Chemical and Biological Detection

Science and Technology

OVERVIEW OF THE THREAT ENVIRONMENT

The risk of chemical and biological attacks poses a major threat to the nation's population, infrastructure, economy, and security. Rapid and accurate detection and diagnosis of dangerous chemicals, pests, or pathogenic organisms in communities and transportation hubs is essential to safeguarding public health. Diagnosing and preventing the spread of transboundary animal and zoonotic diseases among livestock protects livelihoods and economic sectors.

The Science and Technology Directorate (S&T) partners with authorities nationwide to address these needs through technological innovation and research. S&T equips officials with the resources and information they need to identify, prevent and/or respond to the threat of chemical and biological releases and catastrophic diseases. S&T also partners with the U.S. Environmental Protection Agency (EPA) to provide guidance for recovery of critical infrastructure.

S&T-FUNDED PROJECTS

The Food, Agriculture and Veterinary Defense **(FAV-D)** project provides research and development (R&D) solutions to address requirement gaps across the food defense continuum.

The **Protected Spaces** project will provide support to the United States Secret Service (USSS) by conducting mission analysis in support of testing and evaluation (T&E) of collective chemical, biological, and radiological (CBR) protection technologies.

The National Biosurveillance and Security **Built Environment (TestBed) Capability** is a national testing capacity to assess vulnerabilities and mitigate biological risks in building air, water handling, and wastewater systems.

The **Triggered Mass Spectrometry (digital Matrix-Assisted Laser-Desorption Ionization [MALDI])** project will develop a single-particle mass spectrometer for field use to decrease the time to detect and initially respond to an indoor aerosolized biothreat release to within 10-60 minutes.

The **Urban Security Initiative** (USI) aims to understand the impact of chemical and biological weapons on urban settings, and how these materials can spread on mass transit and across communities. By investing in chemical and biological detection R&D in major cities such as New York City (NYC), S&T gains insight into the impact of the spread of biological materials and possible mitigation strategies to better prepare for, respond to, and recover from incidents. Within USI, the Department of Homeland Security (DHS) Viral Phenomenology project will deliver to the NYC Metropolitan Transportation Authority (MTA) actionable data that increases system safety for riders and employees during the COVID-19 pandemic and can be shared nationwide.

ACCOMPLISHMENTS TO DATE

- **FAV-D:** Set up a high-performance computing capability (data analytics and modeling) for agricultural biosecurity.
- **Triggered Mass Spectrometry:** Completed prototype digitalMALDI unit deployment to an operational environment, demonstrated extended operation, and gathered background particle dataset. Deployed prototype unit to a second operational environment, in partnership with S&T Sensors and Platforms Technology Center, to gather additional background particle datasets under a variety of conditions and test extended remote operation of the prototype.
- **Urban Security:** Conducted simulated coronavirus dispersion test in NYC.

UPCOMING MILESTONES

- **FAV-D**: Seek to obtain regulatory approval of an African Swine Fever vaccine for emergency use.
- **Triggered Mass Spectrometry**: Conduct extended deployment of a prototype single-particle mass spectrometer to test remote operations and generate different background particle datasets. Improve current prototype design to reduce size and weight, enhance aerosol collection efficiency, and increase spectral resolution.
- **Urban Security**: Complete technical report on large-scale aerosol dispersion tests in NYC, October 2021.

STAKEHOLDERS AND PARTNERS

NYC MTA; EPA; DHS Countering Weapons of Mass Destruction Office, CWMD Test and Evaluation; S&T Office of Science and Engineering, and Technology Centers Division; USSS; U.S. Department of Agriculture; Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense; National Laboratories; and University-based Centers of Excellence.