



National Urban Security Technology Laboratory

Annual Report

Fiscal Year 2017



**Homeland
Security**

Science and Technology



NUSTL[®]

NATIONAL URBAN SECURITY
TECHNOLOGY LABORATORY

EXECUTIVE SUMMARY

This Fiscal Year (FY) 2017 Annual Report contains a summary of the [National Urban Security Technology Laboratory's](#) (NUSTL's) completed program and project milestones, collaboration and outreach, mission and services, laboratory operations, and organizational successes.

As a federal laboratory organized within the U.S. Department of Homeland Security Science and Technology Directorate, NUSTL is dedicated to making sure first responders have better technologies and the right tools to do their jobs more effectively—a potentially life-saving asset. By partnering with end users to understand their most pressing needs and challenges, NUSTL validates requirements, evaluates technologies for operational readiness and works to strengthen the capabilities of our nation's first responders. NUSTL's notable achievements in test and evaluation include:

- Testing 754 pieces of new equipment including personal radiation detectors and radiation isotope identifier detectors;
- Operational field assessments, tests and evaluations of technologies such as counter-unmanned aerial systems, the smoke and particulate resistant turnout ensemble, and Mutualink and datacasting communications systems;
- Provisioning radiation sources and technical expertise to support more than 15 days of responder training and exercise events for over 360 first responders; and
- Publishing 30+ technical reports and new knowledge products to communicate assessment results and facilitate first responder technology acquisition and deployment decisions.

This report also contains information on NUSTL's research and development investments, which led to the development of new tools and guidance that support local and state emergency managers, incident commanders and decision-makers during radiological or nuclear emergencies. NUSTL completed research and testing of preventative radiological/nuclear detection equipment, developed new modeling products and piloted training materials designed specifically for response workers.

Additionally, NUSTL achieved its International Standard for Quality Management Systems—ISO 9001:2015 certification. These highlights, among many other accomplishments from FY2017, are showcased in this annual report.

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INTRODUCTION

Fiscal Year (FY) 2017 marked 71 years of service to the nation for the [National Urban Security Technology Laboratory \(NUSTL\)](#). A federal laboratory organized within the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T), NUSTL has locations in downtown New York City and the Chicago metropolitan area. The laboratory's mission is devoted to advancing the research and development (R&D) and test and evaluation (T&E) of homeland security technologies and tools that prepare and protect our nation.

NUSTL is the only national laboratory focused exclusively on supporting the capabilities of state and local first responders to make the nation more secure and resilient to terrorism and catastrophic incidents. NUSTL serves first responders and emergency managers throughout the most populous metropolitan areas in the country—solving the complex challenges faced by urban responders and protecting American communities at large.

The laboratory's T&E and R&D mission activities aim to help first responders prepare, protect and respond to homeland security threats. Staff members work side-by-side with first responders to conduct T&E that can influence technology development and inform acquisition and deployment decisions. By investing in R&D efforts to characterize and manage radiological incidents, NUSTL can minimize the impacts on communities and ultimately save lives. NUSTL's Radiological/Nuclear Response and Recovery (RNRR) Team has managed a portfolio ranging from \$2 to \$5 million annually since its creation—a small investment that would prevent more than \$3 trillion in costs if a post-radiological event cleanup occurred and was not performed properly.

The mission work and accomplishments detailed in this annual report were made possible because of our talented, hardworking, dedicated staff.

A 71-YEAR HISTORY OF SERVICE THROUGH SCIENCE

“Our last 70 years in service acknowledges the significant importance of science and technology in critical areas of national security. NUSTL provides research, testing and evaluation capabilities that are essential to the Homeland Security Enterprise and to solving the challenges faced by the nation’s first responders. We are proud of our longstanding history and the impact our services have made— and we expect to be celebrating our successes for many years to come.”

– Dr. Adam Hutter, Laboratory Director

For 71 years, the laboratory has supported the nation as a federal resource. The laboratory has prospered through seven decades of remarkable history—from measuring radioactive fallout during the Cold War, to conducting operational assessments of first responder technologies today. While much has changed since the laboratory’s establishment, the heart of NUSTL’s mission still focuses on the safety and security of the American people.

The laboratory formed in 1947 under the Medical Division of the Atomic Energy Commission to serve the massive research effort that led to the development of the atomic bomb. In the 1950s, the newly named Health and Safety Laboratory shifted its focus to a growing national concern of radioactive fallout from nuclear weapons tests, and used its network of monitoring stations for fallout assessments. The laboratory soon earned its reputation as a world leader in environmental radiation measurements. Its network of air monitoring stations expanded to assess, soil and water samples, air filter samples at the surface and in the stratosphere, and biological samples and measurements of wet and dry fallout. In 1977, the laboratory’s name changed to the Environmental Measurements Laboratory (EML), and it realigned to the newly created U.S. Department of Energy (DOE). The laboratory’s primary focus was to support environmental monitoring, decommissioning, decontamination and remediation efforts. Following nuclear accidents at Three Mile Island and Chernobyl, EML took immediate measurements that provided the ability to accurately and comprehensively reconstruct the environmental contamination that resulted from these events.



In the aftermath of the September 11, 2001, terrorist attacks, President George W. Bush signed legislation to create DHS. EML became part of DHS S&T in 2003 to support homeland security activities. The final name change occurred in 2009 when EML became the National Urban Security Technology Laboratory—or NUSTL—as it is well known today. Four years later, the laboratory moved from its former space to the ninth floor within the same federal building, which offered a new, modern work environment to support the increasing need to collaborate with first responders. More than one hundred representatives from DHS, local police and fire departments, other agencies, and longtime friends attended the ribbon-cutting ceremony.

Today, NUSTL is home to a vast range of capabilities that serve the first responder community, including the testing and evaluation of technologies to better understand and mitigate current and future homeland security threats. Its laboratory staff members provide a critical scientific interface with myriad first responders and end users in the field for the accelerated delivery and successful end-user deployment of technologies and systems, not just in New York, but also across the country.



Homeland Security

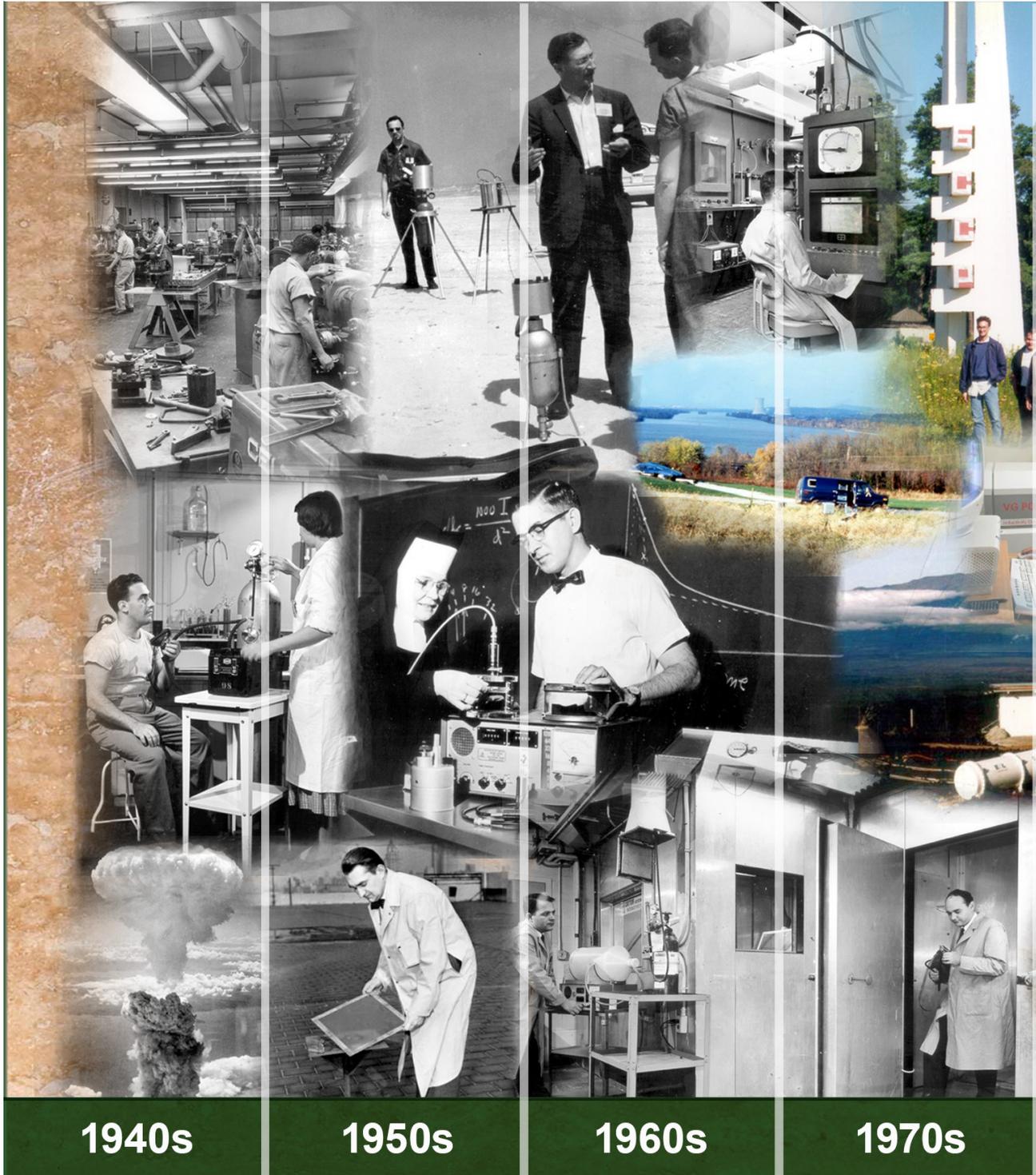
Science and Technology

70+ YEARS OF

ATOMIC ENERGY COMMISSION (AEC),
MEDICAL DIVISION; HEALTH AND
SAFETY DIVISION (1947 - 1953)

AEC, HEALTH AND SAFETY
LABORATORY (HASL)
(1953 - 1974)

ENERGY RESEARCH AND DEVELOPMENT
ADMINISTRATION (ERDA), HASL
(1974 - 1977)



1940s

1950s

1960s

1970s

SERVING THE NATION

DEPARTMENT OF ENERGY (DOE),
ENVIRONMENTAL MEASUREMENTS
LABORATORY (EML) (1977 - 2003)

DEPARTMENT OF HOMELAND
SECURITY (DHS), EML
(2003 - 2009)

DHS, NATIONAL URBAN SECURITY
TECHNOLOGY LABORATORY (NUSTL)
(2009 - PRESENT)



1980s

1990s

2000s

2010s

WE ARE NUSTL

ORGANIZATIONAL SUCCESSSES



NUSTL launched its new logo in 2016, and it was designed to represent the laboratory's role as a national resource to first responders. The logo graphically depicts iconic buildings from across the country to capture the national direction of NUSTL's mission, while not losing sight of its roots in New York City. To develop the new logo, NUSTL held a laboratory-wide contest to solicit creative ideas and designs

from staff members. The design concepts submitted throughout the contest were used to design three logo options, which were later voted on by NUSTL staff to finalize the logo selection.

The launch of the new logo synchronized with NUSTL's participation in the 2016 National Trademark Expo sponsored by the U.S. Patent and Trademark Office. NUSTL received trademark protection for the logo less than a year after its creation.

Staff members collected written testimony from the laboratory's partners and customers, which resulted in an overwhelming number of accolades that were used to describe NUSTL's products, services and staff interactions. The outstanding record of feedback from dozens of first responder customers and partners from federal, state and local entities represented NUSTL's superior level of customer satisfaction and quality performance. The evaluation of customer satisfaction is part of the laboratory's Quality Management System, which requires the continual assessment and improvement of products and services.



Staff members are photographed with Congressman Donovan (center) at NUSTL.

On August 1, 2017, NUSTL hosted U.S. Representative Daniel Donovan, Chairman of the Subcommittee on Emergency Preparedness, Response and Communications of the House Committee on Homeland Security; representing the 11 Congressional District of New York. Three congressional staffers accompanied Congressman Donovan for a guided tour of NUSTL and an overview of the laboratory's capabilities, mission, programs and projects. Staff members led the tour, which included a series of briefings and demonstrations that showcased NUSTL's operational fieldwork and technology assessments. Nearly 20 first responders showed their support by attending the congressional visit and sharing notable examples of the impact and contributions NUSTL's services and products have brought to their organizations.



