

Recent events highlight the importance of detecting and thwarting the use of explosives

In the past several years, attempted terrorist attacks such as on Northwest Flight 253 and in New York City's Time Square have underscored the serious need to thwart terrorists' use of explosives by detection and by mitigation capabilities. Trace explosive detection systems are therefore critical. Recently established requirements for 100% testing of cargo and checked baggage places increased demands on trace explosive detection systems needed to perform necessary security screening.

Stopping terrorist from using explosives to destroy lives, property, and our sense of security requires vigilance; expertise of both personnel and bomb sniffing dogs; and reliable equipment and systems. Trace detection systems play a critical role in the 100 percent security screening of individuals, cargo, and checked baggage. Screeners must be trained safely, and the equipment must be calibrated to detect a wide range of explosives. S&T worked with its partners to develop test materials to meet this challenge.

Making an impact on the performance of trace explosives detection systems

The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) partnered with the National Institute of Standards and Technology (NIST) to develop calibration materials (trace explosive simulants) and methods to improve detector performance for both current and evolving threats. These synthesized materials are designed to simulate trace explosives residues so that technology developers and detector end-users can use them to validate instrument performance and perform routine measurements.

Together with NIST, S&T has identified the chemical and physical nature of the threats, as well as training and best practices for screener performance.

Many of the methods and standards are run through the trace explosive detection test bed at NIST, which provides feedback on test methods and simulants. The results support the development of standard practices and methods for surface sampling. They are targeted for screening explosives at airports and at other checkpoints.

Meanwhile, the development of calibration processes and test materials allows us to ensure that traces of explosives can be reliably detected by standard screening procedures used at security checkpoints. S&T developed an ink-jet printer system to apply known quantities of explosives simulants on various surfaces to facilitate training of screeners and calibration of deployed systems.

Milestones/deliverables/transitions

The following test materials, or standard reference materials, have been developed and are currently being used to perform system calibrations:

- Trace Particulate Explosives Simulants
- Trace Explosives Calibration Solutions
- Trace Terrorist Explosive Simulants
- ASTM E2520: Standard Practice for Verifying Minimum Acceptable Performance of Trace Explosive Detectors

Exploiting canine olfactory senses and refining simulants to help train security officers

Bomb sniffing dogs are readily used to assist law enforcement and transit security officers to identify explosive materials due to their acute sense of smell. Currently, the mechanisms of canine olfaction are being studied to determine how canines are trained to successfully characterize and identify the materials of interest. These studies characterize key odorants and components in explosives formulations and develop prototype canine training aids to deliver explosive particles to begin to understand how dogs identify explosive materials and to improve the effectiveness of their training to detect trace amounts of explosives.

A recent advancement in training aids involved using a NIST-developed vapor-time metrology. NIST's Chemical Sciences Division has created an innovative "infused polymer" approach to simulate uniform release of vapors such as those that originate from explosive materials. These infused polymers should find uses for canine training and performance assessment of instrumental vapor detectors. For forensic and homeland security applications, the use of 'real' explosives and drugs-of-abuse may be avoided using these inherently inert simulants.

