Results of Fiscal Year 2014 Research and Development

February 2, 2015

Fiscal Year 2015 Report to Congress

Homeland Security

Science and Technology Directorate

Results of Fiscal Year 2014 Research and Development

Table of Contents

I.   Legislative Requirement

This report was prepared pursuant to language in Senate Report 113-77 accompanying the *Fiscal Year 2014 Department of Homeland Security Appropriations Act* (P.L. 113-76).

Senate Report 113-77 states:

Reporting Requirements

    S&T is directed to continue to provide the following:
        --a report on results of its research and development for the prior fiscal year.

II. Acronyms

Federal Government
U.S. - United States
USG - United States Government
ATF - Bureau of Alcohol, Tobacco, Firearms and Explosives
CIA - Central Intelligence Agency
CDC - Centers for Disease Control
DoD - Department of Defense
DoJ - Department of Justice
DOT - Department of Transportation
EPA - Environmental Protection Agency
FAA - Federal Aviation Administration
FBI - Federal Bureau of Investigation
FCC - Federal Communications Commission
FDA - Food and Drug Administration
GSA - General Services Administration
HHS - Department of Health and Human Services
OMB - Office of Management and Budget
USDA - United States Department of Agriculture

Department of Homeland Security
DHS - Department of Homeland Security
CBP - Customs and Border Protection
DNDO - Domestic Nuclear Detection Office
FEMA - Federal Emergency Management Agency
FPS - Federal Protective Service
I&A - Office of Intelligence and Analysis
ICE - Immigration and Customs Enforcement
NPPD - National Protection and Programs Directorate
OBIM - Office of Biometric Identity Management
OCIO - Office of the Chief Information Officer
OHA - Office of Health Affairs
TSA - Transportation Security Agency
USCIS - United States Customs and Immigration Services
USCG - United States Coast Guard
USSS - United States Secret Service
S&T - Science and Technology Directorate
HSARPA - Homeland Security Advanced Research Projects Agency
NUSTL - National Urban Security Technology Laboratory
NBACC - National Biodefense Analysis and Countermeasures Center
CSAC - Chemical Security Analysis Center
TSL - Transportation Security Laboratory

III. FY 2014 Research & Development Results of the Science and Technology Directorate

This report was prepared pursuant to language in Senate Report 113-77 accompanying the *FY 2014 DHS Appropriations Act* (P.L. 113-76) to provide information concerning the results of research and development for the DHS Science and Technology Directorate (S&T) that occurred in the prior fiscal year.

The following are the results for FY 2014 organized by S&T budget thrust areas:

IV. Apex

Project: Apex Air Entry/Exit Re-engineering (AEER)
End User: Customs and Border Protection (CBP)
Result: Commissioned the Maryland Test Facility (MdTF) that provides a controlled environment for operational scenario-based testing to evaluate biometric technologies and processes under simulated airport entry and exit conditions. The team also completed the operational analysis phase of Apex AEER and transitioned into the testing phase, which included down selecting technologies for the three modalities to be tested (facial, iris, and fingerprint). The Apex AEER team began testing in September, recruiting approximately 400 subjects for the first phase of testing. AEER continues to engage key industry stakeholders (airline and airport associations) for insight and feedback as the project progresses. S&T also remains in close communication throughout the project with its partner, CBP, to ensure their input and questions are addressed as the program continues.
Group / Division: Homeland Security Advanced Research Projects Agency (HSARPA) Apex

Project: Apex Border Enforcement Analytics Program
End Users: Immigration and Customs Enforcement (ICE) Homeland Security Investigations and Export Enforcement Coordination Center
Result: Transitioned the first version of a new developmental big data storage, computation and analytics capability to ICE to support operations. S&T partnered with ICE to develop promising new algorithms for enforcement operations that will contribute to meeting the Administration's export control reform goals. These new algorithms were implemented and evaluated in the S&T big data laboratory, which will continue transition of capabilities to ICE in FY 2015.
Group / Division: HSARPA Apex

Project: HSARPA Predictive Analytics Center (PAC)
End Users: Transportation Security Agency (TSA), United States Citizenship and Immigrations Service (USCIS), Federal Emergency Management Agency (FEMA), United States Coast Guard (USCG), ICE, CBP
Result: Created the Predictive Analytics Center to serve as the leading resource for big data analysis within DHS. The PAC helps homeland security organizations understand technical opportunities related to big data storage, computation, analytics and visualization capabilities. In FY 2014, HSARPA partnered with TSA's Office of Security Capabilities to evaluate third party vetting algorithms as options for third-party TSA PreCheck enrollment, which has been integral to the introduction of TSA's Commercial PreCheck. HSARPA also partnered with FEMA for the management of information related to unaccompanied. USCIS to establish new fraud detection systems, CBP for big data architecture design information, ICE for cloud utilization options, and USCG for an assessment of big data analytics. Additionally in FY 2014, HSARPA led technical evaluations of 37 different geocoding algorithms for the Department which are now being used by the DHS Geospatial Management Office and many components for acquisition planning. The PAC also hosts a monthly homeland security community of interest session, open to all federal entities, that features training and case studies to help the Department understand technical options related to big data analytics.
Group / Division: HSARPA Apex

V. Small Business Innovation Research

Project: Cargo Container Security: Aviation Scanner
End User: CBP Office of Field Operations (OFO)
Result: Developed and transitioned an Aviation Scanner to operational use at the Laredo, Texas port of entry. The Aviation Scanner is a mobile X-ray system that images the internal voids (fuselage, empennage, wings, etc.) of general aviation and small commercial aircraft for contraband, thereby eliminating costly and time-consuming removal of aircraft panels for manual inspection. CBP is currently analyzing the impact of this new technology for further procurement.
Group / Division: Borders and Maritime Division

Project: Advanced Imaging Displays: ScreenADAPT
End Users: TSA Office of Training and Workforce Engagement
Result: Transitioned the ScreenADAPT training platform to TSA which is a customized, individualized training system that uses eye-tracking technology to diagnose training deficiencies/inefficiencies in X-ray baggage screening. ScreenADAPT adapts training, both in terms of training techniques used and in type and difficulty of images presented, to provide tailored training for each individual screener. After the successful completion of a Phase 1 and 2 S&T Small Business Innovation Research initiative, TSA funded Phase 3 to finalize design specifications to meet TSA needs and to test the effectiveness of the software in the field with Transportation Security Officers. ScreenADAPT field testing is ongoing in collaboration with TSA and is expected to demonstrate enhanced visual search and threat detection performance.
Group / Division: Resilient Systems Division

Project: Virtual Shooter
End User: ICE National Firearms and Tactical Training Unit (NFTTU), other Federal Government agencies such as Department of Defense (DoD), Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), and the Federal Bureau of Investigation (FBI)
Result: Developed a robotic prototype device that mechanically tests firearms and ammunition. NFTTU, which provides support to more than 62,000 armed officers and tests an average of 200,000 handgun rounds annually, currently uses human firing to perform testing. The volume of repetitive firing and absorption of the shock causes numerous physical ailments in human testers. The Virtual Shooter enables quantitative testing while avoiding physical risks to human testers. In FY 2014, field tests were held at ICE's National Armory in Altoona, Pennsylvania. Due to the successful performance and positive response of the NFTTU, the prototype was left for operational use and extended testing. In November 2014, there was a demonstration at the DHS Consolidated Training Facility showcasing the specialized grips included on the prototype designed to hold a variety of different firearms.
Group / Division: First Responders Group

Project: Sensor-Smart Affordable Autonomous Robotic Platform (SAARP)
End Users: FEMA, CBP, first responders, law enforcement officers, DoD
Result: Demonstrated the Sensor-Smart Affordable Autonomous Robotic Platform (SAARP). SAARP includes a robotic "App Store" with many proven robots that can be 3D-printed and

assembled with standard electronic parts. With SAARP, first responders can print and assemble robots with the right capabilities at the scene of a disaster area according to their specific needs. SAARP technology was demonstrated to stakeholders at the Society of Photographic Instrumentation Engineers (SPIE) Technology Conference in Baltimore, Maryland, Urban Shield conference in Oakland, California, and Transformation Innovation for Development and Emergency Support (TIDES) conference in Washington, DC. SAARP also won the Small Business Administration's prestigious 2014 Tibbetts Award for innovative and outstanding contributions.
Group / Division: Resilient Systems Division

Project: Identity and Access Management
End Users: District of Columbia (DC) Government
Result: Transitioned a physical access control interoperable solution for first responders to access controlled buildings in the event of emergencies. The system, which began as an S&T Small Business Innovation Research project, is operational at the new DC Government building on 200 I Street SE. The building owner is able to authorize visitors seamlessly through high assurance smart card credentials (e.g., PIV, CAC), audit capabilities in real-time, and maintain better situational awareness in the event of an incident. The capability provides centralized access control management, the ability to manage multiple buildings remotely, and cost reduction due to avoiding expense of procuring segregated, non-interoperable access control systems.
Group / Division: Cyber Security Division

VI. Border Security

Project: Cargo Container Security: National Capital Region (NCR) Secure Delivery
End User: Federal Protective Service (FPS)
Result: Initiated a pilot with FPS to use electronic security devices to secure and track deliveries, giving FPS confidence in the custody of all packages delivered to facilities owned or leased by GSA in the National Capital Region. The pilot tests an array of security devices and evaluates a newly-developed secure web interface for entering, logging, and reporting on data related to vehicles, drivers, and delivery locations. During the FPS pilot, the electronic security devices help monitor deliveries (e.g., packages, cargoes) after being screened for explosives and firearms at the FPS Remote Delivery Screening facility. The devices monitor unauthorized cargo door openings and trip anomalies (off-route deviations, excessive stoppage, and time limitation notifications) along cargo delivery routes to facilities owned or leased by the GSA.
Group / Division: Borders and Maritime Security Division

Project: Cargo Container Security: Secure Hybrid Composite Container
End User: CBP OFO, DoD
Result: Completed the development and delivered a prototype Secure Hybrid Composite Container to the Singapore Ministry of Home Affairs in February 2014. A second prototype container successfully passed rigorous International Organization for Standardization (ISO) and environmental testing, thereby enabling it to be introduced into the global supply chain flow of commerce. The composite container is stronger and 15% lighter than the standard commercial 20-foot steel container, creating 900 pounds of additional cargo capacity. In addition to being lighter and stronger than steel, the container has embedded sensors to detect and report tampering or intrusion from the point of cargo consolidation to the point of deconsolidation. DoD and the Department of State (DoS) are investigating use of DHS composite container technology to meet their unique cargo security needs. The DoD Title III program budgeted $16.8 million in FY 2016 to support production of this container for U.S. Government needs.
Group / Division: Borders and Maritime Security Division