Staff members show Congressman Donovan a sampling of technologies and prototypes tested by NUSTL with first responder partners.

NUSTL would like to thank all of the partners who attended from the DOE's Brookhaven National Laboratory (BNL), Fire Department of New York City's HazMat Operations, New York City Emergency Management, New York City Police Department's (NYPD's) Counterterrorism Division and Harbor Unit, as well as the Metropolitan Transportation Authority (MTA) Police Department, MTA's Metro-North Railroad and MTA's Triborough Bridge and Tunnel Authority.

AWARDS AND ACKNOWLEDGEMENTS

NUSTL staff members received three awards at the 2017 **DHS S&T Under Secretary's Award Ceremony**:



Adam Hutter
Laboratory Director



Matt Monetti
Test Manager



Abby Hooper
Support Contractor

- Laboratory Director **Adam Hutter** was recognized for his outstanding leadership and his unwavering dedication and commitment to first responder technology testing. Hutter has “transformed NUSTL to serve as a research, development, test and evaluation lead for first responders, while forging strong partnerships with federal, state and local government agencies.”
- Test Manager **Matt Monetti** was recognized for his unprecedented collaboration with more than 300 partner agencies for the 2017 First Responder Electronic Jamming Exercise. The award for outstanding collaboration was presented to the exercise team for their exemplary efforts in planning and conducting the exercise. Monetti volunteered with the Surge Capacity Force to support hurricane relief efforts and was unable to attend the Under Secretary Award Ceremony in person. However, he was recognized for his “tireless dedication, steadfast resolve and visionary leadership during the planning and execution of the First Responder Electronic Jamming Exercise,” at the First Responders Group’s (FRG) Office for Interoperability and Compatibility Award Ceremony.
- Support Contractor **Abby Hooper** was also recognized for improving communications at NUSTL and for her leadership in establishing office camaraderie and cohesion.



Physical Scientist **Sam Lee** received the “Inspiration Award” and the “Division Goal Buster Award” from the New York City Combined Federal Campaign (CFC) at their annual awards ceremony. As the CFC Loaned Executive for Division 3, which includes DHS and U.S. Department of Defense (DOD) agencies, as well as uniformed services located in New York City, Lee surpassed the fundraising goal of \$449,526, set forth by the Local Federal Coordinating Committee, by raising \$469,056 for the campaign.



Support Contractor **Kris Dooley** received her second DHS S&T Plain Language Award for her Enhanced Law Enforcement Uniforms Market Survey Report. This distinguished achievement recognizes the importance of clear and concise writing. DHS Plain Language enthusiast Kathryn Catania of U.S. Citizenship and Immigration Services kicked off the event by reiterating the importance for clear, jargon-free communications that put the reader first.



Physicists **Paul Goldhagen** and **Gladys Klemic** are active members of a working group that produced a new version of the U.S. standard for a type of radiation detector widely used by first responders. The revised standard, American National Standards Institute (ANSI) N42.32-2016, American National Standard Performance Criteria for Alarming Personal Radiation Detectors for Homeland Security, describes minimum performance requirements and test methods for evaluating the performance of alarming personal radiation detectors (PRDs) for homeland security applications. The standard is available at no cost to DHS employees at the following URL:



<http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7755718>

Support Contractor **Hasan Shahid** received the International Council on Systems Engineering, Associate Systems Engineering Professional Certification, dedicated to the advancement of systems engineering. Shahid supports the development of high-level test strategies and requirements for the DHS S&T Next Generation First Responder (NGFR) Apex program and the First Responder Electronic Jamming Exercise, where he is involved in the test design of systems that are integrated with a significant amount of existing equipment. This distinguished achievement recognizes the importance of systems engineering in test and evaluation.



NUSTL staff members showed their support to help put an end to human trafficking by wearing the color blue and holding campaign signs to raise awareness. January 2018 was declared National Slavery and Human Trafficking Prevention Month by Presidential Proclamation and DHS designated a department-wide "Wear Blue Day."



NUSTL staff members join together for a group photograph to support National Slavery and Human Trafficking Prevention Month.

SUBJECT MATTER EXPERTS PANELS AND PRESENTATIONS

Laboratory Director Adam Hutter, Physicist Gladys Klemic and Test and Evaluation Division Director (acting) Ben Stevenson participated in the **2017 National Council on Radiation Protection and Measurements (NCRP) Annual Meeting** and Council Members' Dinner. This year's NCRP meeting focused on the topic of "Emergency Preparedness for Nuclear Terrorism: What are Remaining Gaps and is there Need for Realignment of National Efforts." Hutter served as a keynote speaker at the dinner with approximately 100 council members in attendance, many of whom came to know NUSTL by its predecessor name, the Environmental Measurements Laboratory (EML) and even as the Health and Safety Laboratory more than 50 years ago.

Additionally, Hutter served on a subject matter expert panel at the **11th Annual Homeland Security Week**, a conference focused on the response to a nuclear attack. As a panelist, Hutter discussed NUSTL's research and development activities in the area of radiological and nuclear incident response and recovery with more than 350 federal, state and local government representatives in attendance.

Stevenson presented at the **2016 State and Local Stakeholder Working Group Meeting** hosted by the Domestic Nuclear Detection Office (DNDO). Stevenson represented DHS S&T during the interagency event, which focused on research and technical approaches to preparing for and mitigating the hazards associated with radiological dispersal devices (RDDs). Stevenson introduced the science-based [Planning Guidance for the First 100 Minutes of the Response to a Radiological Dispersal Device \(RDD\) Detonation](#), a tool jointly developed by NUSTL and DOE, which offers recommendations on how local response agencies can be successful early in a response. Additionally, Stevenson presented with the Colorado Division of Homeland Security and Emergency Management Preparedness Program Manager, Fran Santagata, on the piloting of the RDD guidance tool and materials in Fort Collins, Colorado.



Director Adam Hutter (middle) holds his "Sidekicks to the Heroes: How Science & Technology Supports First Responders" plaque at the NCRP Members' Dinner.



Test and Evaluation Division Director (acting) Ben Stevenson presents the RDD guidance tool in Fort Collins, Colorado.



The RNRR team hosts NUSTL's booth at the 2017 Homeland Security Conference in Buffalo, New York.

Stevenson also spoke at the Federal Emergency Management Agency's (FEMA's) **7th Annual Logistics, Operations and Planning Workshop**, primarily designed to provide senior logisticians, operators and planners from the FEMA Region V States with an opportunity to collaborate and share information and best practices. Stevenson presented an executive overview of NUSTL to the state partners in attendance, including the Illinois Emergency Management Agency, Indiana Department of Homeland Security, Michigan State Police—Emergency Management and Homeland Security, Minnesota Homeland Security and Emergency Management, Ohio Emergency Management Agency, and Wisconsin Emergency Management Agency.

Klemic spoke at the **Midwest Chapter Health Physics Society (HPS) Technical Symposium** on the topic of pedestrian radiation portal studies at the Illinois Institute of Technology. The HPS is a scientific and professional organization whose members specialize in occupational and environmental radiation safety. Klemic presented information related to the analysis and characterization studies conducted through NUSTL's project entitled *Optimizing Radiation Contamination Screening at Community Reception Centers for the Fire Department of New York City and the New York City Department of Health and Mental Hygiene to HPS members and health physicists in the audience.*

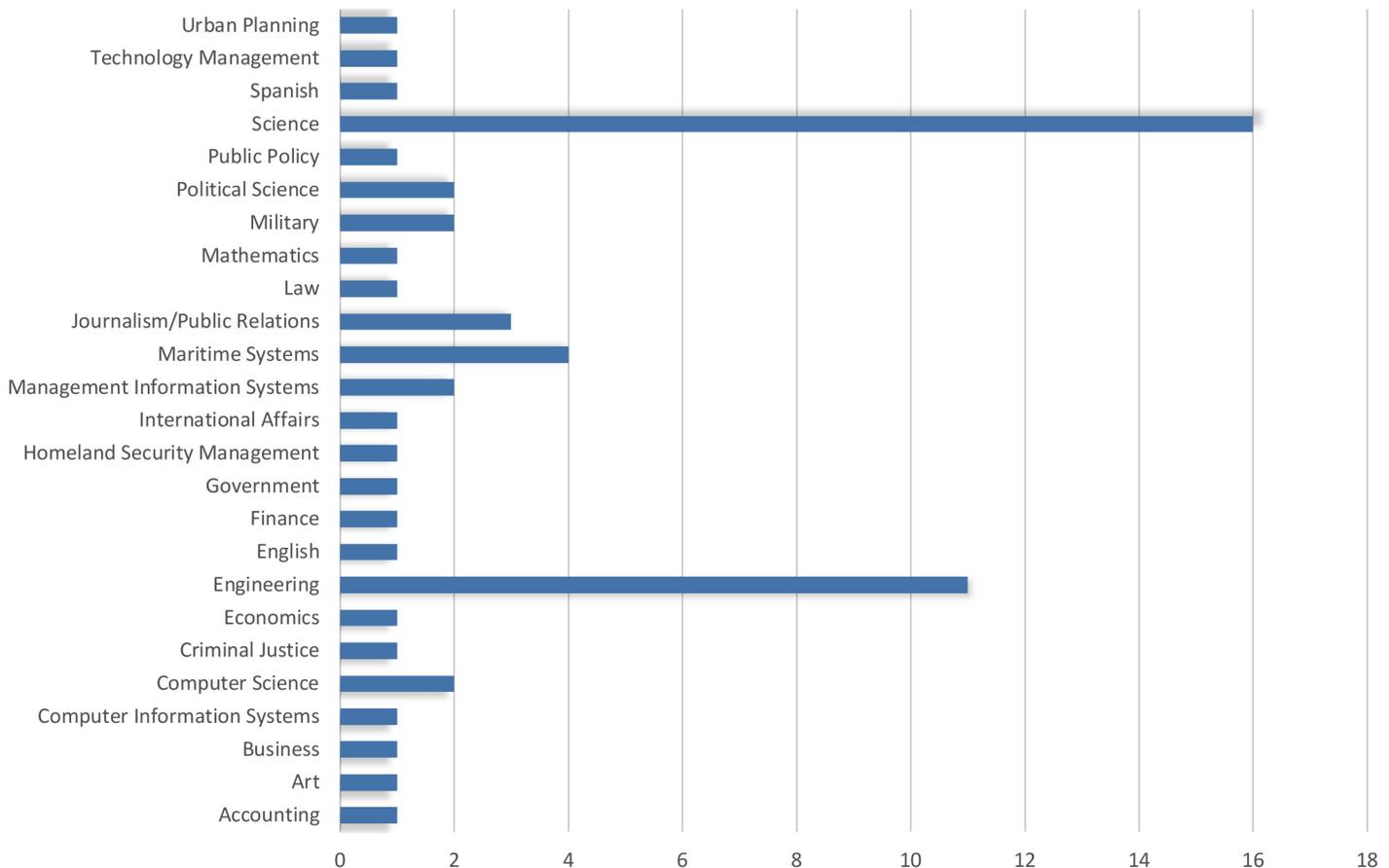
NUSTL's RNRR team participated in a panel discussion, "Whole Community Preparedness," at the **2017 Homeland Security Conference** in Buffalo, New York. The panel focused on NUSTL's jointly developed science-based *Response Planning Guidance for the First 100 Minutes of the Response to a Radiological Dispersal Device Detonation*. First responders and partners from the New York City Emergency Management, New York City Fire Department, Philadelphia Office of Emergency Management and the Philadelphia Police Department accompanied NUSTL at the panel discussions to speak to the operational implementation of the guidance tool and its adoption by key stakeholders.

NUSTL's RNRR team also hosted a conference booth exhibit with materials on programs and projects, the RDD guidance tool, and information on NUSTL's program work. NUSTL's dialogue with government leaders, homeland security professionals, emergency managers, public safety representatives and the first responders in attendance provided a valuable opportunity to hear directly from the end users that NUSTL's products and services support.

