metadata, thus becoming a "digital twin" available to engineers and maintenance personnel, which facilitates the shift from analog to digital engineering.

Photos courtesy of Aerial Alchemy

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California

Forecast-Informed Reservoir Operations (FIRO)

U.S. Department of Defense | U.S. Department of Commerce | U.S. Department of the Interior

Center for Western Water and Weather Extremes (CW3E) at Scripps Institution of Oceanography, UC San Diego | Sonoma Water | California Department of Water Resources | National Oceanic and Atmospheric Administration: National Weather Service, Earth System Research Laboratory, National Marine Fisheries Service | U.S. Bureau of Reclamation | U.S. Army Corps of Engineers

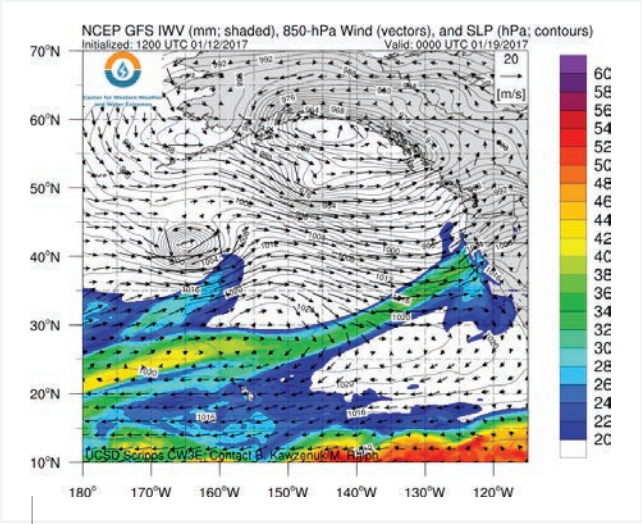
Finding a workable balance between enforcing flood control measures and ensuring adequate water reserves has been a perpetual challenge for state, county, and federal agencies. To achieve better balance, an interagency partnership in northern California is now completing a full viability assessment of a novel management strategy informed by sharing state-of-the-art tools from science and technology, and leveraging the expertise of government and university scientists, engineers, and water managers.

An interagency Steering Committee, created in 2014, began exploring methods to optimize water management at Lake Mendocino reservoir. Called Forecast-Informed Reservoir Operations (FIRO), the collaborative study sought improved local water supplies, reduced flood risk, and added ecosystem benefits. Combining the best available computer modeling, advanced climate forecasting, watershed monitoring techniques, and other technical inputs from several science-based agencies, the FIRO partnership reported in a preliminary viability assessment (August 2017) that the new strategy offers significant advances.

FIRO participants share their technologies and knowledge within a complex but robust partnership with impressive results. The FIRO partners include: Center for Western Water and Weather Extremes (CW3E) at Scripps Institution of Oceanography, UC San Diego; Sonoma Water; California Department of Water Resources; National Oceanic and Atmospheric Administration/National Weather Service/Earth System Research Laboratory/National Marine Fisheries Service; U.S. Bureau of Reclamation; and U.S. Army Corps of Engineers.

The project engages a network of experts in biology, economics, climate, civil engineering, hydrology, meteorology, and computing from federal, state, and local agencies, as well as universities and other stakeholders safeguarding water resources and healthy ecosystems. Transferability potential of the effort is being tested now at additional reservoirs, including Prado Dam in southern California and at Oroville and New Bullards Bar dams in the Sierra Nevada foothills. The FIRO strategy's use of the best available technology also has wider applicability to any situation balancing weather-affected water supplies, environmental issues, flood risk reduction, and dam safety. More broadly, FIRO is changing the way the study partners and other water and flood management officials expect to integrate emerging R&D from government and nongovernment researchers.