Project: Air Based Technologies: Robotic Aircraft for Public Safety (RAPS)
End User: Federal, state, local, and tribal law enforcement
Description: Published test reports from the RAPS project to inform first responders on the purchase of Small Unmanned Aircraft Systems (SUAS) platforms. S&T assessed commercial off the shelf (COTS) SUAS platforms in emergency response and law enforcement scenarios (search and rescue, fire response, safe flight, etc.). Products from the RAPS project inform potential SUAS users of the utility of these systems, provide best practices for safe and effective use, and help guide potential SUAS acquisition decisions by allowing users to avoid the cost of performing their own evaluation. The systems selected for participation in RAPS were mature SUAS weighing less than 25 pounds and were evaluated based on input from the first responder community. The first phase of RAPS evaluated the performance of 25 SUAS platforms over 14 flight weeks, resulting in a full set of reports (For Official Use Only) available for download by registered first responders from the RAPS Community of Practice on www.firstresponder.gov.
Group / Division: Borders and Maritime Security Division

Project: Air Based Technologies: Wide Area Airborne Surveillance System
End User: CBP Office of Air and Marine (OAM)
Result: Conducted an operational demonstration of a Wide Area Airborne Surveillance System (WAASS), which is an integrated, multi-spectral, all-weather sensor platform to assist CBP agents in Nogales, Arizona in the detection, identification, and response to illegal border activity. Funded by CBP's Office of Technology Innovation and Acquisition, S&T provided the technical expertise to evaluate and make recommendations to the vendor for improvement of the sensor. Occurring in May 2014, the demonstration helped inform a follow-on effort to integrate a component of the WAASS technology on CBP OAM aircraft. A final report was provided to CBP as a result of the project.
Group / Division: Borders and Maritime Security Division

Project: Ground Based Technologies: Buried Tripwire
End Users: CBP Office of Border Patrol (OBP)
Result: Completed the integration of a prototype fiber optic tripwire surveillance system on the U.S.-Mexico border that provides alerts of border crossers. The system has the ability to differentiate between people, animals, vehicles and aircraft. In 2014, the prototype system was turned over to CBP for operational assessment. S&T is monitoring system performance and performing upgrades based on agent feedback.
Group / Division: Borders and Maritime Security Division

Project: Ground Based Technologies: Automated Scene Understanding/Canada-U.S. Sensor Sharing Pilot (ASU/CUSSP)
End Users: CBP OBP
Result: Completed installation of a tower-mounted radar and imager on the northern end of Lake Champlain, New York. ASU monitors boating activity at the border and alerts operators to anomalous behaviors. This system also supports CUSSP, which in August 2014 began to use the ASU sensors and complementary Canadian sensors to provide a joint surveillance picture simultaneously to both CBP and Royal Canadian Mounted Police agents.
Group / Division: Borders and Maritime Security Division

Project: Small Dark Aircraft
End User: CBP OBP
Result: Completed a long duration operational test of a prototype small dark aircraft detection and tracking system in very rugged terrain on the U.S.-Canada border in the State of Washington. The system detected, tracked, and classified low-flying and low-observable aircraft and performed well throughout the 9-month test with no downtime, including during the winter. The re-locatable system consists of an integrated suite of sensors (including radar, acoustic sensors, and cameras), communications, remote power (using batteries and solar panels since no line power is available on the northern border), computational processing and data storage, air picture data manipulation, and visualization. The project is now focusing on ruggedizing and optimizing the system for usability, commercialization, and transition.
Group / Division: Borders and Maritime Security Division

Project: Tunnel Detection and Surveillance: Tunnel Detection Prototype Development
End User: CBP OBP, ICE
Result: Developed and delivered a software-based tool to CBP that predicts the performance of detection equipment and methods for detection of clandestine tunnels in border hot spots. To date, the new tool has been used to characterize five sites (Otay Mesa, California; Tecate, California; Calexico, California; Nogales, Arizona; and San Luis, Arizona) along the Southern border. This information will allow Border Patrol agents to optimize the performance of already purchased CBP equipment for tunnel detection, will guide and inform the CBP Office of Technology Innovation and Acquisition on future procurement of detection equipment, and enable sensor developers to build better systems for border hot spots.
Group / Division: Borders and Maritime Security Division

Project: Port and Coastal Surveillance: Coastal Surveillance System (CSS) Pilot
End User: CBP Air Marine Operations Center (AMOC), USCG, other government agencies
Result: Installed new node of the Coastal Surveillance System at USCG's Sector San Diego. S&T continued enhancing our newly developed CSS, which integrates existing data and creates new maritime security common operating data to share across DHS Components and with state, local, and international partners. The installation of the new node is a critical first step in sharing real time operational maritime information between two DHS Components. CBP's support and endorsement of CSS was reflected in AMOC staff-led briefings and demonstrations of CSS at the 2014 Maritime Security West Conference in Tacoma, Washington, and to a House Appropriations Committee visit to AMOC in the third quarter of FY 2014. In FY 2014, S&T also co-sponsored (with the Naval Research Laboratory) the Coalition Tactical Awareness and Response (CTAR) Joint Capability Technology Demonstration, which focused on space-based capabilities to detect small, dark maritime targets outside the range of shore-based sensors. CTAR can potentially integrate into CSS to provide an operational commander with rapid ability to task and receive unclassified, shareable, wide area space-based commercial radar and electro optical imagery over the maritime domain in near real time. CBP AMOC has invested in-kind support (e.g., manpower for testing, hardware for hosting the pilot software, sensor feeds to enable integration testing/validation) in this capability for its potential to meet its operational need for augmented detection of dark (non-emitting) vessels.
Group / Division: Borders and Maritime Security Division

VII. Chemical, Biological and Explosive Defense

Project: Agricultural Screening Tools
End User: USDA National Animal Health Laboratory Network (NAHLN), Secure Milk Supply Plan, Dairy industry
Result: Developed a standardized high-throughput protocol for detection of Foot and Mouth Disease (FMD) virus in milk. The delivery of this protocol to the NAHLN enhances the testing capability for detection of FMD in milk samples using existing reagents, protocols, and instrumentation. This new assay will be available for use during an FMD outbreak to rapidly demonstrate freedom from disease in large geographic areas to ensure maximum continuity of business in the dairy industry.
Group / Division: Chemical and Biological Defense Division

Project: Agricultural Screening Tools
End User: USDA NAHLN
Result: Assessed and delivered to USDA two methods for stabilizing viral samples collected from swine via oral fluid sampling. Oral fluid sampling is a key sampling method for testing the health of swine and will be critical for rapid sampling in any outbreak response. This project validated a method to neutralize live virus and stabilize nucleic acid for storage at room temperature, reducing the requirement for cold chain storage of samples. USDA is using results of this work to develop a standard protocol for inclusion in the Animal and Plant Health Inspection Service Master Control International Organization of Standardization (ISO) database and possible use in the NAHLN.
Group / Division: Chemical and Biological Defense Division

Project: BioAssays
End User: Laboratory Response Network (Department of Health and Human Services (HHS), Centers for Disease Control (CDC), Food and Drug Administration (FDA), Federal Bureau of Investigation, United States Secret Service (USSS), United States Department of Agriculture (USDA), and the entire federal biodefense matrix)
Result: Delivered methodology for developing antibodies without access to hazardous viral proteins. This new proprietary method is applicable to many other Biological Safety Level 3 and 4 agents and allows the Federal Government to make antibodies for rapid detection using only bioinformatic data rather than dealing directly with biosafety hazards. The antibodies were tested and evaluated by the Centers for Disease Control (CDC) Variola Group in Atlanta.
Group / Division: Chemical and Biological Defense Division

Project: BioAssays
End User: Laboratory Response Network (HHS, CDC, FDA, FBI, USSS, USDA, and the entire federal biodefense matrix)
Result: Developed a ricin detection assay that solves the existing problems of numerous false positive and false negative results in the laboratory detection of ricin. The assay is rapid and uses a moderately priced off-the-shelf instrument platform. This success followed approximately two years of improved antibody development, testing, evaluation, and validation per Public

Health Actionable Assay standards. The final resulting robust and specific multiplexed assay has been transitioned to CDC and is therefore available for manufacture commercially.
Group / Division: Chemical and Biological Defense Division

Project: BioAssays
End User: Laboratory Response Network (HHS, CDC, FDA, FBI, USSS, USDA, and the entire Federal biodefense matrix)
Result: Transitioned an assay for laboratory-based detection of abrin, a protein toxin derived from the seeds of the *Abrus precatorius* (rosary pea) plant. Abrin is approximately 70 times more toxic than ricin and made from seeds that grow in the wild in many warm to tropical regions of the world, including southern areas of the United States. The assay captures small amounts of the toxin and allows detection in a commonly used off-the-shelf laboratory instrument for laboratory-based confirmation of the toxin's presence in a sample. This suspension bead assay closed a gap that existed within the biodefense community. The development and validation of the assay included teams from the FDA Center for Food Safety and Applied Nutrition, USDA, DHS, CDC, and the USSS.
Group / Division: Chemical and Biological Defense Division

Project: Chemical and Biological Research and Development Seedlings and Studies
End User: Environmental Protection Agency (EPA)
Result: Delivered protocols for analysis and identification of Non-Traditional Agents (NTAs) following an incident involving release of such a chemical. The protocols enable high-throughput analysis (greater than 100 environmental samples per day on a single instrument) to rapidly map contamination and support the recovery of contaminated areas. The NTA Laboratory Capability (NTALC) Project was initiated in 2009 to address a need for laboratory capability to analyze and identify environmental samples contaminated by an NTA. During a two-day training session in April, EPA scientists and analysts learned sample processing and testing protocols that will prepare them for future events involving these threats. Those scientists will, in turn, train other analysts on the procedures.
Group / Division: Chemical and Biological Defense Division

Project: Rapid Diagnostic Capability
End User: Laboratory Response Network, CDC, commercial entities, physicians, hospitals, point-of-care sites
Result: Developed and supported the transition of a new assay to differentiate between a viral and bacterial infection in a human by using a drop of blood from a finger prick. This inexpensive lateral flow device can be used to triage patients in point-of-entry and point-of-care situations to determine the nature of the agent causing their illness/fever. This test will be extremely useful in therapeutic decisions and administration or use of antibiotics in a prudent manner to avoid contributing to antimicrobial resistance. This effort supports the Combating Antimicrobial Resistance initiative from the White House. As part of development, the project recently obtained a commercial CE Mark (the European Union equivalent of FDA approval) with a parallel FDA trial underway.
Group / Division: Chemical and Biological Defense Division

Project: Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM)
End User: New York Police Department (NYPD)
Result: Transitioned detectors to four locations in New York City. As the final test bed activity of S&T's Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM) project, several detectors were transitioned to New York City (World Trade Center, Brooklyn Police Station, Times Square Subway, and Chamber Street Subway) in collaboration with the NYPD. The 12-month test bed concluded with integration of multiple detector data streams into the NYPD dashboard with associated Concept of Operations (CONOPS) for response activities associated with alarms.
Group / Division: Chemical and Biological Defense Division