STAFF MEMBER EXPERTISE: FAST FACTS

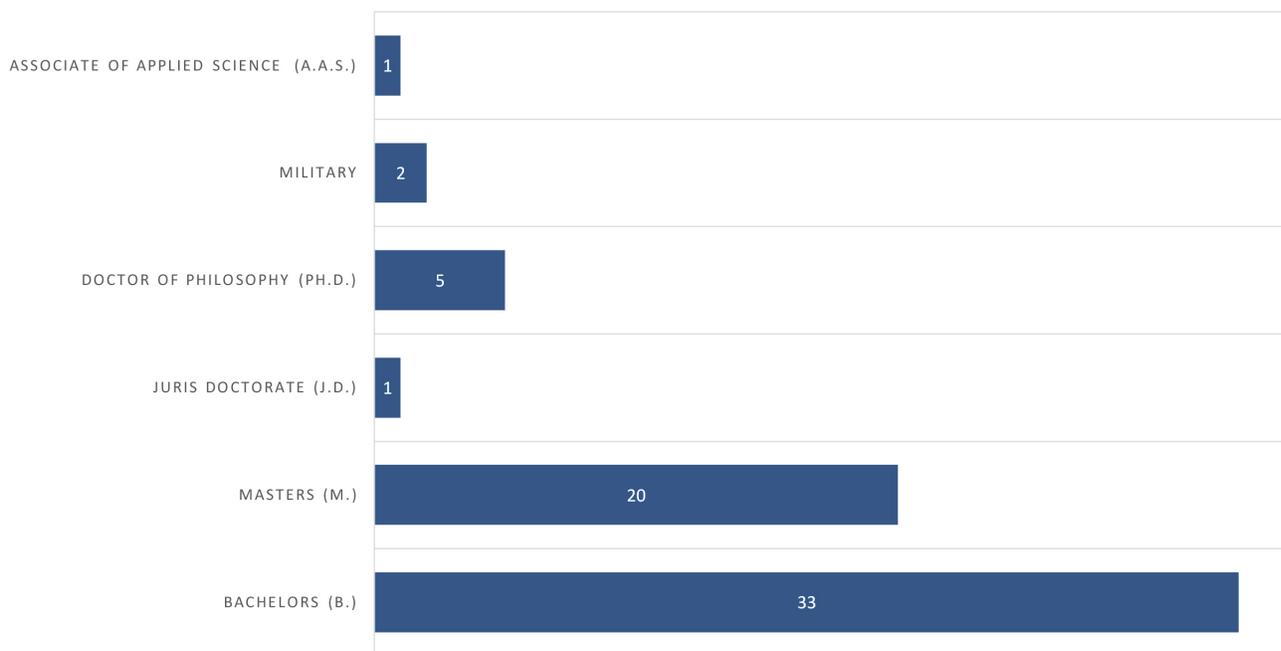
The diversity of NUSTL staff members' educational backgrounds, particularly those with science and engineering focus areas, uniquely positions NUSTL to provide support to federal, state and local stakeholders and first responders.

EDUCATIONAL BACKGROUNDS

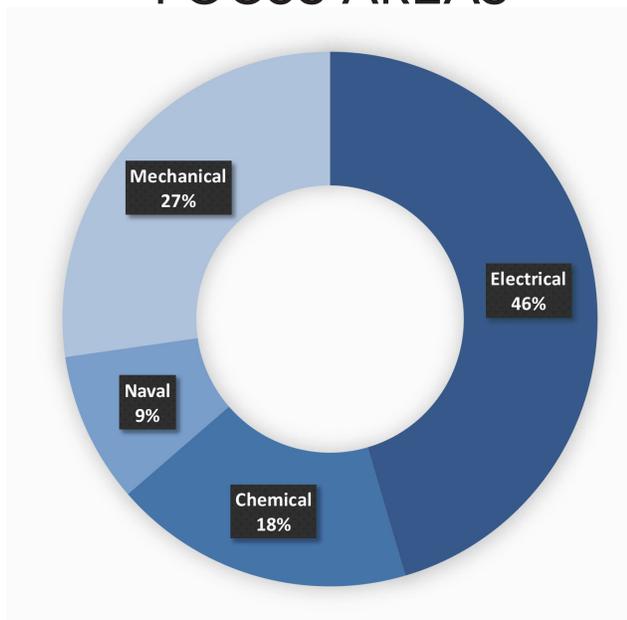


DEGREES OF HIGHER EDUCATION

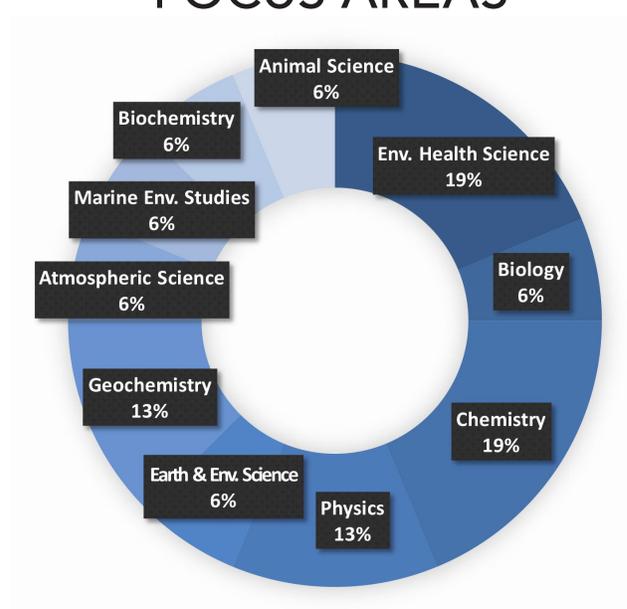
38 total staff members at NUSTL collectively hold 62 degrees.



ENGINEERING FOCUS AREAS



SCIENCE FOCUS AREAS



**PARTNERING AND
COLLABORATING
WITH THE
HOMELAND
SECURITY
COMMUNITY**

Academia: Columbia University (NY), Massachusetts Institute of Technology, North Carolina State University, Stanford University, Stevens Institute of Technology, University of Chicago (IL), University of Kentucky, University of Michigan

DHS: Countering Weapons of Mass Destruction Office, Federal Emergency Management Agency, Immigrations and Customs Enforcement, National Protection and Programs Directorate, Office of Intelligence & Analysis, Transportation Security Administration, U.S. Coast Guard, U.S. Customs and Border Protection

Federal: Department of Commerce National Oceanic and Atmospheric Administration, Department of Defense Defense Advanced Research Projects Agency, Department of Energy, Department of Health and Human Services Centers for Disease Control and Prevention, Environmental Protection Agency, Department of Transportation Federal Aviation Administration, Federal Bureau of Investigation, General Services Administration, National Institute of Health, National Nuclear Security Administration, United States Army Armament Research, Development and Engineering Center

International: Centre for Aerial Robotics Research and Education, International Atomic Energy Agency, International Forum to Advance First Responder Innovation, International Police Organization, NovAtel Inc., Public Health England

National Laboratories: Argonne National Laboratory, Brookhaven National Laboratory, Idaho National Laboratory, Lawrence Livermore National Laboratory, Marine Corps Warfighting Laboratory, Pacific Northwest National Laboratory, Remote Sensing Laboratory, Sandia National Laboratories, Savannah River National Laboratory, Transportation Security Laboratory

Responder Agencies: Boston Police Department (MA), Connecticut State Police Department, Fire Department of New York, Frederick County Division of Fire & Rescue Services (MD), Grant County Sheriff's Department (WA), Harris County Fire Marshal's Office (TX), Metropolitan Transportation Authority, Nassau County Police Department (NY), New Mexico State Police, New York City Department of Environmental Protection, New York City Police Department, New York State Police, Port Authority of New York and New Jersey, Philadelphia Police Department (PA), Torrance Fire Department (CA)

Stakeholder Groups: Association of Public Safety Communications Officials, Conference on Radiation Control Program Directors, Federal Radiological Preparedness Coordinating Committee, InterAgency Board, International Association of Fire Fighters, First Responder Resource Group, NYPD's SHIELD

Note: This listing is not all inclusive.

NUSTL collaborates and strategically partners with organizations from across the United States to test and evaluate first responder technologies, implement tools and resources for state and local emergency planning, and maximize the laboratory's overall mission impact. NUSTL's partnerships and collaborations have consistently increased year after year. In FY2017 alone, NUSTL collaborated with 464 organizations. Laboratory staff worked with a broad range of representatives from a total of 101 private industry organizations, 16 academic institutions, 167 federal, and 162 state and local agencies, in addition to 18 international organizations.

NUSTL's broad range of partnerships and collaborators are comprised of first responder key customers, project performers, stakeholders and government agency representatives from federal, state and local levels, who contribute to the laboratory's products and services either through direct program or project participation, cooperative research or attendance at laboratory events such as meetings and technology assessments. The collaborator listing (shown to the left) outlines some of the organizations that NUSTL worked with throughout this fiscal year.

NUSTL's mission focuses on ensuring first responders have better equipment and technology to do their jobs more efficiently. NUSTL's programs and projects collectively work together to achieve this mission by working directly with first responder and government agency representatives during a variety of testing and evaluation events, meetings, workshops, presentations, trainings, and other laboratory-based events.

Highlights from NUSTL's program and project collaborations are listed below:

- NUSTL collaborated with 54 different organizations to evaluate commercial and emerging first responder technologies through the System Assessment and Validation for Emergency Responders (SAVER) and Responder Technologies (R-Tech) programs.
- The RNRR team at NUSTL has worked with 133 organizations to maximize the value of government investment in R&D funding.
- Through S&T's NGFR program and First Responder Electronic Jamming Exercise, NUSTL collaborated with 108 stakeholder organizations to assess technologies, raise awareness of risks and share recommendations on improving long-term communications resiliency.
- NUSTL's Urban Operational Experimentation event facilitated connections between technology developers and the national end user community, which brought together 70 participants from federal, state and local first responder agencies, as well as private industry and academia partners.

This report also contains information on NUSTL's research and development investments, which led to the development of new tools and guidance that support local and state emergency managers, incident commanders and decision-makers during radiological or nuclear emergencies. NUSTL completed research and testing of preventative radiological/nuclear detection equipment, developed new modeling products and piloted training materials designed specifically for response workers.

Additionally, NUSTL achieved its International Standard for Quality Management Systems–ISO 9001:2015 certification. These highlights, among many other accomplishments from FY2017, are showcased in this annual report.

NUSTL ESTABLISHES NEW PARTNERSHIP AGREEMENT

NUSTL executed a new memorandum of agreement (MOA) between DHS S&T and the New York City Fire Department (FDNY) to improve the development of technologies and knowledge products for the safety and effectiveness of first responders. The new MOA further substantiates the strong partnership between NUSTL and its first responder partners.



Speakers brief the NYAST audience on UAS threats and projections of terrorist and criminal acts caused by UAS operations, based on the trends and forecasts seen today.

NEW YORK AREA SCIENCE AND TECHNOLOGY FORUMS

NUSTL's [New York Area Science and Technology \(NYAST\) Forums](#) provide a platform for cross-collaboration and information exchanges with a focus on first responder-specific science and technology applications. NUSTL's NYAST membership—comprised of first responders, emergency response professionals, federal, state and local agency representatives, as well as academia and private sector groups—**grew by nearly 80 members in FY2017**. NUSTL hosted two forums in FY2017, which attracted attendance from a total of 125 NYAST members representing 62 unique organizations across 21 cities in seven different states.



Law enforcement officers try on backpack and vest-mounted prototypes of the WIND during the interactive portion of NYAST.

NYAST 40 focused on Unmanned Aerial Systems (UAS) Criminal, Terrorist and Military Threats: UAS Challenges and Countermeasures. NYAST 40 members heard presentations by subject matter experts from the Aerospace Corporation, Robert Bunker and Matthew Begert, who provided a threat brief with up-to-the-minute information on UAS operations that led to productive discussions on current and emerging threats. The speakers highlighted the ever-evolving technical capabilities of UAS and the increasing use of the systems as they become more available and affordable in the commercial marketplace.

