NIST Entry Point Screening Test Bed for Explosives Trace Detection

Objective

The NIST Entry Point Screening Test Bed conducts fundamental research to generate measurements and standards that address critical challenges in Homeland Security and demonstrates their impacts in an applied environment. The NIST Entry Point Screening Test Bed was developed to: (1) validate laboratory results in an operational setting and assess their utility to personnel who screen for explosives, and (2) enhance security measures at NIST by field-deploying explosives trace detectors for screening at entry points to the campus. The test bed serves a critical role within the overall goal of the NIST explosives trace detection program, which is to develop measurements and standards that improve the reliability and effectiveness of detection efforts.

Science and Technology Directorate

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Department of Homeland Security

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Department of State

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Law Enforcement Standards Office

Impact and Customers

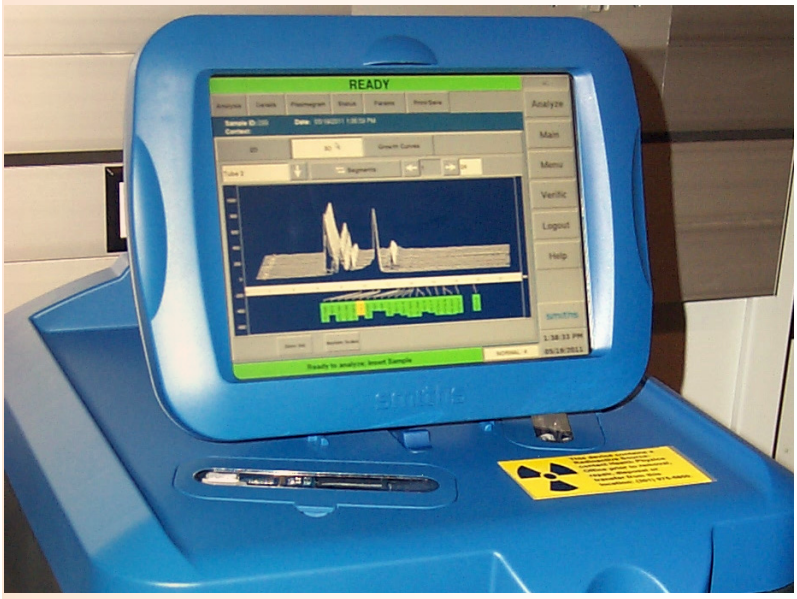
There is a critical need to improve and advance explosives detection due to concerns of domestic and foreign terrorist attacks. To help mitigate this threat, an estimated 20,000 explosives trace detectors are deployed at security checkpoints worldwide.

Explosives trace detection (ETD) systems have demanding requirements for a wide range of threats including high sensitivity, high specificity, fast analysis time and high reliability in various environmental conditions.

The NIST Entry Point Screening Test Bed provides researchers with a platform to evaluate real-world instrument performance issues such as false alarms, background contamination, environmental conditions and sample throughput.

Approach

The NIST Entry Point Screening Test Bed expands measurement science and standards production beyond the laboratory and into an applied environment. This collaboration between the Material Measurement Laboratory's Surface and Microanalysis Science Division and the NIST Emergency Services Division allows researchers to work directly with active security personnel to optimize entry point screening technologies and procedures. Explosives trace detectors (ETDs) based on ion mobility spectrometry typically analyze collection swipes that may contain trace residues of explosives. To eliminate the influence of sampling artifacts while systematically studying ETD performance, NIST researchers have developed the metrology infrastructure required to produce high-level explosives test materials. The test bed allows researchers to evaluate the stability of these test materials in the field while NIST screeners simultaneously benchmark the performance of deployed ETD systems. The availability of NIST explosives test materials to the end-user community, combined with practical data from real-world instrumentation, is critical for both ETD calibration purposes and evaluation of instrument performance.



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Accomplishments

Tangible benefits afforded to our critical stakeholders from the NIST Entry Point Screening Test Bed program include:

The NIST screener program

Sample collection plays a critical role in the effective detection of trace explosives. Laboratory research findings directed toward standardizing sampling techniques have been integrated into a program for NIST physical security personnel. Officers receive both laboratory and field training on standard operating procedures for proper instrument operation and best practices for sample collection and alarm resolution. Field experiments with officers we trained have yielded data supporting the improvement of collection media (swabs) as well as hand-held wands used for sample collection. Based on end-user feedback and results from test bed pilot studies, NIST researchers have recommended that collection media be modified to specify the exact area where residue must be collected for optimal detection. Hand-held wands used to swipe surfaces are also being modified to indicate to screeners whether they are applying the optimal amount of pressure to remove explosives particles.

A NIST physical security screener wipes the inside of a delivery truck for trace residue of explosives.

A NIST research scientist uses a fluorescently-tagged simulant to help screeners visualize typical trace residue contamination on gloves after handling explosives.

ETD quality assurance/quality control (QA/QC) program development

QA/QC test materials are produced using inkjet printing technology capable of depositing a known mass of explosive with better than 1% precision. QA/QC results of explosives trace detectors deployed as part of the NIST Entry Point Screening Test Bed have helped define field instrument performance specifications such as measurement repeatability, instrument drift and response variability.

Test material stability studies

Field research also allows testing of different storage methods to establish test material shelf life. Researchers have been able to determine sample decay as a function of environmental conditions such as temperature and humidity.

Instrument response comparison

The use of test materials removes variables such as the screener's ability to harvest a sample and delivers a way for end users to focus on evaluation of instrument performance issues like detector lifetime, stability in response and need for service. These high-level test materials allow end users to compare instrument response between multiple instruments deployed at multiple locations and help define "acceptable" performance.

Operational improvement recommendations

Reports developed through our test bed are now being leveraged by stakeholders in a series of pilot studies to determine their value for airport security screening.

Learn More

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Publications

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