Project: Lightweight Autonomous Chemical Identification System (LACIS)
End User: CBP
Result: Transitioned two models of handheld chemical vapor detectors to CBP Laboratory and Scientific Services Directorate (LSS). LACIS detects Chemical Warfare Agents and Toxic Industrial Chemicals to allow determination of areas having dangerous concentration levels and whether protective garments will be required. Accurate and timely analysis can accelerate operations and increase effectiveness. The six detectors were transitioned to CBP via training that occurred at two different LSS laboratories on April 3, 2014 at the CBP LSS SW Regional Science Center located in Houston, Texas and at CBP LSS New York Lab located in Newark, New Jersey on April 15, 2014, which trained the CBP scientists in the use, data recording, and maintenance of the detectors.
Group / Division: Chemical and Biological Defense Division

Project: Detect to Protect
End User: Office of Health Affairs (OHA), DoD, TSA
Result: Completed the 18-month test and analysis of Detect to Protect sensors in the Boston subway system. The program developed a full complement of bio-aerosol detection sensors that can be rapidly integrated into system architectures within buildings and structures around the nation. Results from the Detect to Protect tests will inform CONOPS development and adoption of this rapid alerting technology for several end-users including the OHA BioWatch program, DoD, and TSA.
Group / Division: Chemical and Biological Defense Division

Project: Vehicle-borne Improvised Explosive Device (IED) Countermeasures: Taurus Robot
End User: Federal, state, local, territorial and tribal bomb squads
Result: Demonstrated the Taurus robotic tool to federal, state, local and tribal public safety bomb squads. Taurus, funded and managed by S&T's Explosive Division, allows public safety bomb technicians to perform sophisticated tasks with unprecedented speed and dexterity. S&T worked closely with public safety bomb squads and with the FBI to develop this capability, which offers human-like coordination to existing bomb squad robots. Its integrated stereoscopic camera system and user-controlled manipulators deliver unprecedented precision and integrity of remote motion.
Group / Division: Explosives Division

Project: Commercial Aircraft Vulnerability and Mitigation: Hardened Unit Load Device
End User: TSA, commercial air carriers
Result: Developed an improved (reduced cost and weight) Hardened Unit Load Device (HULD-R). The HULD-R is a blast-resistant container that can be used for the transport of checked passenger luggage and air cargo onboard wide body commercial aircraft. The new HULD-R design complies with all relevant Federal Aviation Administration (FAA) airworthiness certification requirements for installation/use. In addition, the HULD-R provides a blast mitigation option for wide body aircraft operators at an acquisition cost ($10,000 per unit) that is significantly less expensive than previous generation HULD designs ($20,000 to 25,000 per unit). FAA is assessing HULD-R technology as a solution for air transport of lithium batteries.
Group / Division: Explosives Division

Project: Canine Explosives Detection: Canine Training Aids
End User: TSA, DoD, other canine explosive detection communities
Result: Developed non-hazardous, low-cost homemade explosive (HME) training aids for the Explosive Detection Dog (EDD) that can be employed throughout the entire EDD community, including federal, state, local, territorial, and tribal partners. These training aids are being deployed in four TSA regions in early FY 2015 for operational field assessment and to begin odor imprinting with the canines, which is a part of initial training. These training aids represent a paradigm shift in the way the community can cost-effectively reach across the Homeland Security Enterprise to establish and maintain operational proficiency on a major explosive threat. S&T is executing its strategic plan to commercialize these training aids for controlled access nationwide , a process expected to complete in FY 2016.
Group / Division: Explosives Division

Project: Next Generation Passenger Checkpoint: Mass Spectrometry Based Explosive Trace Detection System (EDS)
End User: TSA, USSS, CBP
Result: Developed a mass spectrometry-based Explosive Trace Detection (ETD) system. The TD-MS 2.0 ETD System completed Readiness Assessment testing at the Transportation Safety Laboratory (TSL) and Functional Requirements Document (FRD) testing at the TSA Systems Integration Facility (TSIF). It underwent multiple field data collection events by TSA, CBP, and the National Park Service prior to Qualification Test and Evaluation (QT&E) and Operational Test and Evaluation (OT&E). Pending its passing of these last two certification tests, it may become the first qualified mass spectrometry-based ETD on TSA's procurement list.
Group / Division: Explosives Division

Project: Algorithm and Analysis of Raw Images: Computed Tomography Dataset
End User: Computed Tomography (CT or CAT Scan) Based Explosives Detection Equipment Developers
Result: Developed an unclassified, non-sensitive CT luggage dataset. This unique dataset is a resource for the research and development community that provides security-like images for use in evaluating, improving and refining state-of-the-art techniques for baggage screening equipment. The creation of the dataset was made possible by an industrial-academic partnership

between S&T and the Awareness and Localization of Explosives-Related Threats (ALERT) Center of Excellence.
Group / Division: Explosives Division

Project: Screener Training and Selection: X-Ray Imaging Aptitude Test
End Users: TSA Office of Security Capabilities and TSA Office of Human Capital
Result: Developed and tested the X-ray Imaging Aptitude Test (X-APT) battery incorporating a number of standardized tests that evaluate cognitive aptitudes critical for Transportation Security Officers performing X-ray image threat detection and resolution. These tests allow the TSA Office of Human Capital to target employees that are more likely to identify threats in X-ray images. In field tests, it was demonstrated that performance on these tests were significantly related to X-ray screener performance as measured by their threat image projection scores and annual certification scores. By implementing the X-APT battery during pre-hire activities, TSA should see substantial reductions in time and costs related to training new employees.
Group / Division: Resilient Systems Division

VIII. Counter Terrorist

Project: Integrated Terrorism Risk Assessment (ITRA)
End User: White House National Security Staff; Office of Management and Budget (OMB); interagency stakeholders; state, local, tribal and territorial first responders
Result: Completed a tailored assessment of the ITRA for CDC and HHS Biomedical Advanced Research and Development Authority (BARDA). In addition, S&T completed a FEMA-sponsored document called "Key Planning Factors in Response to a Biological Attack". This work was co-developed with the Chemical, Biological, Radiological and Nuclear Emergency (CBRNE) Office/Response Directorate to support state, local, territorial and tribal planning in response to a biological attack, with support from the Integrated CBRN Terrorism Risk Assessment. ITRA looks across CBRNE threats to provide an overall risk picture. This informs decisions that must take into account risk of a terrorist attack, including allocation of resources and investment decisions.
Group / Division: Chemical and Biological Defense Division

Project: Risk Prediction
End Users: TSA Secure Flight Program
Result: Delivered to TSA a Threat Pattern Learning and Evaluation report for the Secure Flight Rules Engine initiative. In support of this report, S&T applied statistical data analysis and advanced supervised machine learning algorithms to a large set of 2.6 billion historical TSA travel records over a two year period. This analysis measured performance, accuracy and impact for implementation of new rules in the TSA Secure Flight Rules Engine. The report, which summarizes comparisons between TSA baseline rules and S&T-learned rules, was used by Secure Flight and TSA management to validate the TSA Rules Engine and justify implementation to DHS management and Congress, design rule sets and tune rule weights for the initial implementation, and plan for future implementation that takes advantage of a greater range of travel features and more complex combination rules and risk assessment methods.
Group / Division: Resilient Systems Division

Project: Risk-based Resource Deployment Decision-aid (R2D2)
End Users: Federal Air Marshal Service, TSA
Result: Transitioned the Risk Based Resource Deployment-aid (R2D2) to the Federal Air Marshall Service. R2D2 applies risk calculation to the deployment of Federal Air Marshal Service resources to air, land, and water security assignments. The application is in an agile development cycle to provide frequent opportunities for end-users to influence the direction of development and provide feedback on features and usability. As of November 2014, four cycles of development have contributed to geospatial visualization, temporal filtering, flight route characteristic filtering, and airport (departure and arrival) filtering, all of which combine to allow analysis of various forms of protective resource deployment.
Group / Division: Resilient Systems Division

Project: Homemade Explosives (HME) Characterization
End User: TSA, S&T, FBI, DoD
Result: Delivered more than 120 reports on performance characterization of HME and more than 30 reports on aircraft vulnerability to TSA and the Transportation Security Laboratory (TSL). In addition, S&T consolidated the performance characterization data for pentaerythritol tetranitrate and potassium chlorate/fuel mixtures into monographs which were delivered to TSA, FBI and other federal entities at the Domestic Homemade Explosives Working Group at Fort Bragg, North Carolina. S&T delivered final hydrogen peroxide/fuel monograph in November 2014 to TSA, TSL, and FBI at a joint stakeholders meeting. These monographs are knowledge products used by TSA to inform development of new screening technologies and requirements to mitigate aviation security vulnerabilities regarding HME. This work was performed at the National Explosives Engineering Sciences Security (NEXESS) Center, a tri-lab effort supported by Sandia National Laboratories, Lawrence Livermore National Laboratory, and Los Alamos National Laboratory.
Group / Division: Explosives Division

Project: Actionable Indicators and Countermeasures: Terrorism and Extremist Violence in the U.S. Database
End Users: DHS Office of Intelligence and Analysis (I&A); Fusion centers; federal, state, local, territorial, and tribal law enforcement
Result: Conducted a successful demonstration of the Terrorism and Extremist Violence in U.S. Database (TEVUS) for end users in I&A. TEVUS integrates four existing open-source datasets that will be accessed through an easy-to-use interface with graphing, mapping, and analysis functions. Once completed, it will allow end users to analyze the behavioral, geographic, and temporal characteristics of extremist violence in the United States using the most comprehensive open-source database available.
Group / Division: Resilient Systems Division

Project: Hostile Intent Detection and Surveillance
End Users: TSA, CBP
Result: Conducted a data collection exercise at the TSA Systems Integration Facility (TSIF) in August 2014, a first-of-its-kind event using the Future Attribute Screening Technology (FAST) sensor suite in a kiosk to predict hostile behavior. The event was deemed a success and lays the foundation for future research in an operational airport environment using actual Transportation Security Officers, Behavioral Detection Officers, and/or CBP officers. The test also built confidence with operational users, and helped correct design issues with the current configuration of the system.
Group / Division: Resilient Systems Division

Project: Wide Area Surveillance: Scalable Integration of Geo-dispersed Monitoring Assets (SIGMA)
End Users: Transit authorities (Massachusetts Bay Transportation Authority, Port Authority of NY/NJ), law enforcement (Boston and Atlanta Police Departments)
Description: Demonstrated the Scalable Integration of Geo-dispersed Monitoring Assets (SIGMA) system to Boston Police Department. In 2014, an offline proof-of-concept demonstration of the SIGMA concept was presented to potential stakeholders. The mock-up

included a preliminary interface that allows the display of video feeds and selection by criteria (e.g., geographic location, ownership). SIGMA is designed to increase the ingestion rate of video data for review and provide an open-architecture for integration and deployment of video sharing, monitoring, and analysis. The demonstration utilized video data from the Massachusetts Bay Transportation Authority subway system and from the Massachusetts Institute of Technology police camera system, which represent operationally relevant environments.
Group / Division: Resilient Systems Division