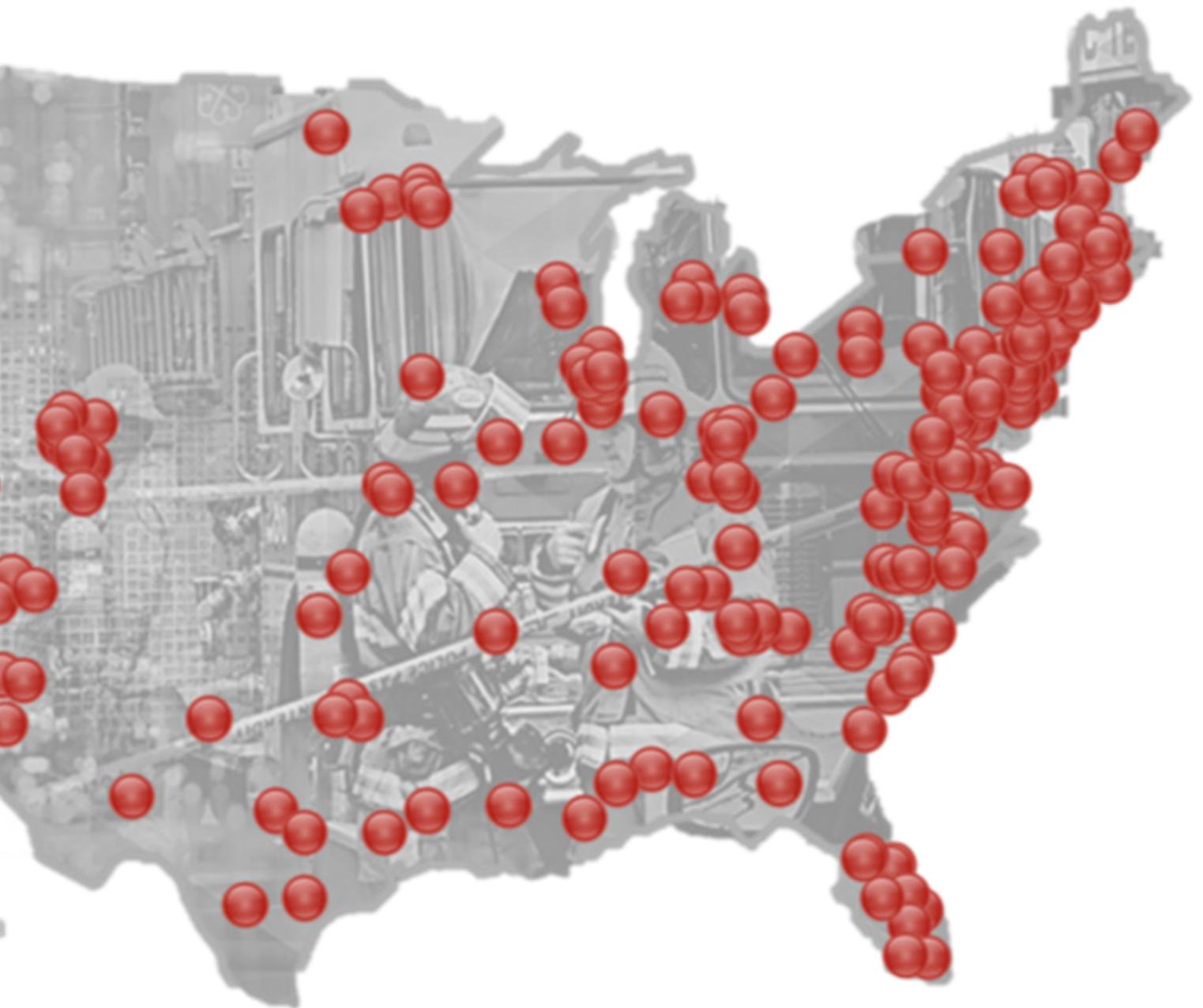
NYAST 41 focused on Improving Radiological/Nuclear (R/N) Detection Technologies featuring the Wearable Intelligent Nuclear Detection (WIND), addressing the latest advancements of next generation man-portable R/N search equipment, which can be worn by first responders in many operational search environments including (vehicle-inaccessible) wide areas, indoor venues, public transportation and maritime vessels. Discussions on the evolving capabilities of R/N detection technologies were led by two subject matter experts, Valentin Novikov, Joint Project Leader for Radiological and Nuclear Defense, DOD, and Stephen Luke, Program Manager for the WIND Advanced Technology Demonstration, DHS DNDO.

To learn more about the NYAST forums, please register for membership at the First Responder Communities of Practice website:

<http://communities.firstresponder.gov>, or contact NUSTL@hq.dhs.gov.

In FY2017, NUSTL
collaborated with
464 ORGANIZATIONS
located in **306 CITIES**
across **41 STATES**,
expanding NUSTL's
outreach to
216 NEW CITIES.





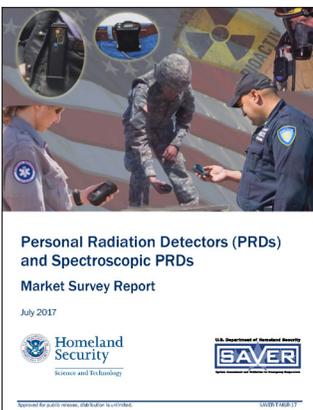
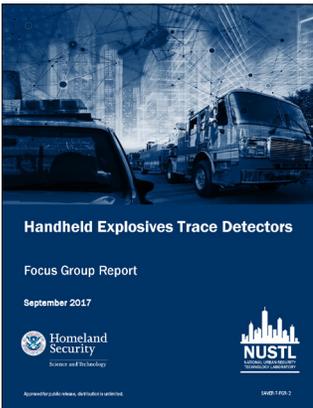
SYSTEM ASSESSMENT AND VALIDATION FOR EMERGENCY RESPONDERS

NUSTL's [System Assessment and Validation for Emergency Responders](#) (SAVER) program, also known as the "[Consumer Reports for First Responders](#)," was established to assist responders with procurement decisions. Through SAVER, NUSTL conducts impartial, practitioner-relevant, operationally oriented assessments and validations of commercial off-the-shelf (COTS) equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL). Results are shared with responders through the publication of various reports or knowledge products, including focus group, market survey and assessment reports, which enable responders to better select, procure, use and maintain emergency response equipment. Reports are delivered to the responder community through publication on the [SAVER section](#) of the DHS S&T website.

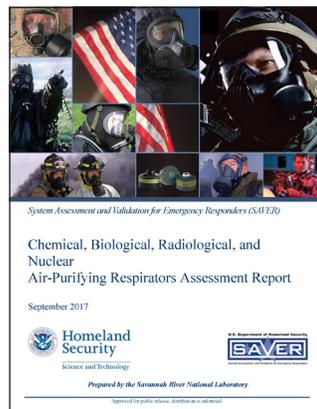
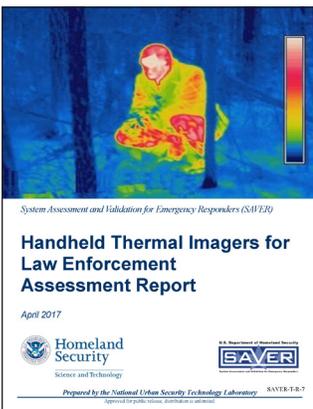
In FY2017, SAVER **assessed 21** products and **published 14** knowledge products, including two focus group reports, four market survey reports, three assessment reports and five TechNotes. Additionally, two SAVER-on-Demand (SoD) reports were completed. During this period, 28 emergency responders from 12 states—Illinois, New Jersey, Nevada, Texas, Virginia, Washington, South Carolina, Florida, Colorado, New York, New Mexico and Maryland—participated in SAVER focus groups and assessments.



- [Asset Tracking and Inventory Systems Market Survey Report](#)
- [Ballistic-Resistant Body Armor for Women TechNote](#)
- [Chemical, Biological, Radiological, and Nuclear Air Purifying Respirators Assessment Report](#)
- [Continuous Air Monitor SAVER-on-Demand Report¹](#)
- [Emergency Manager and First Responder Use of Social Media Updates TechNote](#)
- [Handheld Explosive Trace Detectors Focus Group Report](#)
- [Handheld Explosive Trace Detectors TechNote](#)
- [Handheld Radiation Survey Meters Market Survey Report](#)
- [Handheld Thermal Imagers for Law Enforcement Assessment Report](#)
- [Hearing Protection with Integrated Radio Communications Assessment Report](#)
- [Personal Decontamination Kits Market Survey Report](#)
- [Personal Physiological Monitoring Systems TechNote](#)
- [Personal Radiation Detectors \(PRDs\) and Spectroscopic PRDs Market Survey Report](#)
- [Portable Radiation Portal Monitors Focus Group Report](#)
- [Portable Infrared Spectroscopy Chemical Detectors for Identification of Unknown Liquids and Solids TechNote](#)
- [Validation Testing of Radiation Dosimeters SAVER-on-Demand Report²](#)



^{1,2} SAVER-on-Demand reports are not for distribution outside the requesting agency.





Evaluators use respirator gear during an operational scenario overseen by NUSTL.

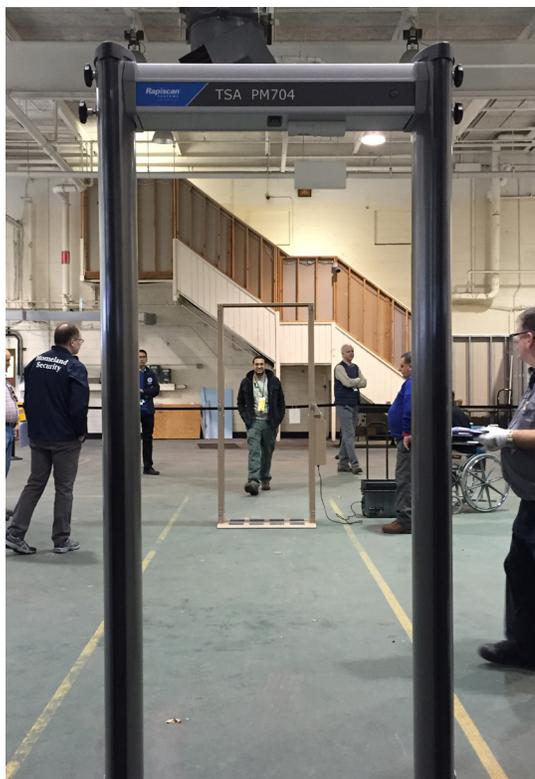
SAVER is a responder-driven program. Emergency responders inform project selection and prioritization, and participate in focus groups and assessments. Responders develop evaluation criteria and operational scenarios, and select equipment they evaluate in SAVER assessments. Responders can also make direct requests to assess specific equipment and technology.



Responders use a radionuclide identification device to detect shielded radiation from a source located behind the wall during the assessment.

ALLOWING RESPONDERS TO MAKE DIRECT REQUESTS TO NUSTL FOR ASSESSMENT

NUSTL has established itself as a trusted and neutral advisor to emergency responders. Because of its reputation, NUSTL frequently receives direct requests from emergency response agencies to assess specific technologies that can include emerging technologies as well as COTS. In response to these requests, NUSTL tailored an “on-demand” approach to distinguish direct agency requests from traditional SAVER activities.



A source handler walks through a PRPM while evaluators observe alerts and alarms.

Through SAVER-on-Demand, or SoD, NUSTL provides testing and evaluation services to address requirements specific to the requesting agency. During FY2017, one SoD request came from the New York City Department of Health and Mental Hygiene's Office of Emergency Preparedness and Response to assess the use of a **continuous air monitor** as a radiological air monitoring device by New York City first responder organizations involved in response and recovery operations during a radiological emergency. In a second SoD request, NUSTL conducted laboratory testing to characterize **radiation dosimeters** for the New York Police Department. SAVER offers a mechanism for communicating the results of SoD work to a wide audience; however, knowledge products that result from SoD requests are published only with the express permission of the requesting agency.

SAVER is planning to conduct new projects on topics of high importance to first responders. These topics include body armor for women, less than lethal mitigation equipment, in-suit communications equipment for firefighters, gas chromatograph mass spectrometers for hazardous materials detection/identification and tourniquets.

COLLABORATING WITH INTERAGENCY PARTNERS TO EXPAND SAVER'S REACH

In addition to enlisting emergency responders to participate in SAVER, NUSTL partners with other laboratories and agencies. These partnerships enable SAVER to leverage partners' facilities at which SAVER assessments can be conducted and increase the range of subject matter expertise from which the program can draw, thus expanding the breadth of emergency response equipment that the program can effectively evaluate. Partnerships also help ensure geographic diversity of emergency responder participants.

In FY2017, NUSTL partnered with LLNL and Savannah River National Laboratory (SRNL) on assessments of **handheld thermal imagers** for law enforcement and chemical, biological, radiological, nuclear and explosive **air-purifying respirators**, respectively, and with BNL on assessments of **portable radiation portal monitors** and **radionuclide identification devices**. NUSTL also collaborated with the Transportation Security Laboratory on a focus group for handheld **explosive trace detectors** and will conduct an assessment of this technology in FY2018.

**OPERATIONAL ASSESSMENT
AND EXPERIMENTATION OF**

FIRST RESPONDER TECHNOLOGIES

RESPONDER TECHNOLOGIES TESTING AND EVALUATION SUPPORT

Through S&T's Responder Technologies (R-Tech) program, NUSTL conducts operational field assessments (OFAs) of S&T developed prototype technologies before they are transitioned to the commercial market. During OFAs, emergency responders use the technology under realistic conditions to assess its capabilities and operational suitability, and to verify that the project goals were met.

