

BACKGROUND

The Department of Homeland Security 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 TSA and other Homeland Security Enterprise (HSE) stakeholders.

TSL collaborates with:

- Transportation Security Administration (TSA)
- U.S. Customs and Border Protection (CBP)
- U.S. Secret Service (USSS)
- Department of Justice (DOJ)
- Federal Bureau of Investigation (FBI)
- Department of Energy (DOE) National Laboratories

Two satellite facilities at the Tyndall Reactive Materials Group (TRMG) located in Panama City, FL and the Joint FBI-TSA-S&T Terrorist Explosive Device Analytical Center (TEDAC) Improvised Explosives Detection and Synthesis (TIEDS) Center in Huntsville, AL provide TSL with the capability and flexibility to quickly respond to emerging threats.

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)



EXPERTISE

INDEPENDENT TESTING AND EVALUATION:

- Conducts **certification tests** supporting TSA acquisition of **explosive detection systems**

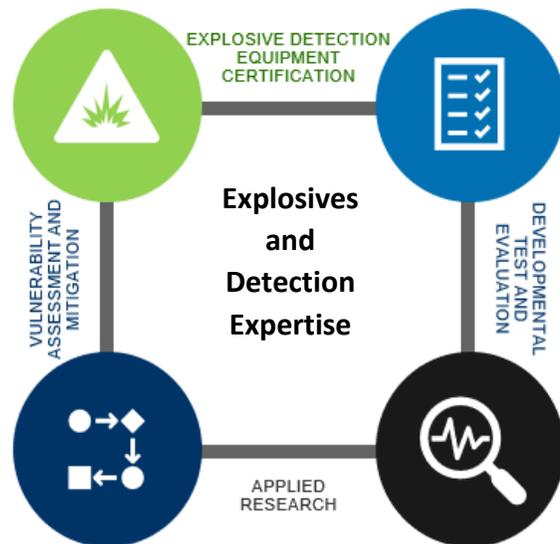
- Validates **changes to fielded configurations** dictated by new threats and new operating protocols

DEVELOPMENTAL TEST AND EVALUATION:

- 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**
- Conducts **modeling and simulation** to accelerate testing, lower costs, and improve confidence in test results

APPLIED RESEARCH:

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



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, and providing subject matter expertise to system developers.

TSL CAPABILITIES

PASSENGER INSPECTION TECHNOLOGY:

TSA uses Millimeter Wave Technology Passenger Inspection Systems also known as **Advanced Imaging Technology (AIT)** at all major U.S. airport checkpoints. TSL ensures that current generation technologies (the L3 Provision) and emerging technologies (Rohde and Schwarz QPS) are able to reliably detect explosives and other threats concealed on a passenger's body.

Machine Learning 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 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 systems developers produce systems that provide TSA with both reliably high detection and a low rate of false alarms. Results from tests inform 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. TSL remains committed to making this technology more reliable (higher threat detection rates and lower false alarm rates) while also ensuring that next generation systems can detect the ever-increasing array of homemade explosive 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 belongings 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).

TSL SUPPORTS OPIOID PRIZE COMPETITION

In November 2019, TSL supported the Opioid Detection Challenge, an international prize competition with S&T, CBP, U.S. Postal Inspection Service, and Office of National Drug Control Policy. Eight finalists were selected for additional assessments conducted at TSL, which was responsible for measuring the ability of prototypes to detect select contraband and the alarm rate against interferent materials. TSL also supported a live announcement and demonstration event for the challenge, which hosted high ranking government officials and press, and demonstrated the finalists' capabilities. The goal was to identify a solution that could be deployed at international mail facilities within a year to stem the flow of opioids into the country.