Project: Wide Area Surveillance: Imaging System for Immersive Surveillance
End Users: Law Enforcement (Boston Police Department, New York Police Department), Transportation Authorities (Massport)
Result: Demonstrated the Imaging System for Immersive Surveillance in an operational environment. The Imaging System for Immersive Surveillance is a multi-camera system that provides continuous, high-resolution, 360-degree coverage of a scene. Using advanced video processing algorithms, information from multiple cameras is fused to create a single stitched image. The system provides full scene situational awareness without sacrificing image resolution as distance from the camera increases. In 2014, the system was successfully demonstrated and used by the Boston Police Department at the 2014 Boston Marathon, providing coverage at the finish line and at Kenmore Square.
Group / Division: Resilient Systems Division

Project: Rapid DNA
End Users: CBP Laboratories and Scientific Services Directorate
Result: Delivered two Rapid DNA systems to the CBP Chicago Laboratories and Scientific Services (LSS) facility for evaluation. This new capability provides CBP with a cost-effective and highly accurate measure to establish family relationships in an extremely time-sensitive environment. CBP can now identify family members, via a mouth swab sample, with 99.94 percent accuracy within 90 minutes. The systems were tested over a six week period to evaluate their accuracy, ease of use by laboratory and non-laboratory field personnel, and ability to verify family relationships. The systems met performance requirements, generating full DNA profiles 87 percent of the time and verifying family relationships to a better than 99.94 percent probability (goal of 99.5 percent). The 13 percent of profiles that did not complete on the first run did not contain any false or inaccurate information, so another sample was needed in those cases. The systems were found to be accurate and ready for field use with LSS laboratory backup when necessary.
Group / Division: Resilient Systems Division

Project: Mobile Biometrics
End User: State and local police
Result: Piloted mobile biometrics device with the Stockton, California Police Department to collect and transmit latent finger print biometric data at crime scenes and receive potential subject data back to the mobile device. This is considered a technology game changer in the forensic community due to the enhanced capability to identify potential suspects near real time while at crime scenes.
Group / Division: Resilient Systems Division

Project: Non-Cooperative Biometrics
End User: CBP, TSA, USSS, other federal agencies and state, local, tribal and territorial police
Result: Provided the facial recognition community with a set of video data that is operationally realistic and serves as a baseline performance metric of current facial recognition systems in operational scenarios. This performance data will allow CBP, TSA, and USSS to make decisions about their operational use of face recognition in their specific environments.
Group / Division: Resilient Systems Division

IX. Cyber Security / Information Analytics

Project: Research Data Repository (PREDICT)
End Users: Cybersecurity researchers or evaluators
Result: Demonstrated the Internet Atlas to representatives from the National Cybersecurity and Communications Integration Center and the National Geospatial-Intelligence Agency. The Internet Atlas is a visualization and analysis portal for diverse measurement data. The starting point is a geographically anchored representation of the physical Internet including nodes (e.g., data centers, hosting facilities, and points of presence), conduits and links that connect these nodes, and relevant metadata (e.g., source provenance). The repository currently contains over 10,000 point of presence locations and over 13,000 links for over 400 networks around the world. Data is added to the repository on an ongoing basis (nearly 3,000 maps remain to be entered). Customized interfaces enable a variety of dynamic (e.g., Border Gateway Protocol updates, Twitter feeds, and weather updates) and static (e.g., highway, rail, census) data to be imported into Internet Atlas, and to layer it on top of the physical representation which results in situational awareness of internet function at multiple levels. The PREDICT program also demonstrated the Trinocular outage detection system to the Federal Communications Commission (FCC). Trinocular learns current network states by probing to capture information over time and using Bayesian inference to determine status. Trinocular has been operating 24x7 since December 2013, and there is ongoing work with the FCC to evaluate its potential use assessing network robustness in times of disaster and in regular operation.
Group / Division: Cyber Security Division

Project: Software Quality Assurance
End Users: Open source software developers
Result: Transitioned Code Pulse, a software assurance analytics tool, to the open-source community through the Open Web Application Security Project community and Github in May 2014. Code Pulse provides an understanding of code testing coverage overlaps and boundaries of different dynamic application security testing and penetration testing tools. CodePulse helps improve penetration testing by showing a penetration tester what parts of the application their tests were able to reach. By visually showing the areas of the application that were not reached, penetration testers can customize and narrow in on those areas to get better coverage, reducing the residual risks associated with traditional penetration testing. Lastly, it allows the penetration testers to determine what, if any additional tools are needed to improve testing coverage.
As of September 2014, Code Pulse has been downloaded 296 times by interested parties such as software developers. It is available at www.code-pulse.com.
Group / Division: Cyber Security Division

Project: Transition to Practice
End User: Groups that need truly random numbers and secure communications
Result: Brokered a deal for Los Alamos National Lab's (LANL) quantum encryption technology. In September 2014, a private company licensed the quantum encryption package from LANL in the largest single IP deal in the lab's history. That license resulted in the formation of a new company to develop and take the quantum security technology to market. The technology package contains a random number generator that uses the quantum properties of

light to create truly random numbers as opposed to currently prevalent (mathematically based) pseudo random number generators. The package also contains technology that allows for secure communications and is at the cutting edge of encryption keys and communications that cannot be tampered with. For an overview of the Quantum Encryption package, see the Year Two section of the TTP Tech Guide: http://www.dhs.gov/sites/default/files/publications/csd-ttp-technology-guide-volume-2.pdf.
Group / Division: Cyber Security Division

Project: Experiments and Pilots
End Users: Exercise planners and executors
Result: Developed the Cyber Scenario and Report Tool (CyberSMART) execution engine. CyberSMART is used to plan, architect, and run a cyber-exercise. While the planning portion had already been developed, S&T invested additional R&D funds to help create the execution engine portion of the tool, so that the entire lifecycle of a cyber-exercise can be completed within a single tool. The CyberSMART tool is undergoing DHS Certification and Accreditation expected to be complete in the second quarter of FY 2015.
Group / Division: Cyber Security Division

Project: Cybersecurity Outreach: Cybersecurity Competitions
End User: System administrators, security analysts
Result: Funded scenario and competition environment development for and inserted S&T-developed technologies into the National Collegiate Cyber Defense Competition (NCCDC). During the 2014 NCCDC in San Antonio, Texas, three S&T-developed technologies were incorporated into the competition: the Backend Attribute Exchange Protocol for Personal Identity Verification Interoperable (PIV-I) cards from the Identity and Access Management project; the Proactive Incident Response Command Shell, an incident response tool developed under the Usable Security project; and the kernel-protection component of the Hardware Enabled Zero Day Protection technology developed under the Moving Target Defense project. By placing these cutting edge technologies into the competition environment, participants become familiar with technologies and will take knowledge of these innovative products with them when they enter the workforce.
Group / Division: Cyber Security Division

Project: Disrupting Cyber Threats: Evidentiary Integrity for Incident Response Tool
End Users: Law enforcement investigators and cyber analysts; cyber forensics examiners
Result: Transitioned the Evidentiary Integrity for Incident Response Tool (EIIR) to the New York State Police and the New York State Enterprise Information Security Office. EIIR insures all cyber-related evidence collected during the examination of computer and network equipment presumed to be affected by a cyber-security breach or criminal activity is managed and secured through established chain-of-custody procedures. The tool is unique from all other cyber incident forensics tools in that it provides an easy-to-use and more secure command line interface. EIIR is now being commercialized through license from a private company.
Group / Division: Cyber Security Division

Project: Software Assurance Marketplace (SWAMP)
End User: Open source software developers
Result: Transitioned SWAMP to operational use. SWAMP is an online, open-source, collaborative research environment that allows open software developers to test their software for security weaknesses, software tool developers to improve their tools by offering a wide range of software packages to test against, and software researchers to interact and exchange ideas to improve software assurance tools and techniques. SWAMP is unique as it allows software developers to leverage multiple software analysis tools together to test their software, which improves the accuracy of their results. SWAMP became operational in February 2014 and has drawn a great deal of interest from software developers in academia, the Federal Government and industry. As of December 2014, SWAMP is approaching 500 users per week averaging 750 assessments per week. For more information on the SWAMP, visit https://continuousassurance.org. To access SWAMP, visit https://www.mir-swamp.org.
Group / Division: Cyber Security Division

Project: Identity and Access Management
End Users: FEMA and state/locals public/private emergency response communities
Result: Developed the open source Mobile Attribute Retrieval and Credential Authenticator (MARCA) app for Android phones to quickly and securely authenticate and authorize emergency responders by electronically verifying identities and authority to enter a restricted area. The Cyber Security Division is supporting FEMA National Continuity Programs to increase the effectiveness of emergency response/recovery missions, which includes relocating essential government employees and ensuring continuity of operations at a secondary location in the case of a large-scale emergency. The MARCA application can be downloaded from OpenICAM.org at http://jhuapl-icam.github.io/
Group / Division: Cyber Security Division

Project: Leap-Ahead Technologies
End Users: Network operators including the DHS National Protection and Programs Directorate (NPPD), USSS, USCG, FCC, and DoD
Result: Demonstrated the Secure Network Attribution and Prioritization (SNAP) technology to several Federal Government parties over the first and second quarters of FY 2014. This included representatives from DHS, FCC, U.S. Army Cyber Command G3, U.S. Army Program Executive Office Enterprise Information Systems (PEO EIS), and the Deputy Secretary of the Army Research & Technology Office. In addition, the U.S. Army Telecommunications Systems Engineering Course (TSEC) implemented a network of SNAP routers on virtualized hardware as part of their capstone project and provided a written report on additional steps needed for SNAP deployment within the Army network environment.
Group / Division: Cyber Security Division

X. First Responder/Disaster Resilience

Project: Chemical Forensics and Attribution
End User: FBI and other investigators collecting evidence related to chemical attacks
Result: Completed the Chemical Threat Agents Sampling Guide, which provides guidance for the collection of samples of suspect toxic chemicals. The collaborative effort with FBI Laboratory Hazardous Materials Response personnel produced a 41-page quick reference guidebook that can fit in a large pocket. It provides guidance for sampling material preparation, sampling methods and considerations, and recommended storage conditions. The methods comport with general sampling techniques published by standards organizations, as well as the results of specific chemical threat agent sampling studies funded by the S&T. The guide was disseminated to end-users in July 2014 and has been well-received. It is credited with improved collection effectiveness and efficiencies.
Group / Division: Chemical and Biological Defense Division

Project: Tech Solutions: Wildland Firefighters Advanced Personal Protection System
End User: California Department of Forestry and Fire Protection (CAL FIRE), U.S. Forest Service (USFS), multiple local California fire departments
Result: Developed a wildland firefighter ensemble that meets National Fire Protection Association Standards 1975 and 1977. The certified garment system improves radiant thermal protection; reduces heat stress; and improves the form, fit, and function of the garments. S&T, in partnership with CAL FIRE, U.S. Army Natick Research Development and Engineering Center National Protection Center, United States Forest Service (USFS), and California firefighters, designed and tested approximately 1,000 new garment ensembles for wildland firefighters over the course of two fire seasons during 2012 and 2013 (FY 2014). Testing was conducted in both laboratory and real-world fire scenarios, and conclusions indicated the garment ensembles reduced heat stress burden on the wearer and fully met program goals, including the intent for the government to own the garments' designs so it could be used by first responders without a fee. It is anticipated that the garments will be commercially available in FY 2015.
Group / Division: First Responders Group