During FY2017, **NUSTL conducted OFAs for two technologies intended to address firefighter safety**—the Smoke and Particulate Resistant Turnout Ensemble (SRT) and the Wireless Physiological and Environmental Monitoring System (WiPEM). The firefighters who served as evaluators found value in participating in these assessments. One participant stated,



A fire hydrant hose was used to wet the SRT. Evaluators opted to include this because they noted that their gear typically gets soaked during routine operations.

“The opportunity to come out and test the equipment is a once in a lifetime opportunity and just a great experience to be in on the ground floor of the testing.”

NUSTL conducted the SRT OFA at the FEMA National Fire Academy (NFA) in Emmitsburg, Maryland. SRT is intended to reduce turnout gear infiltration of combustion products and aerosolized particles that could expose firefighters' skin to toxicants and carcinogens. SRT was developed by North Carolina State University's Textile Protection and Comfort Center in partnership with LION First Responder PPE Inc. It uses a particulate filtration material to supplement wrist, ankle and waist interfaces and garment closures on firefighter turnout ensembles.

Three firefighters (from Chicago, Illinois; Montgomery County, Maryland; and San Diego, California) participated in the OFA, performing typical firefighting activities in simulated operational scenarios to assess the SRT's comfort and usability. These scenarios entailed using a fire hose, swinging a sledge hammer, dragging a weighted mannequin, climbing and carrying ladders, and crawling through a previously burned structure containing soot, debris and the scorched remains of household furnishings. Subject matter experts from the International Association of Fire Chiefs, FEMA NFA and a county-level fire and rescue service observed the OFA and participated in discussions.

The evaluators indicated the SRT was acceptable for use and comparable to their currently issued turnout gear in range of motion, comfort and usability. Some suggestions for enhancements to increase comfort and flexibility were provided, while overall the evaluators were satisfied with the SRT and thought that it would be an asset to the firefighting community. The [Smoke and Particulate Resistant Structural Turnout Ensemble Operational Field Assessment Report](#) is available from the DHS website.



During the post operational scenario debrief session, the first responder evaluators discussed their experiences using the WiPEM throughout the OFA with NUSTL's data collectors.



Torrance Fire Department firefighter wearing an SCBA face mask equipped with WiPEM prior to beginning the OFA.

NUSTL conducted the WiPEM OFA at a local fire station in Torrance, California. Developed by the Physical Optics Corporation, WiPEM consists of an array of sensors that measure a firefighter's heart rate, respiration rate, skin temperature and blood oxygenation level. The sensors are designed to be integrated into a self-contained breathing apparatus (SCBA) face mask and to transmit the physiological data to an incident commander. WiPEM's software calculates the wearer's physical strain index, and displays results as a color-coded indicator to warn the incident commander if the wearer is near exhaustion or already exhausted. In addition, the air pressure and time remaining in the wearer's SCBA air tank and external environmental gases detected by a separate multi-gas meter are transmitted to the incident commander.

Six firefighters from the Torrance Fire Department used the WiPEM prototype in various activities. They provided valuable feedback indicating that the additional development and testing is required before the system could be used by firefighters, and they offered specific suggestions to improve the system. The [Wireless Physiological and Environmental Monitoring System Operational Field Assessment Report](#) is published at the DHS website.

In addition to conducting OFAs during FY2017, NUSTL developed and implemented a system of process improvements to streamline and enhance the quality of the R-Tech OFA program (as seen on page 31). In FY2018, NUSTL will conduct OFAs of several prototype technologies for the law enforcement and firefighting communities, including a system to automatically activate body-worn police cameras and a device for firefighter respiratory protection during overhaul operations.

NUSTL R-TECH OFA PROGRAM



Contract Awarded

FRG Program Manager notifies NUSTL's R-Tech T&E Support Program Manager of contract award, OFA target month and expected date for critical design review.

Documents Provided

FRG Program Manager provides project document to NUSTL which includes the Project Management Plan, Broad Agency Announcement, Statement of Work, project performer presentations and test results.

Quad Chart ◆

NUSTL R-Tech T&E Program Manager develops a Project Quad Chart based on the FRG provided documents.

Needs Notification Form

FRG Project Manager provides an OFA Needs Notification Form to the NUSTL R-Tech T&E Program Manager which identifies requirements, number of prototypes, performer points of contact, and potential evaluators, observers and venues.

Project Charter ◆

NUSTL OFA Test Director develops Project Charter that includes a project overview, participants, venue requirements, capability gaps, milestones and costs.

Internal Kick-Off Meeting

NUSTL OFA Test Director conducts an Internal Project Kick-Off Meeting to delegate tasks to the NUSTL OFA Test Team and identify areas of research.

Requirements Matrix ◆

NUSTL OFA Test Director develops an OFA Requirements Matrix to categorize identified requirements, summarize activities to assess the requirements and to denote requirements outside of the OFA scope.

Test Protocol ◆

NUSTL OFA Test Director develops an OFA Test Protocol describing technology and test methods, which is submitted to CAPO, OGC and Privacy to ensure compliance with DHS regulations for Human Subjects Research and Privacy Protection.

Venue Site Visit

NUSTL OFA Test Director or team member conducts a venue site visit to ensure venue has appropriate infrastructure, equipment and space for evaluators to safely perform the identified operational activities.

OFA Test Plan ◆

NUSTL OFA Test Director develops an OFA Test Plan that includes the agenda, operational activities, venue description, evaluator questionnaires and safety considerations.

OFA Execution

NUSTL OFA Test Team executes the OFA in accordance with the OFA Test Plan.

Lessons Learned

NUSTL OFA Test Team conducts a hot wash via teleconference with FRG and the NUSTL R-Tech Management Team.

OFA Report ◆

NUSTL OFA Test Team develop a draft OFA Report and submits to the NUSTL Quality Management Office for review, edit and approval.



The Instrumentation Van, built and operated by the Stevens Institute, is a mobile test bed that supports the DHS PEO and NUSTL's data collection efforts, including at TACTIC, OpEx and other test activities.

COUNTER-UNMANNED AERIAL SYSTEMS TESTING AND EVALUATION SUPPORT

NUSTL's Counter-Unmanned Aerial Systems (C-UAS) Testing and Evaluation Team continued to support the directorate's focus on providing technical assistance and guidance to the Homeland Security Enterprise on detecting, tracking and identifying malicious or nefarious small UAS, or drones. During FY2017, in coordination with DHS S&T's Program Executive Office (PEO) UAS, two events were held to assess C-UAS under operational scenarios applicable to DHS components and first responders, including:

- [Urban Operational Experimentation \(OpEx\)](#); and;
- [2017 Technical Assessment of C-UAS Technologies in Cities \(TACTIC\) Part One](#).

URBAN OPEX

In November 2016, NUSTL led an experimentation to assess the capabilities of a radio frequency finding UAS detection system with first responders and DHS components. The experimentation was held at the U.S. Army Armament Research, Development and Engineering Center (ARDEC) at their Homeland Defense Technology Center and Army National Guard Building located in Picatinny Arsenal, New Jersey, and executed collaboratively with the U.S. Coast Guard (USCG) Research and Development Center. The Stevens Institute of Technology, a DHS S&T performer, provided data collection support during the experimentation.

Observers and evaluators included first responders and representatives from various divisions of the NYPD, Port Authority of New York and New Jersey, USCG, DOD and DOE. After evaluators had an opportunity to operate the system, NUSTL conducted a question-and-answer session with end users to help inform DHS on C-UAS technology requirements.

2017 TACTIC PART ONE

As the number of available C-UAS technologies has increased, the homeland security community needs to understand how such technologies perform under various conditions, such as in dense urban areas, and in different operational scenarios to make informed procurement decisions. To meet this need, NUSTL led a technical assessment, called the [Technical Assessment of Counter UAS Technologies in Cities](#), or TACTIC, in FY2017.

The objectives of the 2017 TACTIC were to:

- Provide DHS components and first responders with an understanding of the state of C-UAS technology performance;
- Develop and validate modeling and simulation programs to predict system performance in various environments; and
- Build an interagency compendium of C-UAS solutions that will be updated semi-annually for the National Security Council.

The 2017 TACTIC was designed as a two part-assessment. Part one was held from July 23-July 28, 2017, at Marine Corps Base Quantico in conjunction with the Marine Corps Warfighting Laboratory. It was designed by NUSTL to be a familiarization assessment for C-UAS technology developers that were selected through an open request-for-information-or-participation process. Part one offered the participating technology developers the opportunity to understand DHS requirements and the test environment. It also offered NUSTL an opportunity to determine appropriate flight paths, hone data collection procedures and better understand how to build an operationally relevant environment for future assessments.

Part two, planned for FY2018, will be a quantitative assessment designed to collect performance data on the C-UAS technologies.



A member of the United States Coast Guard serves as an evaluator of the C-UAS technology.



A rotary quadcopter UAS conducting low altitude flights through an "Urban Canyon" during TACTIC part one.

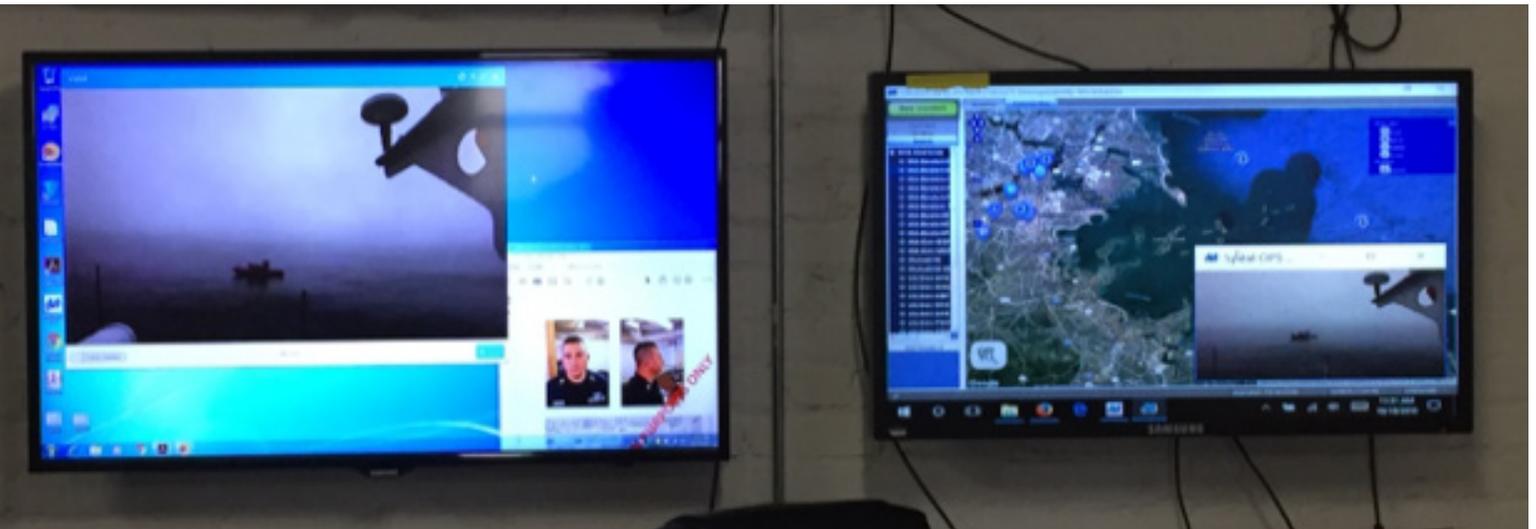


NUSTL Engineers Bhargav Patel and Cecilia Murtagh conduct a site survey at Quantico.

TEST AGENT FOR THE NEXT GENERATION FIRST RESPONDER PROGRAM

NUSTL serves as the Test Agent to the [DHS S&T NGFR Apex program](#). This five-year program, ending in FY2020, has the goal to help tomorrow's first responder be more protected, connected and fully aware. NUSTL's role entails working with the program leads to develop test strategies and overseeing its implementation. NUSTL has lead roles in test events in many cases, while in others NUSTL provides review and oversight.

In FY2017, NUSTL supported the planning and execution of two NGFR test events: the Boston Components Communication Experiment and the Grant County – Technology Experiment (TechEx).



Both screens show the video feeds transmitted from a camera installed on the USCG response vessel during the exercise. A map of the Boston Harbor is shown on the right screen depicting the location of the vessel.

