Transportation Security Laboratory (TSL)

Science and Technology

BACKGROUND

The Science and Technology Directorate (S&T) Transportation Security Laboratory (TSL) in Atlantic City, NJ supports the maturation, evaluation, and certification of explosives detection technologies. TSL helps the detection equipment industry meet performance requirements established by the Transportation Security Administration (TSA) and other Homeland Security Enterprise (HSE) stakeholders. Two satellite facilities at the Tyndall Reactive Materials Group (TRMG) located in Panama City, FL, and the joint Federal Bureau of Investigation (FBI) - TSA-S&T TIEDS Detection Technology Center in Huntsville, AL provide TSL with the capability and flexibility to quickly respond to emerging threats. TSL also partners with the Aberdeen Test Center (ATC) at the Aberdeen Proving Grounds in Maryland. ATC offers live-fire test ranges that allow TSL to perform small-scale, full-scale, and quick turn-around blast testing in support of requirements development and blast mitigation technology validation.

In addition to TSA and the FBI, TSL collaborates with:

- U.S. Customs and Border Protection
- U.S. Secret Service
- Department of Justice
- Department of Energy National Laboratories

MISSION

- Support TSA's mission to protect our nation's transportation systems.
- Perform research, development, and validation of solutions to detect and mitigate improvised explosive devices.
- Help HSE stakeholders address other detection problems (e.g., opioids).

IMPACT

TSL is committed to sharing technical data and knowledge that supports the development of next generation explosive detection equipment. TSL does this by:

- Delivering detection system performance reports to stakeholders
- Providing access to data related to threat detection characteristics
- Analyzing aircraft vulnerability and mitigation strategies
- Providing subject matter expertise to system developers

EXPERTISE

Independent Testing and Evaluation (IT&E)

- Conducts certification tests supporting TSA acquisition of explosive detection systems.
- Validates changes to fielded configurations dictated by new threats and new operating protocols

Developmental Test and Evaluation (DT&E)

- Establishes cooperative research and development agreements (CRADAs) with industry and academia to mature explosives detection technologies.
- Designs and executes experiments to assess performance of explosive detection technologies.
- Develops, validates, and applies methods to assess automatic threat detection algorithms incorporating machine learning (ML).
- Conducts modeling and simulation to accelerate testing, lower costs, and improve confidence in test results

Applied Research Division (ARD)

- Characterizes the signatures of energetic materials to help TSA set requirements for threat detection.
- Develops methods, tools, and test articles necessary to perform tests and evaluation of explosive detection systems.
- Conducts specialized training on explosives, explosive threat detection, and blast vulnerability and mitigation.
- Assesses vulnerability of commercial aircraft to explosive threats and investigates blast mitigation countermeasures.

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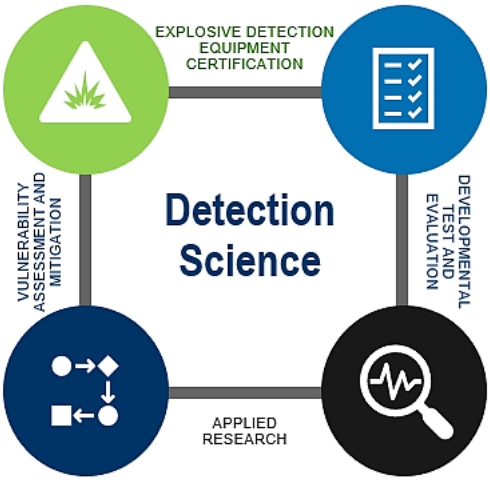

TSL CAPABILITIES

Passenger Inspection Technology

TSA uses Millimeter Wave (MMW) Technology Passenger Inspection Systems also known as Advanced Imaging Technology (AIT) at all major U.S. airport checkpoints. TSL ensures current and emerging technologies can reliably detect explosives and other threats concealed on a passenger's body.

ML algorithms for AIT systems will soon be capable of meeting and even exceeding the performance of trained image analysts (and they don't ever get tired), but validating these technologies is a new and challenging task. TSL is already preparing the tools, methods, and test articles for this task.

Emerging shoe screener technology, when used in conjunction with fast and reliable AIT, will have the potential to make transiting the checkpoint quick and easy. TSL is committed to working with system developers to produce reliable shoe screeners with low false alarm (FA) rates.

Carry-On Bag Inspection

X-ray Computed Tomographic (CT) imaging of passengers' carry-on bags and other personal items results in 3D images of objects whose characteristics can be identified as benign or threatening by automatic threat detection algorithms (many of which will soon incorporate machine learning). TSL is committed to helping developers produce systems that provide TSA with both reliably high detection and a low rate of FAs. Test results have informed technology purchases within fire, police, and emergency management agencies.

Checked Bag Inspection

The first and most successful explosive detection systems were CT-based checked bag Explosive Detection Systems (EDS) with automatic target recognition (ATR). TSL remains committed to making this technology more reliable (higher threat detection rates and lower FA rates) while also ensuring that next generation systems can detect the ever- increasing array of homemade explosive (HME) threats.

Cargo and Mail Inspection

TSL is committed to helping shipping companies acquire and deploy highly reliable and cost-effective screening systems for everything from full-sized pallets of air cargo to mail envelopes that may contain illicit drugs.

Alarm Resolution

Because no detection system is perfect, threat alarms at checkpoints must be resolved, and, while physical inspection of a passenger or his belonging is always possible it is neither efficient nor convenient. TSL and TSA are committed to the development and validation of a suite of alarm resolution technologies to quickly assess alarms and determine whether certain objects are concealed threats or benign items. These technologies include Explosive Trace Detection (ETD) systems (to determine if a concealed or obscured substance is an energetic material), and Bottle Liquid Screening (BLS) systems (to non-invasively determine if a bottle's contents are consumable liquids or liquid explosives).

CONTINUOUS IMPROVEMENTS

To effectively and efficiently detect and defeat threats to the homeland, DHS operating agencies work closely with TSL to constantly improve their capabilities. Examples of recent improvements include:

- Certification and deployment of AIT algorithms with significantly lowered false alarm rates
- Deployment of TSL-validated gender-neutral algorithm for airport passenger screening
- Establishment of a rapid-response capability at TIEDS for assessing trace detectability of new threats
- Assessment of the blast vulnerability of composite aircraft structure
- Assessment of millimeter wave technology for identifying metallic shielding that could conceal illicit substances passing through international mail facilities