Project: First Responder Technologies: Wireless Patient Vital Signs Monitoring (WPVSM)
End User: Federal, state, local, territorial, and tribal emergency medical services community, as well as receiving/attending physicians at points of care
Result: Developed a small, lightweight device that can monitor vital signs without connecting wired sensors from the patient to other equipment. The technology improves basic life support medical care and allows end-to-end, real-time connectivity between the emergency medical technician in the field and the emergency room. In December 2013, S&T, a private company, and applicable subject matter experts (SMEs) from around the nation convened at the American Medical Response facility in San Diego, California to conduct an operational field assessment of the device. Lessons learned from the operational field assessment were incorporated into the final product design, which is in the process of gaining FDA approval. Once approved, the device will be a valuable tool for air and ground EMS personnel by reducing entanglement and eliminating the need to constantly connect and disconnect to different vital signs monitoring systems.
Group / Division: First Responders Group

Project: Tech Solutions: Radio Internet-protocol Communications Module (RIC-M)
End Users: Any first responder at the federal, state, local, territorial, and tribal levels
Result: Delivered RIC-M prototypes to participating first responders. This project's mission was to develop an after-market interface board for legacy-based station radio equipment permitting multiple parties to produce and distribute their interoperable products to the first responder community. The project successfully conducted an operational field assessment at the U.S. Department of Interior Radio Lab in Denver, Colorado. In FY 2014, prototypes were transferred to all participating partners. Initial feedback was very positive, and FPS, the New York Fire Department (NYFD), and Treasury Inspector General for Tax Administration have indicated intention to purchase additional units to support their operational systems. DHS has secured the intellectual property rights from the inventor and filed patent and trademark applications.
Group / Division: First Responders Group

Project: First Responder Technologies: Low-Light High Definition (HD) Video Surveillance Camera
End Users: Federal, state, and local law enforcement
Result: Developed a video surveillance camera that is capable of covert, low light level tilt, pan, and zoom video surveillance while providing six frames per second of high definition (HD) quality video over low bandwidth networks (i.e., 3G cellular). A prototype was delivered and tested in September 2014, and the camera was successfully commercialized in the fourth quarter of FY 2014. This camera was developed in conjunction with the digital HD Data Encoder Project, which allowed the data to be compressed, encrypted and streamed in high quality. ICE Homeland Security Investigations is executing a $12 million procurement to implement the low light video surveillance camera and encoder technology into its surveillance operations.
Group / Division: First Responders Group

Project: First Responder Technologies: HD Data Encoder
End Users: Federal, state, and local law enforcement
Result: Developed an encrypted data encoder that has the ability to stream HD video from surveillance equipment to monitoring stations as well as handheld and smart devices. The project was created and operated in conjunction with the Low-Light HD Video Surveillance Camera project upon realizing that the camera would not be able to both encrypt and stream high definition video using existing equipment. A prototype was delivered and tested in October 2014, and the HD Data Encoder was successfully commercialized in the fourth quarter of FY 2014.
Group / Division: First Responders Group

Project: First Responder Technologies: Prepaid Card Reader
End Users: Federal, state, local, territorial, and tribal law enforcement
Result: Developed a software solution capable of reading any magnetic strip card to determine the exact amount of monetary value for the card. This prepaid card reading software solution has the ability to identify the amount stored on the card using any magnetic strip terminal and to freeze those assets before it can be transferred to another individual. Law enforcement will use this technology to stop criminal organizations from being able to use pre-paid credit cards to smuggle money into and out of the United States.   The project produced 10 prototypes which

were delivered in the first quarter of FY 2014. The product is now commercially available to law enforcement agencies.
Group / Division: First Responders Group

Project: Tech Solutions: Improved Firefighting Structure Glove
End User: State, local, territorial, and tribal fire/rescue departments; Federal Government agencies
Result: Transitioned the Improved Firefighting Structure Glove (FFSG). This project's goal was to improve traditional structural firefighting gloves, which are bulky and have limited dexterity. The use of traditional gloves in an emergency often results in firefighters removing their gloves to perform such tasks as operating radios, picking up small items, or working with certain tools. In FY 2014, S&T conducted an operational field assessment at Northeastern Illinois Public Safety Training with first responders. The field assessment provided valuable information to finalize the form, fit, and function of the glove. The solution is lightweight, improves dexterity, don and doffs ability when wet or dry, and has been National Fire Protection Association certified. The FFSG will be commercially available from a private company in 2015.
Group / Division: First Responders Group

Project: Virtual Training: Enhanced Dynamic Geo-Social Environment (EDGE) Virtual Training
End Users: Federal, state, local, territorial, and tribal agencies in need of training for incident response.
Result: Developed a readily accessible, high-fidelity simulation tool to augment and support a training program for first responders at the tactical level for multiple disciplines (e.g., fire, law enforcement, emergency medical services) as well as at a strategic level for incident commanders operating in a unified command structure. The training enhances communication, coordination, and efficiency of cross-discipline response to complex scenarios. The tool is designed in an open sandbox configuration to allow first responders to develop their own training scenarios and to train to their own organizations' response plans. This sandbox concept was successfully demonstrated at an operational field assessment with over 40 Sacramento, California first responders role-playing the virtual game. To date, over 50 local first responder agencies have requested access to this training tool. During FY 2014, Rutgers University completed an EDGE Virtual Training transition study, and S&T is currently working with the Federal Law Enforcement Training Center (FLETC) and the International Association for Fire Chiefs for permanent transition of the EDGE Virtual Training platform.
Group / Division: First Responders Group

Project: Response and Defeat Operations Support (REDOPS): Vehicle-Borne Improvised Explosive Device (VBIED) Technology Assessment and Test Bed
End User: FBI and other federal, state, and local bomb squad/explosive ordnance disposal organizations
Description: Conducted operational field assessments of four VBIED response and defeat tools resulting in a knowledge product to assist the FBI and state and local bomb squads with acquisition decisions for robotics, X-ray, and vehicle breaching tools. This is a joint FBI and S&T investment in how SWAT and bomb technicians will attack and conduct render safe activities for improvised explosive devices and people borne improvised explosive devices.
Group / Division: First Responders Group

Project: REDOPS: Laminated Window Entry Kit
End User: FBI and other federal, state, and local bomb squad/explosive ordnance disposal organizations
Result: Demonstrated the Laminated Window Entry Kit to the National Bomb Squad Commanders Advisory Board. S&T worked with the FBI to validate a previously developed but repurposed explosive charge capable of cutting a hole in a laminated vehicle side window. The analysis also became a baseline for test and evaluation of bomb squad technician methodology for accessing laminated vehicle windows.
Group / Division: First Responders Group

Project: REDOPS: X-Ray Scanning Rover (XSR)
End User: FBI and other federal, state, and local bomb squad/explosive ordnance disposal organizations; security details; infrastructure protection details at nuclear power plants, refineries, and chemical plants
Result: Demonstrated a prototype XSR device allowing responders to quickly determine whether suspicious objects/bags contain explosives without putting lives at risk. The XSR will be portable with near real-time maneuverable imaging system advanced enough to capture three-dimensional, high-resolution images that can clear the leave behind bags quickly while simultaneously identifying and characterizing critical IED components (e.g., power sources, detonators, and electronic circuitry). Operational field assessment is planned for the third quarter in FY 2016.
Group / Division: First Responders Group

Project: Responder Engagement
End Users: Federal, state, local, and tribal public safety entities with dispatch systems; First Responders Network Authority (FirstNet)
Result: Published the *Public Safety Broadband Console Requirements*. Based on the work with the National Public Safety Telecommunications Council (NPSTC) and the Public Safety Communications Research (PSCR) Program, this document identifies 54 new requirements for public safety consoles connected to Long-Term Evolution (LTE) networks. These public safety consoles are used by dispatch centers, Emergency Operations Centers, hospital emergency departments, and trauma centers for LTE-enabled mission-critical communications. The document is intended to guide development of the Nationwide Public Safety Broadband Network by FirstNet.
Group / Division: First Responders Group

Project: Operational Assessment Tools to Strengthen Agency Acquisition
End User: Federal, state, local and/or tribal public safety representatives; FirstNet
Result: Published the report *LTE Physcial Layer Performance Analysis*. This report presents modeling results for the LTE physical network layer based upon Third Generation Partnership Project (3GPP) specifications. The results of this study can be used in building higher level modeling tools such as cellular network planning and network modeling tools using physical layer performance as an input. This also informs the work of FirstNet as it stands up the Nationwide Public Safety Broadband Network.
Group / Division: First Responders Group

Project: Wireless Communications (Bridging Broadband with Land Mobile Radio (LMR))
End Users: Federal, state, local, territorial, and tribal public safety entities using Land Mobile Radio and LTE communications; DHS operational components
Result: Demonstrated the Turtle Microphone (Turtle Mic) prototype to operational end users and technical personnel in May 2014. The Turtle Mic enables operational field agents and officers to augment their legacy Land Mobile Radio networks and devices with new, commercial LTE broadband capabilities for extended video and data use.
Group / Division: First Responders Group

Project: Emergency Response and Management Tools for First Responders: Next-Generation Incident Command System (NICS)
End Users: CAL FIRE, Massachusetts Executive Office of Public Safety and Security, Massachusetts Department of Fire Services, Massachusetts National Guard, the Commonwealth of Australia (State of Victoria Emergency Services), other first responders and emergency managers from local, state, tribal, territory, and federal governments
Result: Completed the development of NICS, a common platform to share standards-based data with real-time collaboration and online white-boarding across the first responder community (fire, police, National Guard, emergency management, etc.). NICS has been extensively used by CAL FIRE for wildland fire management to collaborate, pool resources and plot strategies for their response to nationally recognized wildland fires (e.g., Yosemite Rim Fire and Napa Butts Fire). NICS is comprised of over 2,500+ users and over 500 organizations. Internationally, NICS was adopted by Australia's Emergency Management Community (State of Victoria) in FY 2014 and is currently under review by the North Atlantic Treaty Organization (NATO) to assist with disaster response.
Group / Division: First Responders Group

Project: Emergency Response and Management Tools for First Responders: Portable Handset Integrated Next-Generation Incident Command System (PHINICS)
End User: USCG, CAL FIRE
Result: Transitioned PHINICS. Initially developed by USCG, this mobile platform was modified by S&T for the CAL FIRE community and deployed operationally in FY 2014 to all battalion chiefs. PHINICS allows NICS to go mobile and streamline data entry from the field for an enhanced common operational picture. PHINICS enables users to retain mobility while tapping into incident command data flows. It extends and enhances NICS by putting an incident command interface into the pocket of anyone with a mobile device. This includes two-way data flows of blue force tracking, weather and maritime data feeds, and data inputs from various camera feeds or Bluetooth enabled sensors.
Group / Division: First Responders Group