BOSTON COMPONENTS COMMUNICATION EXPERIMENT

At the [Boston Components Communication Experiment](#), NUSTL assisted with the evaluation of two communications systems—Mutualink and datacasting—to address requirements defined in the Coast Guard Authorization Act of 2015. This law requires the execution of a pilot of three or more DHS components to assess the effectiveness of commercially available systems certified by the DOD Joint Interoperability Test Center. These systems would allow multiagency collaboration and interoperability, and wide-area, secure and peer-invitation-and-acceptance-based multimedia communications. The experiment focused on the movement of voice, video and data information among the participants by integrating Mutualink and datacasting networks into existing first responder communication systems.

The two communication systems provided interoperability and enhanced communication capabilities during a realistic operational response scenario in which the USCG was activated to interdict a vessel four nautical miles offshore that was suspected of importing illicit materials. Voice communication integration and interoperability were accomplished utilizing Mutualink. Data (text, file sharing and video) interoperability was accomplished using datacasting. Video feeds from devices at the incident scene were shared over both the Mutualink and datacasting networks. The information was made available to several command centers in the Boston region and other east coast regions, including:

- USCG (Boston, Massachusetts)
- Boston Police Department (Boston, Massachusetts)
- FEMA, Region I (Washington, D.C.)
- Massachusetts Emergency Management Agency (Framingham, Massachusetts)
- U.S. Customs and Border Protection (Boston, Massachusetts)
- USCG (Washington, D.C.)
- USCG (Philadelphia, Pennsylvania)
- DHS S&T (Washington, D.C.)
- DHS Transportation Security Administration (Orlando, Florida)
- DHS Federal Law Enforcement Training Center (Glynco, Georgia)

NUSTL supported the data collection and analysis where feedback on the two communications systems provided an assessment of their performance and capabilities, as well as insight into how they could be improved or integrated into current operations. It was determined there was merit and interest in the use of each technology as they proved to be operationally functional, useful and accepted by users, but more importantly, the experiment revealed obstacles that would need to be addressed before the technologies could be integrated into operations. The obstacles included issues with the bandwidth impeding the transmission quality and other administrative challenges for integrating the technologies into existing systems. responder communication systems.

GRANT COUNTY - TECHNOLOGY EXPERIMENT (TECHEX)

The [TechEx](#) was conducted by S&T with first responders at the Gorge Amphitheater near George, Washington, located in Grant County from June 6-7, 2017, to assess the capabilities of 15 NGFR technologies to support their public safety operations. TechEx focused on identifying capability gaps from participating Grant County first responder groups, evaluating the operational deployment and effectiveness of potential technology solutions in a simulated scenario, and developing an after action report detailing the outcomes of the experiment and feedback from first responders.

Various technologies, including deployable communications networks, situational awareness user interfaces, physiological sensors and video streaming applications, were used to improve core capability areas of operational communications, responder health and safety, situational awareness, and operational coordination.



Surrounded by canyons, a participating first responder tests sensors and communications devices during the TechEx aimed to help address the challenges faced by rural responders.

The scenario for the TechEx was comprised of three vignettes, which involved over 40 first responder participants from the Grant County Sheriff's Office, Grant County Fire Districts 3 and 5, Grant County Multi-Agency Communications Center, Grant County Technology Services, and Moses Lake Regional Tactical Response Team preparing for simulated incidents at the Gorge Amphitheatre to prompt response efforts and use of the NGFR technologies. The first vignette was a roll call, which provided all participants an opportunity to confirm the technologies were operational; the second was a response to a missing person with subsequent rescue; and the third was a response to a fire down the ravine behind the amphitheater and simultaneously an altercation in an adjoining campground.

The technology suite, a systems of systems, included in the TechEx was to facilitate:

- **Geolocation**—first responder units and personnel locations displayed on a map at the Grant County Multi-Agency Communications Center (MACC), command posts and smartphones.
- **Wireless data service**—various broadband technologies, including cellular broadband (Long Term Evolution (LTE)), Wi-Fi and digital TV datacasting created networks at the Gorge Amphitheatre concert venue, campgrounds and along the Columbia River valley.
- **Real-time video**—streaming and viewing of UAS video at the MACC, command posts, emergency management and other destinations from UAS and smartphones.
- **Physiological data**—monitoring and transmission of first responders' physiological data to the MACC and/or command posts for viewing using a video dashboard on a monitor.
- **Communications support**—a combination of county-owned land mobile radios (800-MHz P25), commercial mobile networks and a deployable government-band public safety broadband LTE network (Band Class 14) network for data communications enhanced communications.

NUSTL led the T&E subcommittee for TechEx, including the planning of technology evaluations and the review and support of related planning needs. As part of this effort, NUSTL supported integration testing in Boulder, Colorado, in April, and a dry test run in May at the Gorge Amphitheatre. Twelve operational NGFR requirements were associated with the technologies and 23 tests were developed to determine whether technologies met the requirements. The event was successfully executed and NUSTL provided contributions on the results for the publicly available [Grant County DHS Science and Technology Directorate Next Generation First Responder Apex Program Technology Experiment \(TechEx\) After Action Report](#).

DHS S&T FRG and NUSTL's support was highly lauded by the participating first responders.

"Our first responder community very much appreciated the efforts put forth by DHS to ensure our voices were heard, our guidance considered and our input utilized... overall, the Grant County TechEx was a positive experience that provided our public safety with insight as well as new capabilities to improve our preparedness and response."

– **Grant County Chief Deputy**

In FY2018, NUSTL plans to work on at least three events that are being planned for NGFR. Chronologically, the first is called PlugTest, which will evaluate the joint integration of several selected technologies per guidelines documented in the NGFR Handbook. The PlugTest will be conducted in February 2018 at the National Aeronautics and Space Administration Jet Propulsion Laboratory in Pasadena, California. The next event will be Spiral 3 in Harris County, Texas, where the integration of several technologies will be the focal point of the assessment. NUSTL will also be leading the test planning for an operational experimentation that addresses the incorporation of an artificial intelligence technology and possibly a patient monitoring technology into emergency medical services in Hastings County, Ontario, Canada. A large portion of the planning will take place in FY2018, but the actual event will be in FY2019.

NUSTL Provides Test and Evaluation Management at S&T'S ELECTRONIC JAMMING EXERCISE



The antenna array is set up for the DHS 2017 First Responder Electronic Jamming Exercise (JamX 17) to detect and reject GPS interference. NUSTL Test Manager Matt Monetti and Support Contractor Hasan Shahid participated in the planning and execution of the DHS 2017 First Responder Electronic Jamming Exercise (JamX 17) at the Department of Energy's Idaho National Laboratory, which focused on characterizing the impact of illegal commercial grade jamming devices on federal law enforcement and public safety communications systems and critical infrastructure.

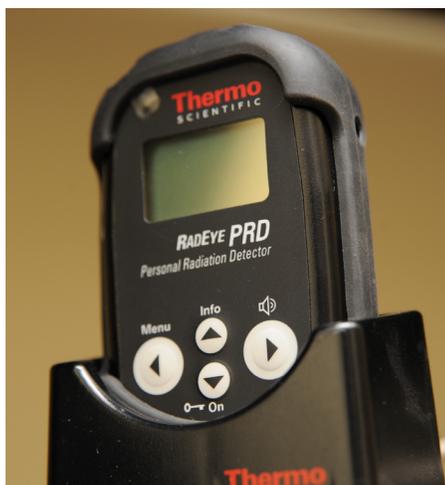
LABORATORY TESTING OF
RADIATION
DETECTION
EQUIPMENT
FOR FIRST RESPONDERS

PERFORMANCE TESTING AND EVALUATION AT NUSTL

Through the [Performance Test and Evaluation at NUSTL \(PTEN\) program](#), NUSTL helps first responders to better detect radiological and nuclear threats by conducting functional testing of radiation detection equipment prior to their field deployment. PTEN ensures that equipment supplied to the first responders works as intended, and that all equipment accessories, guides and electronic display devices are present and functional. Since 2009, **NUSTL has tested more than 20,000 radiation detectors** through PTEN.

In FY2017, PTEN's goal was to balance and maintain service to multiple customer bases, and this was achieved by ensuring that NUSTL staff were trained and scheduled to meet customer needs. This year for Securing the Cities (STC) equipment, all shipments were tested and delivered within two months of delivery. This timeframe includes returning equipment to vendors and receiving replacement units. For the FDNY electronic dosimeter project, units were scheduled so that the turnaround time of units was one week. NUSTL works closely with all customers to ensure that their equipment is making it to the field as soon as possible and always with attention to mission need.

RadEyePRD



GF10 PRD



RIIDs



Images of personal radiation detectors and radiation isotope identifier detectors that are tested by NUSTL.

In FY2017, NUSTL received, **tested and deployed 754 pieces of new equipment** including PRDs and radiation isotope identifier detectors for the NYPD, New York State Division of Homeland Security and Emergency Services, and the MTA Police Department. This equipment, which was purchased under the STC grant program, is provided by the DNDO.

Throughout FY2017, NUSTL continued its partnership working with the FDNY to support their use of electronic dosimeter equipment as a part of their personnel protection program. This support is a follow-on effort to the cooperation of FDNY and NUSTL to design and implement a test of electronic dosimeter equipment that FDNY was considering purchasing. These efforts support FDNY's Hazmat Battalion, and was developed specifically for when electronic dosimeters reach their first- and second-year marks of service. During FY2017, PTEN tested 1,659 electronic dosimeters for the FDNY. This collaboration has allowed NUSTL to provide additional means of support to the FDNY.

Additionally, PTEN initiated a new project with New York City Emergency Management to conduct one-time testing of their radiological detection equipment. This included testing one personnel screening portal and 104 PRDs to determine if the units were viable for repair, calibration and continued use.

In FY2018, NUSTL through its PTEN program plans to:

- Continue to service all incoming STC equipment;
- Maintain a one week delivery schedule for the FDNY electronic dosimeter testing; and
- Introduce a new work flow and data collection method for the FDNY testing and train additional technical staff to the project.

“NUSTL has greatly helped the FDNY in their mission to keep the department’s radiation detection equipment in proper working order. Without their assistance, the FDNY would be hard pressed to keep up with the amount of equipment that needs to be processed. In addition, the quality of work done by NUSTL is equivalent, and in some aspects superior, to the other entities working with our equipment. In short, NUSTL has earned a job well done.”

– FDNY

“I greatly appreciate all of your consistent hard work in assisting the NYPD and the NYC Region. Yours and NUSTL’s services are crucial to the continued success of the STC NYC Program.”

– NYPD

EQUIPPING LAW ENFORCEMENT

**DURING RADIATION DETECTION
TRAINING EVENTS**

RESPONDER TRAINING AND EXERCISE SUPPORT

NUSTL established its [Responder Training and Exercise \(RTE\) program](#) in 2009 to support the DNDO's STC program. STC aims to prevent radiological or nuclear attacks on high-risk urban areas by helping local and state responder agencies to detect and interdict illicit radioactive and nuclear material.

NUSTL assists first responder agencies in the New York City metropolitan area with their radiation detection training sessions and exercises by providing licensed radiation sources, training materials and technical support. Since 2009, **NUSTL has supported training and exercises for more than 2,000 first responders from across federal, state and local organizations** through the RTE program.

In FY2017, NUSTL's RTE program, led by Radiation Safety Officer Carl Schopfer, Ph.D., has supported more than 15 days of training for over 360 first responders at five state and local agencies in and around the New York City metropolitan area, including:

- Nassau County Police Department (NCPD);
- NYPD's Harbor Unit;
- New York State Department of Environmental Conservation Police Department;
- Port Authority of New York and New Jersey Police Department (PAPD); and
- Suffolk County Police Department (SCPD).



NUSTL Engineer Norman Chiu (left) and Test and Evaluation Division Director (acting) Ben Stevenson (right) serve as source handlers during a radiation detection training at the PAPD.



The instructor at SCPD demonstrates ways to recognize how materials such as water can shield radiation from a PRD unit.