The FLC nominees' respective institutions are longtime innovators in the specific science, engineering, and technology areas used in developing the FIRO strategy. As examples, a primary mission of the Army Corps of Engineers is planning, designing and operating dams and flood prevention systems. NOAA's National Marine Fisheries Service is deeply involved in recovery of three endangered fish species that depend on the Russian River, and the agency's Office of Atmospheric Research leads U.S. research on weather model improvements. Researchers with the U.S. Geological Survey have been involved in hydrologic monitoring and research in the Russian River watershed for over a decade, including development of soil moisture monitoring methods and modeling of rainfall, soil moisture, and water flow.



NOAA's National Centers for Environmental Prediction (NCEP) Global Forecast System (GFS) model forecast of integrated water vapor (IWV) from an atmospheric river (AR) predicted to impact northern California on 19 January 2017. The term "pineapple express" comes from ARs frequently appearing to originate near the Hawaiian Islands.

The Russian River watershed encompasses Lake Mendocino, where initial research in flood control, water supply and recreational needs was conducted under the FIRO project.

www.usace.army.mil/ /USACEHQ @USACEHQ

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Kansas

Successful Partnership to Increase Adoption and Utilization of Sorghum in Bioenergy

U.S. Department of Agriculture | Agricultural Research Service | Center for Grain and Animal Health Research | Grain Quality and Structural Research Unit | Kansas State University - Center for Sorghum Improvement | Western Plains Energy

This nomination details the successful partnership between a federal laboratory, university, collaborative sorghum stakeholder group, and a bioenergy industry partner to address an issue in bioethanol production and address barriers to adoption and utilization of sorghum—a crop in the United States that is more acclimated to growth in hotter/dryer climates.

The partnership identified a barrier to a grain processor, the biofuel plant, responding to the variability in local production of starch-based grains. Specifically, ethanol plants located on the Great Plains have influx between the availability of corn and sorghum based on the growing season. This necessitates the need to utilize diverse feedstock. A barrier to diversifying feedstock is the requirement to account for the grain in an infrastructure that mixes commodities in lieu of single commodity storage. Feedstock accounting supports both the management of fermentation efficiency and requirements of fuel markets. Addressing this barrier required high throughput technology that is scalable with easy adoption in a commercial processing plant.

Specifically, researchers at USDA Agricultural Research Service (ARS), Kansas State University, The Center for Sorghum Improvement and Western Plains Energy, LLC, collaborated to develop and validate a rapid near infrared (NIR) spectroscopic test to determine the composition of corn-sorghum flour mixtures used in the production of bioethanol. In addition to this rapid NIR test method, the partners developed a real-time PCR method to support the rapid NIR methodology with a reference and validation method. Adoption of the NIR technology was rapid due to the integral partnership approach. Western Plains Energy, LLC, has received the NIR calibration curve and reference samples, and is integrating the methodology into operations. In addition, an NIR instrument company and a bioethanol enzyme company have received the NIR method and are working with Western Plains Energy to further implement and develop the methodology. This expansion of the partnership to service providers enables broader dissemination of the technology. Further distribution of the process will occur by publication and stakeholder presentation in the fall.

Western Plains Energy is currently in the process of adopting this technology for use and has installed in-line NIR instrumentation to facilitate it. This technology could be used industry-wide where needed to help identify the composition of feedstock used to produce a given batch of ethanol.

This project leveraged existing strong partnerships between the USDA-ARS lab in Manhattan, Kansas, Kansas State University researchers, and the Center for Sorghum Improvement at Kansas State University (state government). The interface between the researchers and industry provided by leadership at the Center for Sorghum Improvement was critical to the success of this project and highlights the potential for future partnerships between ARS, academia and the sorghum industry. Sorghum is an important crop for the central and southern region of the Great Plains, with an estimated gross production value for the U.S. of approximately $1.3 billion (www fao.org/faostat/en/#home). Continued partnerships like the one detailed in this nomination will serve to strengthen and increase the value of U.S. sorghum and benefit the U.S. ethanol industry.

Western Plains Energy LLC, ethanol plant.

Online near infrared instrument Installed at the Western Plains Energy, LLC plant

Photos courtesy of Derek Peine, Western Plains Energy

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