Project: Interoperability and Compatibility Standards: LiveWall Virtual Collaboration System
End User: Federal, state, local, territorial, and tribal entities
Result: Demonstrated LiveWall with the Seattle Police Department. The LiveWall system was used to support communicating the commander's intent, expediting and improving the accuracy of roll call, and improving situational awareness across the Seattle Police Department during large scale events. The LiveWall Virtual Collaboration System was one of the first operational prototypes of the Precision Information Environments initiative between S&T and the Pacific

Northwest National Laboratory (PNNL). Security testing of the LiveWall system was conducted and passed rigid DHS security firewalls for use between government, public, and private agencies. Further testing is being conducted to implement full use of all LiveWall System key features.
Group / Division: First Responders Group

Project: Performance Test and Evaluation (PTEN) at the National Urban Security and Technology Laboratory (NUSTL)
End User: State and local law enforcement and first responders including the New York City Police Department, Fire Department of New York, and New Jersey/New York/Connecticut State Police Departments
Description: Completed testing of 4135 rad/nuc detection units, surpassing an overall milestone of 10,000 rad/nuc detection units tested for the Domestic Nuclear Detection Organization's (DNDO) Securing the Cities grant program partners. Since 2009, NUSTL's PTEN program has conducted unit functional tests of first responder radiological/nuclear detection equipment to ensure operational readiness of deployed units. Units include personal radiation detectors, handheld isotope identifiers, backpack systems, radiation detection kits and mobile detection systems.
Group / Division: First Responders Group

Project: Standard Unified Modeling Mapping Integrated Toolkit Response (SUMMIT-R)
End User: Sweden
Result: Transitioned SUMMIT, a software integrating architecture to the Swedish Civil Contingencies Agency (MSB) as part of S&T's bilateral agreement with Sweden. The SUMMIT modeling and simulation software environment enables analysts, emergency planners, responders, and decision makers to seamlessly access integrated suites of modeling tools and data sources for planning, exercise, or operational response.
Group / Division: Resilient Systems Division

Project: Resilient Structures Program
End Users: State and local Transit Authorities (Port Authority of New York/New Jersey, Washington Metropolitan Area Transit Authority, New York Metropolitan Transit Authority), TSA, and DoD Technical Support Working Group (TSWG)
Result: Commissioned a new tunnel plug testing facility in Frederica, Delaware. This facility has been reconfigured to facilitate tunnel plug full system testing (the tunnel plug plus storage, inflation, and control systems) as well as the testing of other innovative flood control technologies. The facility's 16 feet by 42 feet, full-sized test tunnel will simulate real flooding conditions and evaluate the ability of the plug to contain flooding in mass transit tunnels. Additionally, the project manufactured a new and improved prototype tunnel plug that will be evaluated in the new test facility.
Group / Division: Resilient Systems Division

XI. Acquisition and Operations Support

Project: Integrated Investment Life Cycle Model (IILCM) Pilots
End User: DHS Components, Homeland Security Enterprise
Results: Completed comprehensive analyses of the three IILCM Pilots for biodefense, cybersecurity, and screening and vetting. These pilots fed into the Secretary's Unity of Effort initiative including the creation of the DHS Joint Requirements Council. They developed operational visualizations; functional evaluations; capabilities-based assessments, and prioritized shortfalls and operational analysis reports for each portfolio. The analyses identified over 150 capability gaps across the 3 portfolios that can now be addressed at the DHS enterprise level rather than by individual Components. Across the 3 IILCM pilots, 6 DHS operational Components and over 10 DHS Headquarters organizations were represented, including CBP, FEMA, TSA, USCG, USSS, ICE, NPPD, Office of Biometric Identity Management (OBIM), OCIO, OHA, Operations Coordination and Planning (OPS), Program Analysis and Evaluation Division (PA&E), Office of Policy (PLCY), Screening Coordination Office (SCO), and S&T.
Group / Division: Capability Development Support Group

Project: Standards: Response Robot Test Method Development
End User: CBP, federal, state, local, territorial and tribal bomb squads and search and rescue teams, DoD
Result: Developed standards to characterize the key performance parameters for response of Counter Vehicle Borne Improvised Explosive Device robots. These test methods have stimulated the development of response robot technologies resulting in robots with increased, verified performance in the areas of mobility, manipulation, range, visual acuity and other key parameters. These test methods have supported the informed procurement of millions of dollars of robots across the government and in state and local agencies. The test methods are now being used to form a training and proficiency testing program for robot operators. This model and many of the test methods were adopted in Japan for training and certification to support the decommissioning and decontamination of the Fukushima, Japan reactor complex damaged in the 2011 earthquake and tsunami.
Group / Division: Office of Standards

Project: Standards: Measurement, Calibration, Standardization and Optimization of Trace Contraband Detection Systems
End User: TSA, FPS, USSS, CBP, U.S. Capitol Police; DoD, Department of State, Federal, state, local, territorial, and tribal law enforcement.
Results: Developed standards for measurement, calibration and optimization of trace contraband detection systems. S&T's Office of Standards, in partnership with the National Institute of Standards and Technology (NIST), developed methodologies and test materials for direct insertion, dry transfer, standoff, fingerprint, background, documentary standards and procedures, round robin events and training in the areas of trace contraband (explosives and drugs) sampling and detection. The Limit of Detection standard was published through American Society for Testing and Materials International.
Group / Division: Office of Standards

Project: Standards: Radiation Safety Standards for Screening Systems
End User: TSA, TSL, CBP, FPS, and DNDO
Results: Developed standards for radiation safety of x-ray and gamma-ray security screening systems. S&T's Office of Standards, in partnership with NIST, informs technical grant and procurement guidance across DHS components and harmonizes national and international x-ray security screening standards. This effort resulted in a number of knowledge products including standards for performance of portable transmission x-ray systems used in improvised explosive detection and hazardous device identification; for evaluating the imaging performance of security x-ray systems; for evaluating the image quality of x-ray CT security-screening systems; and for measuring the imaging performance of x-ray and gamma-ray systems for security screening of humans.
Group / Division: Office of Standards

Project: Test and Evaluation
End User: CBP, TSA, USCIS, USCG, USSS
Result: Participated in 10 operational test & evaluation events, resulting in 10 Letters of Assessment to inform key acquisition decision makers on DHS Major Acquisition Programs. Oversight included approval of independent Operational Test Agents, system Test and Evaluation Master Plans, and Operational Test and Evaluation plans. S&T is responsible for prescribing department wide test and evaluation (T&E) policies and procedures, acting as the principal advisor on Operational Test and Evaluation to the Office of the Secretary and the Component heads.
Group / Division: Office of Test and Evaluation

Project: SAFETY Act: Best Practices for Anti-terrorism Security for Sports and Entertainment Venues
End User: Public and private owners and operators of sports and entertainment venues in the United States
Result: Published the Best Practices for Anti-Terrorism Security (BPATS). S&T's Office of SAFETY Act Implementation and the Office of University Programs led a research project whereby the Command, Control, and Interoperability Center for Advanced Data Analysis at Rutgers University developed the BPATS guide. The BPATS guide provides an overview of best security practices for sporting and entertainment venues designed to assist venue owners and operators who are interested in submitting a SAFETY Act application for their venue security and is based on best practices from major sport leagues and associations and other local stakeholders (e.g., law enforcement organizations, first responder groups, private sector groups) as well as lessons learned from the April 2013 Boston Marathon attack. The BPATS guide is available for public viewing and download from the SAFETY Act program website at www.safetyact.gov.
Group / Division: Office of SAFETY Act Implementation

XII. Laboratory Facilities

Project: Bioforensics
End User: National Institutes of Health (NIH) Genome Reference Consortium, federal law enforcement
Description: Developed a novel method for the assembly of single-molecule sequencing fragments into high-quality complete genomes. This method reduces the time needed to reconstruct the genome of a microbial agent from hours to minutes, improving response times for bioforensic investigations. In addition, applying this method to the human genome has uncovered new sequences missing from the human reference for over a decade. The NIH Genome Reference Consortium is currently evaluating the NBACC assembly as a means for patching these gaps and improving the quality of the human reference genome.
Group / Division: Office of National Laboratories: National Biodefense Analysis and Countermeasures Center (NBACC)

Project: Biological Threat Characterization
End User: Homeland Security Enterprise (DHS, HHS, EPA, DoD), DHS Biodefense Knowledge Center
Description: Established aerosol decay rate and stability data for *Bacillus anthracis* over a wider range of relevant environmental conditions than has been available previously to support response and remediation modelling. These data were selected to be transitioned for utilization in modeling the threat posed by *Bacillus anthracis* in the second generation Material Threat Assessment for *Bacillus anthracis*, which will be used by DHS and HHS for national preparedness planning.
Group / Division: Office of National Laboratories: NBACC

Project: Biological Threat Characterization
End User: White House National Security Council staff and Homeland Security Enterprise
Description: Determined that *Bacillus anthracis* preparation purity is not a major determinant of risk in a potential biological attack. Therefore, the use of published virulence values for pure spore preparations can be used to model consequences of *Bacillus anthracis* attacks for both pure and crude preparation attack scenarios. Natural and nefarious *Bacillus anthracis* cultures likely contain vegetative cells, thus these data are useful for assessing the risk following exposure to mixed cultures, as well exposure to highly purified agent. The knowledge gained from these studies was used to respond to questions from National Security Council staff following the potential exposure of laboratory personnel to *Bacillus anthracis* at CDC.
Group / Division: Office of National Laboratories: NBACC

Project: Chemical Terrorism Risk Assessment
End Users: USSS, CBP, NPPD, TSA, HHS, USDA, DoS, DoD
Result: Delivered the first version of the Chemical Terrorism Desktop Risk Calculator to TSA and HHS/BARDA. In addition, the desktop tool has been used to address 17 chemical threat related questions from customers during the fiscal year. The Chemical Terrorism Risk Assessment is a comprehensive end-to-end assessment of the risk associated with an intentional or catastrophic accidental release of a toxic chemical. The desktop calculator allows customers

to answer focused questions regarding consequence and risk by enabling a focused look at specific venue and release conditions. The tool uses a menu driven graphical user interface and contains default input values and capability for user-provided parameters.
Group / Division: Office of National Laboratories: Chemical Security Analysis Center (CSAC)

Project: Chemical Hazard Analysis
End Users: NPPD
Result: Delivered a comprehensive report to NPPD Office of Infrastructure Protection assessing potential capability improvements to the Chemical Facility Anti-Terrorism Standards (CFATS). The report provides technical justification for expanding the CFATS Chemical of Interest list to include additional toxic release chemicals as well as a detailed, expert-derived definition of what constitutes a poison. The work directly supports continued improvements to the Chemical Terrorism Risk Assessment. CSAC is helping shift the CFATS paradigm to a truly risk-based approach.
Group / Division: Office of National Laboratories: CSAC