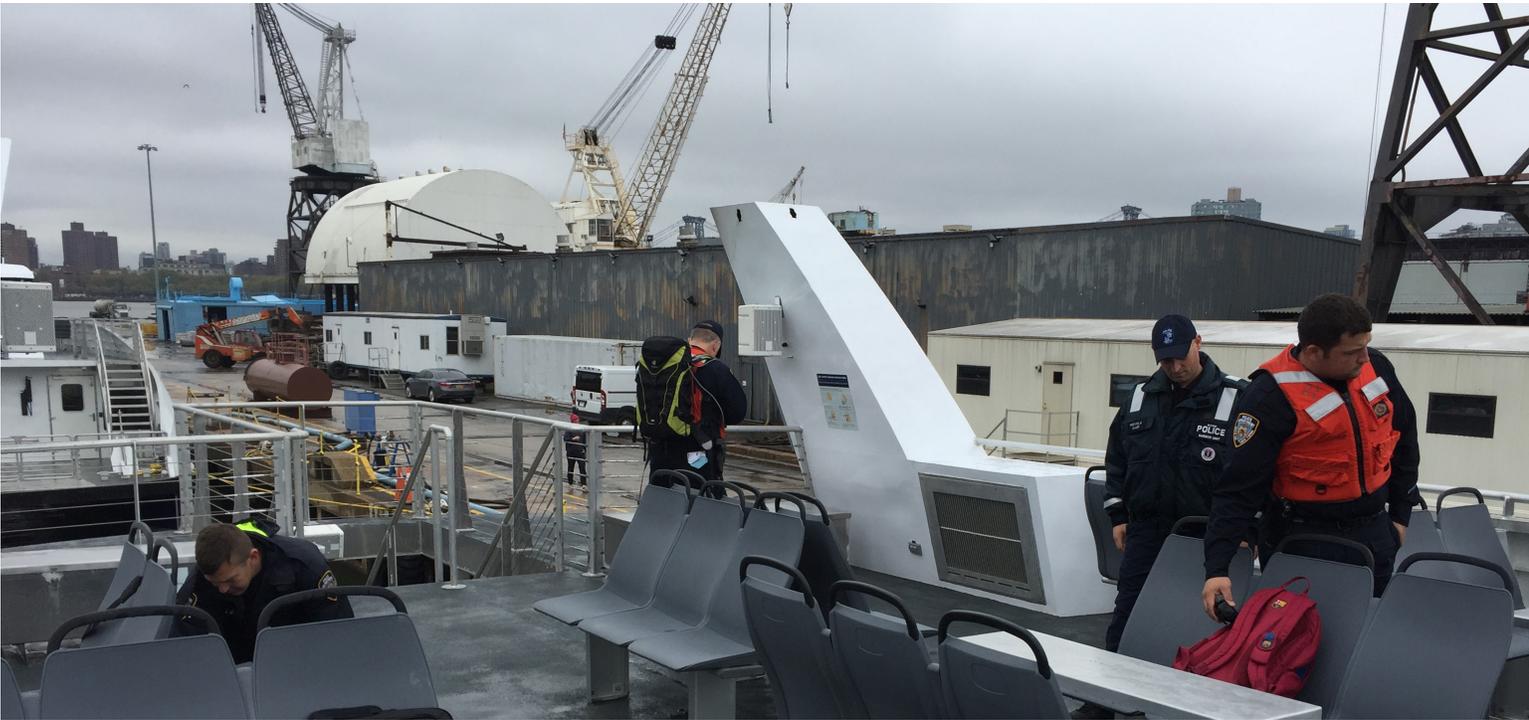
In FY2017, NUSTL supported training programs to address radioactivity-related topics, including radiological dispersal devices, improvised nuclear devices, the use of radiation detector equipment, concept of operations and legal concepts. Police recruits from SCPD Academy, officers from NCPD and police academy students from PAPD were trained on how to use person-worn radiation detection devices in both classroom and interactive settings.

NUSTL also routinely responded to technical assistance requests from state and local agencies to address technical questions and provide solutions that enable first responders to better use and maintain their radiation detection equipment. For example, NUSTL responded to a request from the New York State Department of Environmental Conservation Police Department to test their marine mobile detection system for photon energy and neutron response.



At the NCPD, trainees including police officers and recruits learn how to use PRDs to recognize when a radioactive source is present inside or near a vehicle.

Also in FY2017, NUSTL provided technical support and radiation sources for the testing of a new mobile radiation detection system for the SCPD and their Emergency Services Section, Homeland Security Section and Highway Unit. The new mobile detection system will be deployed in moving vehicles to search for unusual or abnormal radiation, and at local truck stops for routine screenings. The mobile system was also used for radiological detection training in maritime operations during Operation Blue Trident, a full-scale maritime exercise that brought together more than 100 personnel from 23 local, state and federal agencies.



Police officers from the NYPD Harbor Unit conduct a simulated bag search on the upper deck using NUSTL's radiation sources.

NUSTL also provided radiation sources to the NYPD Harbor Unit to test the alarm response of their radiation detection equipment. RTE team members helped prepare the Harbor Unit responders for a Red Team Exercise with DNDO by answering technical and training questions concerning the radiation sources and detection equipment.

NUSTL's committed support and admiration for the first responder community is reciprocated by the agencies that NUSTL supports. For the expertise and guidance that is provided during training courses, the lab has received words of gratitude, including:

“Congratulations to the NUSTL group, your professionalism and commitment to assisting first responders has not gone unnoticed. We look forward to our continued partnership! We couldn't do it without you!”

– NCPD

In FY2018, NUSTL's RTE team plans to continue its partnerships with NCPD, SCPD and PAPD in providing radioactive sources and technical expertise during PRD training events for police officers and recruits. In addition, specialized NUSTL staff members are scheduled to provide radioactive sources to the John F. Kennedy International and Newark Liberty International airports to test the functionality and alarm response of radiation detection systems inside armored vehicles. NUSTL has also been asked by the New York State Department of Environmental Conservation to develop a field test procedure that can be used to routinely test their radiation detection system.

RESEARCH AND DEVELOPMENT

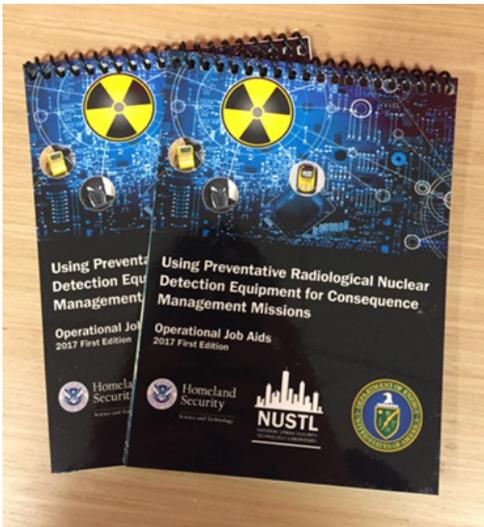
FOR IMPROVING RESPONSE
AND RECOVERY TO
RAD/NUC INCIDENTS

NUSTL's [RNRR R&D program](#) builds products that aid first responders and emergency managers in their preparation for, and response to, radiological and nuclear emergencies. By focusing on building capacity at the local and state level and bridging gaps between federal and local response, the RNRR R&D program has been impactful in its missions to:

- Increase capability at all levels of government to manage and characterize complex and catastrophic radiological and nuclear incidents;
- Improve responder ability to save lives during the initial response operations of a radiological incident; and
- Minimize impact to community and economy through improved methods of incident stabilization, radiological clean-up and recovery.

During FY2017, the RNRR R&D program invested, developed and transitioned tools and products in support of these goals, including: using preventative radiological/nuclear detection equipment for response and recovery missions; funding the development of new modeling products for the DHS-led Interagency Modeling and Atmospheric Assessment Center; and expanding hazard awareness through training and guidance.

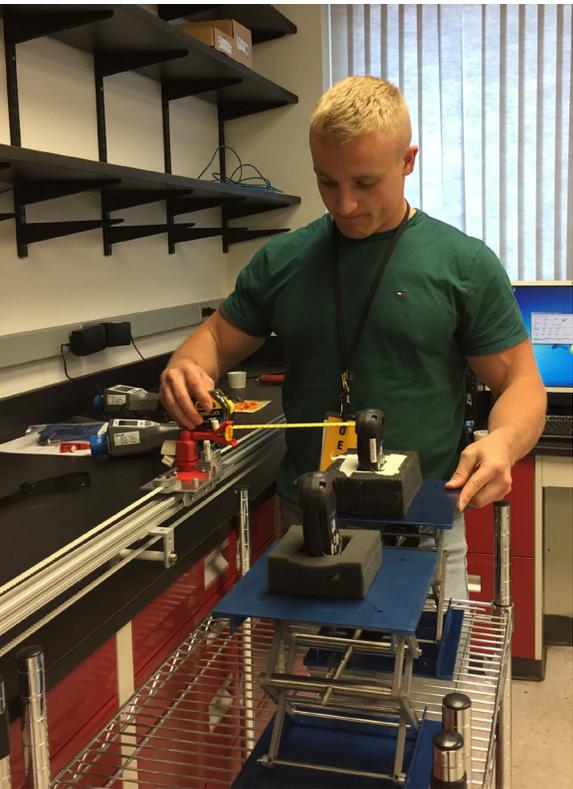
PREVENTATIVE RAD/NUC DETECTION EQUIPMENT FOR RESPONDER AND RECOVERY MISSIONS



Final copies of the Operational Job Aid: Using Preventative Radiological Nuclear Detection Equipment for Consequence Management.

Over the last 15 years, first responder agencies have invested in equipment that interdicts and detects radiological or nuclear materials. This type of equipment is generally referred to as Preventative Radiological/Nuclear Detection (PRND) equipment, and is fielded in jurisdictions by law enforcement, fire department personnel, emergency medical services and other responders who typically have preventative operational missions.

In 2015, NUSTL, along with partners in the DOE's National Nuclear Security Administration (NNSA), initiated a project to research and then test how this PRND equipment could be repurposed for use in different missions, specifically in response and recovery from radiological or nuclear incidents. First responders have limited tools at their disposal for radiological and nuclear hazards, and providing scientific guidance on how trained operators can use the same equipment in different ways to execute their operational responsibilities is critical for the protection of responders and the public.



NUSTL's HS-STEM Intern Lance Schaffer measures the distance between a PRD and a radiological source during laboratory testing at BNL.

A team of scientists from across the DOE's extensive network of laboratories, including BNL, LLNL, SRNL and the Remote Sensing Laboratory, worked collaboratively with NUSTL and DOE NNSA to execute this research and testing.

The first stage of the work was to leverage NUSTL SAVER documents to identify the array of PRND equipment that is available off-the-shelf and evaluate the technical specifications of the types typically fielded by first responder agencies. Next, the scientists determined what operational use cases were important in response and recovery and the technical requirements for safe and efficient use of detection equipment. The capabilities they identified included: exposure rate monitoring and radiation survey, worker exposure monitoring, contamination screening, and isotope identification. DOE scientists then evaluated the PRND equipment against the operational capabilities to see what equipment would be effective for these missions.

In the summer of 2017, testing of equipment against the mission needs began. This work was completed at BNL, and was supported by NUSTL Physicist Gladys Klemic and NUSTL DHS Homeland Security-Science Technology Engineering Mathematics (HS-STEM) Intern Lance Schaffer, who supported the Laboratory for 10 weeks during the summer of 2017.

The results of this testing validated the assumption at the start of the project – that PRND equipment fielded by first responders can be used in support of several response and recovery missions. To provide this information to first responders in an easy-to-use format, the research team created a pocket guide of operational job aids that can be used to help local and state officials understand how their equipment may be repurposed. Copies of the [Using Preventative Radiological Nuclear Detection Equipment for Consequence Management Missions Operational Job Aids](#) were printed for widespread distribution to training professionals and responders in the radiological response community, and the electronic version is publicly available under the Radiological/Nuclear Response and Recovery Guidance and Tools section of [DHS S&T NUSTL's webpage](#). Additional instrument specific job aids were also developed under this project.

A last step of this project was to provide recommendations on how to update standards for future PRND equipment so that the standards provide information on consequence management mission use. These recommendations were compiled and shared with partners, including the DNDO, FEMA, ANSI and the National Institute of Standards and Technology.

NEW MODELING PRODUCTS FOR THE DHS-LED INTERAGENCY MODELING AND ATMOSPHERIC ASSESSMENT CENTER



The [Interagency Modeling and Atmospheric Assessment Center \(IMAAC\)](#) is a FEMA-led center that brings together representatives from several different federal agencies to provide atmospheric modeling and hazard dispersion products to federal, state, local and tribal decision-makers. The briefing products provided through IMAAC enable decision-making on protective actions based on both measured data and projected hazard zones. The RNRR program is working with partners at FEMA who manage IMAAC to invest in additional modeling capabilities to support decision-makers during radiological/nuclear incidents.