Project: Technical Reachback
End Users: FEMA, DHS National Operations Center, DoD, HHS, OHA, USSS
Result: Provided scientific and technical support to several operational elements (both within and outside of DHS) through a quality assured technical reachback program. During FY 2014, CSAC responded to 72 immediate requests for information. An example includes the January spill of 10,000 gallons of 4-methylcyclohexyl methanol into the Elk River in Charleston, West Virginia. CSAC, working with FEMA and the DHS National Operations Center, assessed the event and provided technical data and information to assist in mitigation.
Group / Division: Office of National Laboratories: CSAC

Project: Radiological/Nuclear Response and Recovery Research and Development: Gross Decontamination, Contaminant Containment, and Early Phase Waste Management Guidance
End User: State and local emergency management agencies, hazardous materials first responders
Result: Developed an electronic application that provides first responders with guidance and scientific best practices on how to contain radiological contamination, conduct gross-decontamination/mitigation operations, and perform early-phase waste management following a radiological incident. NUSTL and EPA's National Homeland Security Research Center conducted initial research into widely available technology that local agencies could use to conduct radiological mitigation and waste management. The research team presented findings to stakeholder groups in Vermont, North Carolina, and California and gathered first responder requirements for the development of actionable guidance and electronic tools for emergency operations center and field use.
Group / Division: Office of National Laboratories: National Urban Security and Technology Laboratory (NUSTL)

Project: System Assessment and Validation for Emergency Responders (SAVER)
End Users: Federal, state, local, and tribal emergency responders
Description: In conjunction with first responders from the Chicago and New York City metropolitan areas, developed evaluation criteria for the assessment of Biological Agent

Detection Equipment (BADE). The evaluation criteria were grouped into the five SAVER categories (capability, usability, deployability, maintainability, and affordability) and then ranked based on importance. First responder participants included representatives from the Aurora Fire Department, Illinois; Orlando Fire Protection District, Illinois; Oakton Community College, Illinois; Bedford Park Fire Department, Illinois; New Jersey Transit Police; NYFD; Port Authority of New York and New Jersey Police Department; NYPD; and PNNL.
Group / Division: Office of National Laboratories: NUSTL

Project: Radiological Emergency Management System (REMS)
End Users: NYPD
Description: Completed a quality assurance plan for REMS sensors that are being deployed throughout New York City by the NYPD. Between February and June 2014, NUSTL performed quality assurance tests on 12 new sensors that the NYPD received from its vendor. The tests revealed failed requirements, and in June, NUSTL provided NYPD with recommendations for correcting these problems. As a result of the tests, NYPD is drafting specifications for an open source bid for a new REMS sensor. NUSTL agreed to assist with the development of specifications for the sensor and to act as the quality assurance laboratory for REMS.
Group / Division: Office of National Laboratories: NUSTL

Project: Responder Training and Exercise
End User: Federal, state, local first responders
Description: Provided technical expertise, radioactive sources, equipment, and technical staff to support 22 first responder training events during which 673 responders across dozens of federal, state, and local first responder organizations were trained in rad/nuc interdiction.
Group / Division: Office of National Laboratories: NUSTL

Project: Developmental Test and Evaluation of Explosives Detection Technologies for Screening People
End User: TSA, other DHS/federal agencies with personnel screening venues
Result: Evaluated 10 different personnel screening systems that ranged in development from prototype to mature. TSL used extensive inventory of real explosives and test design expertise to explore each system's explosive detection capability and provided feedback and recommendations to the original equipment manufacturers to assist them with further development of their systems. Results on tests of detection performance and user observations were also provided to S&T and other DHS stakeholders. In FY 2014, TSL looked at eight walk-through portals (most based on millimeter wave technology) and two handheld wands (one based on quadrupole resonance, the other on millimeter wave), which will assist TSA in future procurement decisions.
Group / Division: Office of National Laboratories: Transportation Security Laboratory (TSL)

Project: Certification Testing of Explosives Detection Systems for Checked Baggage
End User: TSA
Result: Tested 11 different checked bag explosives detection systems against new, more stringent performance requirements issued by TSA. Systems with acceptable performance moved on to operational testing by TSA while most of those needing improvement worked on their detection algorithm performance with the Laboratory's Developmental Test and Evaluation

group, which conducted 24 certification readiness tests in FY 2014. Systems that pass the certification readiness test are available for TSA procurement.
Group / Division: Office of National Laboratories: TSL

Project: Technology and Patent Development
End User: TSA
Result: TSL was awarded two patents for "Inert and Non-Toxic Explosives Simulants and Method of Production" and for the "High Volume Samplings Front End Collection Device". The Inert and Non Toxic Explosives Simulants and Method of Production patent allows for creation of simulants that imitate characteristics of known explosives at the microscopic and macroscopic levels, allowing developers and manufacturers to safely test, verify, and calibrate x-ray based explosives detection systems as well as serve as effective training materials for airport screeners. The High Volume Samplings Front End Collection Device patent is for a pocket-sized, front-end device that can brush off particles from a surface or collect particles from a large volume of air (as in a cargo container) with a specialized system of filters.
Group / Division: Office of National Laboratories: TSL

XIII. University Programs

Project: Measuring Recovery through Healthy Community Indicators
Program: Coastal Hazards Center of Excellence (CHC)
Lead University: University of North Carolina, Chapel Hill
End Users: FEMA New York Sandy Recovery Office; emergency managers; planners
Result: Piloted the Disaster Recovery Tracking Tool in four communities in the New York City area impacted by Hurricane Sandy. The tool consists of a Community Recovery Checklist of 79 validated recovery indicators, organized into ten focus areas, to help communities track their progress towards recovery. The Disaster Recovery Tracking Tool and User Guide became available online in FY 2014 and can be located at http://communityrecoverytool.com/.
Group / Division: Office of University Programs

Project: Developed and Piloted a Local Resiliency Planning Scorecard to Assess Community Vulnerability and the Performance of the Network of Plans
Program: Coastal Hazards Center of Excellence (CHC)
Lead University: Texas A&M University
End Users: Emergency managers and agency staff in Beaufort County and the City of Washington, both in North Carolina
Result: Piloted the resiliency planning scorecard, designed to evaluate the effectiveness of local plans (hazard mitigation, land use, climate action) in supporting reduction of the vulnerability of populations and urban development, in Beaufort County and the City of Washington. In addition, the research team provided officials with maps and data requested by the county and city revealing vulnerability hot spots that were not targeted in the county's current plan. The team also provided Beaufort County and City of Washington officials with summary reports and GIS data of social and physical vulnerability. The county will incorporate the GIS and vulnerability hotspots data into the 2015 update of the county hazard mitigation plan. Additionally CHC is working with FEMA to develop a scorecard that will offer a set of national guidelines and data collections standards for assessing and monitoring hazard vulnerability and the performance of local planning for vulnerability reduction.
Group / Division: Office of University Programs

Project: Improving the Communication of Advanced Circulation Storm Surge/Flood Model (ADCIRC), Simulated Waves Near Shore (SWAN) and Other Storm Data to End Users
Program: Coastal Hazards Center of Excellence (CHC)
Lead University: Louisiana State University
End Users: National Weather Service, Southeast Flood Protection Authority, academia
Result: Transitioned both improved model visualization capabilities and the ADCIRC model itself resulting in increased accuracy and broader availability of real time, storm surge/wave forecasting. Improvements to ADCIRC included incorporating the Generalized Asymmetric Holland Model (GAHM), which generates tropical cyclone wind fields from forecast information (storm position, strength and distances to specified isotachs in the four quadrants of the storm) provided by the National Hurricane Center (NHC). The GAHM is the only model that is capable of creating a wind field that uses all of this available information. The Center also transitioned a visualization interface for storm surge/wave/flood inundation models such as ADCIRC,

completing installations at the U.S. Army Corps of Engineers in New Orleans, the National Hurricane Center in Miami, and the National Oceanic and Atmospheric Administration (NOAA) Coastal Survey Development Laboratory. Due to the quiet hurricane season, most of the use to date has been for testing purposes. However, end users with the ADCIRCViz/StormSurgeViz installations will be able to use the system in real time to predict storm surge and flood inundation levels as the next major hurricane approaches.
Group / Division: Office of University Programs

Project: In Situ Erosion Evaluation Probe (ISEEP)
Program: Coastal Hazards Center of Excellence (CHC)
Lead University: North Carolina State University
End Users: Department of Transportation
Result: Developed the In-Situ Erosion Evaluation Probe (ISEEP), a velocity controlled water jet that assesses the potential for scour (erosion of soil due to water flow) around hydraulic structures, including levees and bridges. In FY 2014, developed and submitted draft standards of the testing process and data reduction scheme of the ISEEP to the American Society for Testing and Materials' committee on Evaluation of Soil Erosion. The ISEEP was field tested with end users from the North Carolina Department of Transportation at the Moore County Bridge in Cameron and the Wilmington Bridge.
Group / Division: Office of University Programs

Project: Published Reports
Program: National Consortium for the Study of Terrorism and Responses to Terrorism (START)
Lead University: University of Maryland
End Users: Public
Result: Published 24 reports in FY 2014. The following are the top 10 published reports in 2014 by number of downloads:
- Boko Haram recent attacks, published in May 2014 (26,801 downloads)
- Evolution of ISIL Relationships, published in June 2014 (16,840)
- Transcending Organization: Individuals and the Islamic State, published in June 2014 (6,063)
- Profiles of Perpetrators of Terrorism, published in July 2014 (4,980)
- Understanding Law Enforcement Intelligence Processes, published in July 2014 (3,423)
- Terrorism and the Olympics: Sochi Russia, published in January 2014 (2,742)
- Violence Perpetrated by Supporters of AQAM, published in June 2014 (2,737)
- Far-right Violence Fact Sheet, published June 2014 (2,636)
- Terrorist Attacks in the United States, published in January 2014 (1,936)
- Reporting Terrorism Related Activities, published in April 2014 (1,646)
Group / Division: Office of University Programs

Project: FY 2014 Wait Times Study
Program: National Center for Risk and Economic Analysis of Terrorism Events (CREATE)
Lead University: University of Southern California
End Users: CBP

Result: Delivered a report on the impact of CBP operations on the economy and provided CBP leadership with academically rigorous data results. The study analyzed the impact of passport inspection time on international travel demand and the impact of passport inspection wait times on flight misconnects at U.S. airports. The researchers concluded that change in passport inspection wait time has a small but non-trivial impact on the overall number of passengers traveling. Adding one CBP officer to the inspection sites at the 4 airports studied results in $11.8 million increase in U.S. Gross Domestic Product and 82 annual jobs. Analysis of missed connections at the John F. Kennedy airport in New York City, New York found evidence that late flight arrivals are more important than passport inspection waits in explaining the risk of missed connections.
Group / Division: Office of University Programs