FAST RUNNING URBAN DISPERSION MODEL

The RNRR Program is funding the DOE's LLNL to develop enhanced modeling capabilities for the dispersion of radiological materials in urban areas. Characteristics of urban areas, including building footprints, the urban canyon effect, and other wind and weather patterns, can impact how radioactive materials deposit. Modeling products help first responders and decision-makers understand where radiological contamination may be and how it is dispersed on building surfaces and other infrastructure.

In FY2015, the RNRR initiated phase one of this work, which included investigating radiological source terms, modeling particle deposition for urban releases of radiological material (focusing initially on RDD detonations) and validating modeling results. In FY2017, phase two began and included integrating the enhanced modeling capabilities into the National Atmospheric Release Advisory Center (NARAC), a committee run by LLNL in support of the IMAAC. Upon completion of phase 2 work, expected at the end of FY2018, these improved modeling capabilities will allow operational analysts at NARAC to conduct rapid radiological contaminant modeling and analysis and produce urban model predictions for use by emergency responders through the IMAAC.

RAPID RADIOLOGICAL / NUCLEAR HAZARD ASSESSMENT TOOL

While federal, state, local and tribal decision-makers can get access to modeling and briefing products through the IMAAC during a radiological/nuclear incident, the initial products available are low fidelity models based on limit incident specific information. In the crucial minutes of an improvised nuclear device detonation when hundreds of thousands of lives can be saved by sheltering in place, it is important for emergency managers to have these low-fidelity products at their immediate disposal to make critical health and safety decisions.

To meet this immediate need for decision-making support, in FY2014, the RNRR team funded the development of a prototype tool emergency managers can use to quickly provide initial protective action zones from a nuclear detonation. Known as the Rapid Radiological/Nuclear Hazard Assessment Tool, it requires a few simple data points from users—including approximate detonation location, date/time of detonation and estimated detonation yield, if known—to provide estimates of shelter-in-place and damage zones from an improvised nuclear device detonation.

Based on feedback from the radiological and nuclear response community as well as partners in DOE and FEMA on the value of the prototype, in FY2017, the RNRR program invested in the full development of this tool, expected to be completed in FY2019. Once complete, the tool will be available to emergency managers in command centers to use through a web application, but also as a desktop application, should communications be disrupted following a nuclear detonation. The tool uses the last available atmospheric weather data and the inputs provided by the user for an initial assessment of the nuclear hazard impacts.

HAZARD AWARENESS THROUGH TRAINING/GUIDANCE

To support first responders understanding of the radiological hazard and the integration of science-based RDD response operations into local and state planning, the RNRR program is investing FY2017 funding in the development of training materials and products designed specifically for response workers at the local, state and federal level.

OTHER R&D ACHIEVEMENTS

The projects in the RNRR program continue to positively impact the first responder and emergency response community's ability to respond to radiological/nuclear incidents. Some notable accomplishments in FY2017 include the following:

Publication of National Council of Radiation Protection and Measurements (NCRP) Report No. 179 Guidance for Emergency Response Dosimetry: This RNRR funded research is a tool for the emergency planning and response community that bridges the dosimetry gaps between trained and equipped radiation workers and all other categories of responders who are considered emergency workers during a radiation response. It provides critical information that helps emergency managers and planners optimize and re purpose existing radiation equipment for tracking personnel doses and performing dose reconstruction. Follow on work to develop an operationally focused Commentary is underway and will be completed in FY2019.

This includes the development of animated simulations of key response planning objectives and operational capabilities for the first 100 minutes of a response to a RDD detonation. The animations put the responder into the RDD response by showing, for example, how radioactive material may disperse as fragments and/or smoke, dose rates and total dose for those executing lifesaving rescue operations, and the techniques for measuring and mapping radiological contamination.

These **animated simulations**, expected to be completed in FY2019, will be in a usable training format to allow for increased understanding of the radiological hazard and operational capabilities required for an initial response. They will be available widely to the first responder community to leverage in their preparedness activities. Along with the development of the RDD animations, the RNRR program is sponsoring the training of federal experts located regionally who work closely with their counterparts at the state and local levels to support hazard awareness and operational planning and preparedness.



A sample of the RDD animations that shows first responders conducting lifesaving rescue operations in a radiologically contaminated area. This animation visualizes for first responders that while exposure rates are high, accumulated dose is below the recommended levels in the Protective Action Guidance for response.

Completion of initial research and bench testing of organic radiochromic compounds for first responder use: Scientists from SRNL, with funding from the RNRR program, investigated, engineered and bench tested organic radiochromic compounds that change color at specific radiation levels that are of interest to first responders and integrate into a variety of materials such as personal protective equipment. This initial research has the potential for further exploration and study.

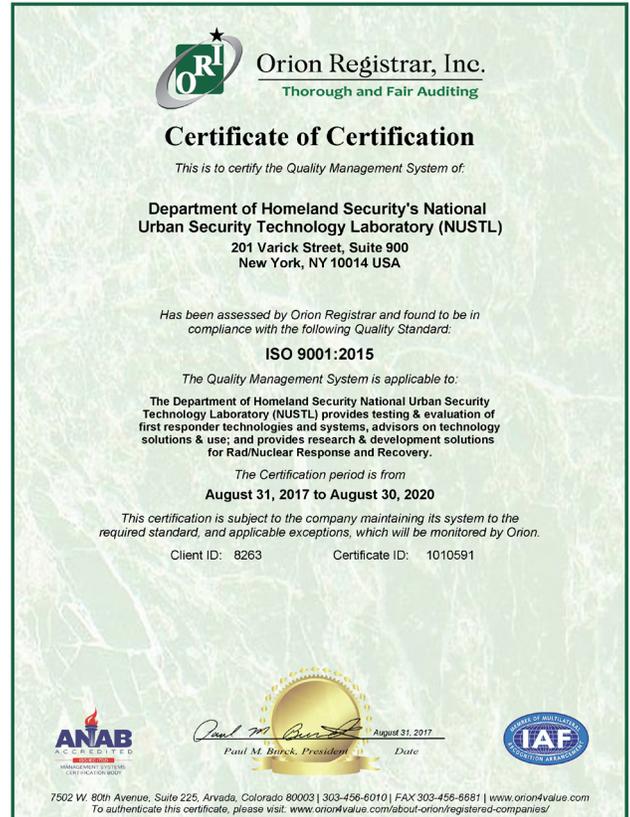
Deployment of RNRR tools in support of national-level nuclear exercise: Several products developed by the RNRR program were leveraged during Gotham Shield 2017, a national exercise led by FEMA and the DOD, in coordination with New York City, New Jersey and New York State emergency response organizations. Radiological Operations Support Specialists, a new emergency response position developed collaboratively by NUSTL with FEMA, NNSA and the Conference of Radiation Control Program Directors, were activated for exercise play, leveraging their training and tools developed through the RNRR program. In addition, RNRR funded work on emergency dosimetry, research on repurposing detection and interdiction equipment for response and recovery, and tools used for estimating waste, were used by players in the exercise.

MANAGING THE NUSTL FACILITY

DELIVERING QUALITY IN EVERY PRODUCT AND SERVICE

Our nation's first responder agencies rely on NUSTL's testing and evaluation products and services when making purchasing decisions for its first responders. As such, it is critical that NUSTL's products and services are of the highest quality—they are informative, substantive, interpretable and timely delivered. To ensure quality, NUSTL implements a **quality management system (QMS)**—the collection of policies, procedures, work instructions, and other planning and operational documents that define how NUSTL conducts business. This QMS includes specific procedures for test planning, execution and reporting, which ensures that all plans and reports are rigorously reviewed prior to delivery.

In FY2017, NUSTL's QMS was certified by Orion Registrar Inc., a certifying body, that it met the International Standard for Quality Management Systems – **ISO 9001:2015 certification**. The Certificate of ISO 9001:2015 (shown to the right) recognizes the effective management system and outstanding customer service delivered by NUSTL.



ISO Certificate

Being ISO 9001 certified also means NUSTL's customers from federal, state and local first responder agencies and the Homeland Security Enterprise can place their highest confidence in the products and services delivered by staff—from field and laboratory testing, technology assessments, radioactive source handling—to knowledge products, reports and guidance tools.

NUSTL's QMS follows a documented, process-based approach to ensure the laboratory's ability to continually monitor, manage and achieve a rising standard of quality across all facets of our operations. The certification is valid from August 31, 2017, through August 30, 2020, and demonstrates the laboratory's conformance to the internationally recognized quality standard.

ENSURING SAFETY THROUGHOUT ALL OPERATIONS

NUSTL developed the [Safety Health and Environmental Management System \(SHEMS\)](#) to aid in the management of environmental and safety related activities in accordance with federal, state and local regulations. Administration Division Director Alfred Crescenzi, who serves as the SHEMS Coordinator, developed, implemented and mandated the DHS S&T SHEMS at NUSTL. On an annual basis, SHEMS goes through a rigorous auditing process to ensure that the laboratory operates safely and efficiently, and this includes training sessions, annual document reviews, as well as internal and external audits. External auditors determined NUSTL's SHEMS has a great responsiveness and ownership from all staff evident by performing good housekeeping practices resulting in hazard-free work during the consolidation of warehouse space. It is evident that the laboratory operates safely and efficiently based on NUSTL's safety metrics, which reflect a year without an environmental release, lost work case, Occupational Safety and Health Administration-recordable case or radiation exposure case. Based on this, NUSTL's Director has deemed NUSTL's SHEMS as suitable, adequate and effective for its intended purposes.



SHEMS Coordinator Alfred Crescenzi monitors safety operations during the set-up of a radiation portal monitor on the laboratory's rooftop space.

SAFEGUARDING EQUIPMENT

Crescenzi, who also serves as the laboratory's security manager, coordinated a semi-annual Preventive Maintenance Inspection (PMI) of NUSTL's security equipment. This inspection was conducted by Physical Security Specialist Willie Houser from the DHS Office of the Chief Security Officer and the contracted preventive maintenance company, Abbey Services Inc. The PMI verified the communications of NUSTL's intrusion detection system, access control system and closed circuit video, and determined the communications are operating successfully with the DHS Command Center. Additionally, Crescenzi coordinated the installation of a new proximity card reader in NUSTL's loading bay area to improve the safety and security of the garage door operations for staff. The proximity card reader enables staff members to operate the garage door from both sides, and an electronic safety stop will activate if a person or object is in the path of a closing door.

INFORMATION TECHNOLOGY

NUSTL upgraded various aspects of information technology (IT) equipment to ensure its collaborative facility remains state-of-the-art. Within the First Responder Training and Assessment Center, there is a new audio/video (A/V) system including the installation of multi-display screens with multi-input options to provide NUSTL and our partners with a more effective way to conduct trainings, operational assessments, demonstrations and exercises.

To continue improving technology infrastructure, NUSTL replaced an outdated analog system with a digital A/V system in the classified discussion room, upgraded routers and printer devices, replaced network switches, and migrated from physical servers to virtual machines to improve the quality of the laboratory's server connectivity. These IT upgrades ensure a state-of-the-art facility that facilitates NUSTL's mission of providing innovative tools, resources and capabilities for collaboration.

PROMOTING ENVIRONMENTAL SUSTAINABILITY

DONATED AND SOLD PROPERTY

- A canner machine for soil samples was resold to a private sector company, Interlab System Technologies in Allentown, Pennsylvania.
- An IT server rack module was resold to a private citizen in Coram, New York.
- A digital hotplate was resold to a private citizen in Granada Hills, California.
- A barometer was resold to a private citizen in San Leandro, California.
- Two radiation detectors were transferred to the Security Department of MTA's Metro-North Railroad in New York, New York.
- Ten radiation detectors were transferred to the Office of Naval Research in Washington, D.C.
- A Chevy Suburban outfitted with radiation detection equipment was transferred to the SCPD in Brentwood, New York.

RECYCLED PROPERTY

- A total of 916 pounds of metal and electronic waste was recycled.
- NUSTL's paper recycling efforts have resulted in more than 10 trees being saved.

National Ur
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**LOOK
AHEAD**

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Laboratory

NUSTL expects FY2018 to be another successful and impactful year as requests for NUSTL's T&E expertise, services and products continue to increase. DHS components, S&T offices and the national first responder community have a high demand for NUSTL's honest and objective assessments of emerging and commercially available technologies that can help guide their investment and acquisition decisions. In addition to these and other test events, NUSTL's RNRR R&D Team will continue their work on existing and new projects to support state and local responders prepare for radiological and nuclear emergencies.