Project: Game Theory Fish
Program: National Center for Risk and Economic Analysis of Terrorism Events (CREATE)
Lead University: University of Southern California
End Users: USCG
Result: Demonstrated the application of game theory to the Coast Guard's Living Marine Resources Mission (http://www.uscg.mil/hq/cg5/cg531/lmr.asp), yielding an increase of Maritime Domain Awareness of Mexican fishing incursions into the U.S. Exclusive Economic Zone in the Gulf of Mexico (CG District 8). This application of game theory focused on protecting moving "infrastructure" (e.g., fish population), as opposed to previous applications' focus on stationary threats (e.g., critical infrastructure). The game theory algorithms propose USCG patrol strategies that consider uncertainty about fish location, quantity and value as well as dynamically update information on adversaries. As a result, this model considered how to manage patrols for a mobile as opposed to a stationary target.
Group / Division: Office of University Programs

Project: Development and Testing of a Cell-Phone Signal Based Global Positioning System (GPS) Denied Navigation System for Small Unmanned Air Vehicles (UAVs)
Program: National Center for Border Security and Immigration (NCBSI)
Lead University: University of Arizona
End User: S&T Borders and Maritime Division
Result: Developed and demonstrated a cell-phone signal based GPS-denied navigation system capable of generating a Position, Navigation and Time (PNT) solution in GPS-denied environments. GPS spoofing or denial is a new threat for public safety in UAV navigation. Using this new system, a UAV can safely return to its point of origin if its GPS signal is compromised. The system uses sensors found on most SUAV autopilots and generates a PNT solution through periodic position fixes derived from cell-phone signals.
Group / Division: Office of University Programs

Project: CBP Supervisory Curricula Review and Gap Analysis
Program: National Center for Border Security and Immigration (NCBSI)
Lead University: University of Texas at El Paso
End User: CBP
Result: Developed improved training for CBP's first line Supervisory Leadership Training (SLT) and Second Level Command Preparation (SLCP) courses for inclusion onto the newly

developed CBP Leadership Development Framework and DHS Cornerstone and Keystone requirements. As part of the DHS effort to improve leadership development of their managers, NCBSI worked with CBP Office of Training and Development to review existing CBP training curricula for first and second line supervisors. NCBSI staff made recommendations for curricular adjustments to ensure developmental trajectory from SLT to SLCP.
Group / Division: Office of University Programs

Project: Optimal Practice Schedules for Enhancing Encoding and Long-Term Retention of Novel Information in Older Adults
Program: National Center for Border Security and Immigration (NCBSI)
Lead University: University of Texas at El Paso
End User: USCIS
Results: Conducted a project to determine what combinations of conditions, practice schedules, and presentation types best support learning and long-term memory in older adults. Based on experimental findings, NCBSI delivered two brochures to USCIS. The first provides citizenship and ESL teachers with specific ideas about how to incorporate the techniques supported by our research into their classroom settings. The second brochure gives test-takers ideas for how to study the materials on their own.
Group / Division: Office of University Programs

Project: Homeland Security Summer Scholars Academy
Program: National Center for Border Security and Immigration (NCBSI)
Lead University: University of Texas at El Paso
End User: Homeland Security Enterprise
Result: Seventeen undergraduate and graduate scholars successfully completed the 2014 Summer Scholars Academy. The Homeland Security Summer Scholars Academy is a 10-week summer research and homeland security-embedded internship experience that provides interested students the opportunity to work closely with professors engaged in research in border security and immigration or with homeland security/law enforcement professionals. In 2014, the Academy was expanded to include the embedded internship program option, and nine scholars completed internships with federal and local homeland security-related agencies. To date, the Academy maintains a 100 percent success rate for completion of the program by scholars selected.
Group / Division: Office of University Programs

Project: Provenance Anti-Malware Software Research
Program: Center of Innovation (CoI)
Lead University: U.S. Air Force Academy
End User: NPPD
Result: Piloted Provenance anti-malware software for malware detection at NPPD's U.S. Computer Emergency Readiness Team (US CERT). Malware provenance research is focused on identifying code reuse to help identify cyber attackers. By removing the ability to reuse or partially reuse malicious code, the research reduces the ability for hackers to purchase and use malware introduced to the cyber domain. During the pilot, CoI's provenance software rapidly detected previously unidentified relationships between families of malware, which could be used in operations to link intrusion sets to known attackers. In addition, the pilot software identified 8

families of malware in a group of 92 samples in seconds compared to an estimated 200 man days for manual analysis. This will improve US-CERT's ability to efficiently thwart malicious malware.
Group / Division: Office of University Programs

Project: Remote Power Module
Program: The Center for Maritime, Island and Remote and Extreme Environment Security (MIREES)
Lead University: University of Hawaii
End User: USCG
Results: Delivered the Remote Power Module, an autonomous powered and remotely controlled system for Maritime Domain Awareness applications in remote and extreme environments to USCG. The RPM has power to support high frequency radars and Automatic Identification Systems (AIS) that provide critical information describing ice movement and the location of potential hazards for first responders who will need to conduct search-and-rescue operations or respond to vessel collisions. MIREES presented this work to DHS stakeholders as well as native, local, state, federal and international scientists, engineers and first responders.
Group / Division: Office of University Programs

Project: AgConnect and the iCVI application
COE: National Center for Zoonotic and Animal Disease Defense (ZADD)
Lead University: Texas A&M University
End Users: USDA Center for Epidemiology and Animal Health, USDA State Animal Health Officials, agricultural producers, veterinarians
Result: Piloted the AgConnect suite of pluggable, mobile, and web-based desktop applications in 16 states and over 60 laboratories nationwide to demonstrate how data aggregation and information sharing will support early animal disease detection. The mobile applications iCVI (Certificate of Veterinary Inspection) and Biosurveillance Field Entry system became available for free download to validated and accredited first responders. The partnership between the Center, federal and state governments, and the animal agriculture industries is a novel public-private arrangement to develop, test, and diffuse technologies that protect the Nation's agriculture sector.
Group / Division: Office of University Programs

Project: FoodSHIELD
COE: National Center for Food Protection and Defense (NCFPD)
Lead University: University of Minnesota
End Users: Government, industry, food and agriculture sector
Result: Made a new user interface with enhanced capabilities for the food and agriculture sector and an App Store. FoodSHIELD is an online collaboration platform designed for the coordination, education, and training of those who protect and defend the global food supply. FoodSHIELD provides public and private food and agriculture sectors an online platform to coordinate their efforts in a secure and efficient way.
Group / Division: Office of University Programs

Project: Food Defense Curriculum
COE: National Center for Food Protection and Defense (NCFPD)
Lead University: University of Minnesota
End Users: Educators and training providers
Result: Provided training opportunities for the food and agriculture sector and homeland security and emergency response officials. At least 60 individuals downloaded the *Food Defense Curriculum Guide*, which provides educators with materials and resources to develop their own courses or integrate food defense into existing courses. NCFPD used materials from the curriculum guide to create and provide approved courses at the University of Minnesota. In addition, NCFPD provided short courses at conferences and upon request to companies, federal agencies and foreign food defense officials.
Group / Division: Office of University Programs

Project: Massive Open Online Course (MOOC)
Program: National Consortium for the Study of Terrorism and Responses to Terrorism (START)
Lead University: University of Maryland
End Users: Homeland Security Enterprise professionals
Result: Conducted START's first MOOC titled "Understanding Terrorism and the Terrorist Threat" in January 2014. A total of 16,779 students enrolled from 179 countries. The MOOC was a successful vehicle to reach out to professionals within the Homeland Security Enterprise. Of the 3,909 individuals who responded to the pre-course survey, 241 identified themselves as being part of the Department of Homeland Security, while 234 identified themselves as being a member of the military, and 99 as part of an intelligence agency.
Group / Division: Office of University Programs

Project: Professional Development Series
Program: National Center for Risk and Economic Analysis of Terrorism Events (CREATE)
Lead University: University of Southern California
End Users: DHS professionals
Result: Conducted a Professional Development Series and, in close collaboration with DHS Office of Policy, designed a seminar series to share innovative methodologies and enhance analytical skills throughout DHS. DHS participants reserved all spaces within two days, and S&T arranged a live webinar to accommodate the overflow for the first seminar, "The Adaptive Adversary Short-Course for Analysts: Expert Elicitation for Modeling Intelligent Adversaries." Seventy-two individuals from DNDO, DHS Office of Health Affairs, NPPD, DHS Office of Policy, TSA, USCIS, and FEMA participated in the 4-hour seminar. The second seminar—a knowledge transfer session to DHS Headquarters CBP analysts was held in May 2014. The third seminar, "Strategies for Enhancing the Capacity of Audiences to Accurately Comprehend Risk," was held in June for DHS employees responsible for communications and public affairs. This four-hour training seminar was attended by over 70 DHS employees from DHS headquarters, NPPD, DHS Office of Health Affairs, ICE, DNDO, TSA, FEMA, USCIS, I&A, S&T, USCG, FPS, and the National Counter Terrorism Center.
Group / Division: Office of University Programs

Project: Course Curriculum and Tip Sheets
Program: National Center for Risk and Economic Analysis of Terrorism Events (CREATE)
Lead University: University of Southern California
End Users: FEMA Disaster Preparedness and Response Teams and other disaster response professionals and volunteers
Result: Transitioned research results to support disaster preparedness and response activities, summarized in tip sheets for distribution to local faith communities. Recognizing that disasters often disproportionately affect at-risk or vulnerable populations, knowing who was impacted, how they were impacted, and their unique needs will have a direct bearing on an effective engagement plan. CREATE developed a course curriculum that will be used to train Disaster Preparedness and Response Teams on how to engage effectively with the local faith communities. CREATE developed 11 Tip Sheets for Faith Community Engagement aimed at building competency for the Disaster Survival Resistance Teams as they interact with community faith based organizations to support community resilience.
Group / Division: Office of University Programs

Program: Scientific Leadership Awards Program
University: Morgan State University
End Users: Homeland Security Enterprise
Result: Scientific Leadership Award recipients co-authored *Cases on Research and Knowledge Discovery: Homeland Security Centers of Excellence*. The book chronicles and catalogs the history and development of S&T's University Centers of Excellence and provides a desk reference of research and student successes as well as documentation for some of the technological challenges COEs have helped address.

Program: Scientific Leadership Awards Program
University: North Carolina Agricultural and Technical State University
End User: Local government, Homeland Security Enterprise
Result: Published an article, "Pre Positioning Commodities to Repair Maritime Navigational Aids" in the *Journal of Humanitarian Logistics and Supply Chain Management*, which won an Outstanding Paper award. Additionally, the program developed maritime and port resiliency models and tools that are being used by the Wilmington, North Carolina government. The tools include a severe storm response planning tool for ports, an interactive tool that recommends allocation of human and material resources to return a port to operational status. Another, the vulnerability assessment for port security screening policies, is an interactive decision support tool for evaluating the impact of potential disruptions to port operations caused by multiple threats (e.g., bombing or hijacking). The robustness of both vessel inspection and cargo screening policies can be evaluated using this tool.

Program: Career Development Grant
University: University of Connecticut
End User: Homeland Security Enterprise
Result: Researchers invented an innovative structural column system. This system provides multi-hazard resilience against blasts, seismic activity, truck collisions and fire exposure while eliminating the use of conventional steel reinforcement within reinforced concrete columns.