

# TRANSPORTATION SECURITY LABORATORY

## Results of Improved Collaboration between Explosives Equipment Manufacturers and DT&E Engineers

**Michael Snyder, DT&E X-ray Inspection Branch Chief**

**March 8, 2017**

Transportation Security Laboratory

DHS/Science and Technology Directorate



**Homeland  
Security**

Science and Technology

# Agenda

- Background
- DT&E Paradigm “Shift Left”
- DT&E Throughout Acquisition Life Cycle
- DT&E’s Value Added
- Benefits of Early Collaboration Between Test Engineers and OEMs
- Specific Examples of DT&E Value Added
- Moving Further Left
- Summary

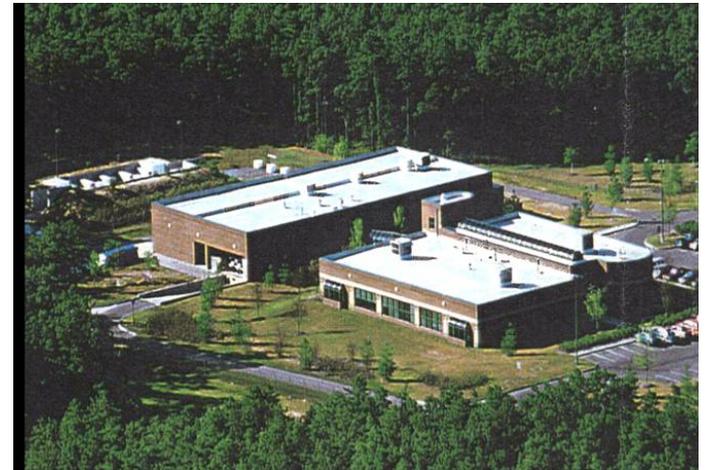
# Background

- The DHS S&T Transportation Security Laboratory is responsible for certifying all explosives detection equipment deployed at airports throughout the U.S.
- The lab has three divisions:
  - Applied Research Division
  - DT&E Division
  - IT&E Division
- The Applied Research Division supports the DT&E and IT&E Divisions by developing testing standards for explosive trace testing, homemade explosives simulants for Advanced Imaging Technologies, and liquid HME simulants for X-ray and Bottle Liquid Systems



# Background (cont')

- The DT&E Division works with S&T and TSA to accelerate system development, provide more reliable detection performance of fielded systems, increase cost savings, and improve passenger experience
- The DT&E Division also works closely with explosives detection equipment manufacturers, to review their data collection plans, provide SME support in collecting “intelligent” data for algorithm development, and providing an unbiased, standardized system evaluation
- The IT&E Division conducts and maintains a Physical Configuration Audit and executes certification testing on behalf of the Transportation Security Administration

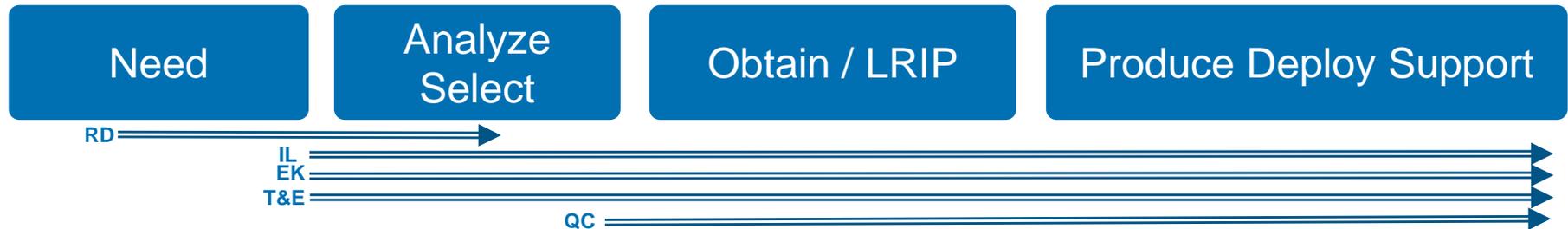


# “Shift Left”

- Dr. Steven Hutchison, as the Principal Deputy for DT&E in the Office of the Secretary of Defense, began a paradigm shift of moving DT&E earlier in the system development cycle.
- Advantages include:
  - Finding problems earlier in the lifecycle,
  - Cost savings in fixing problems earlier, and
  - Reduced deployment schedule risks
- To this end, Dr. Hutchison is strongly encouraging the lab to push DT&E more upstream and get involved in new system design reviews (PDRs, CDRs, etc.).

**Early DT&E means greater benefits to all parties**

# DT&E's Value Added Throughout Acquisition Life Cycle



REQUIREMENTS DEVELOPMENT (RD)	Image Libraries (IL)	Explosives Knowledge (EK)	Test & Evaluation (T&E)	Quality Control (QC)
<ul style="list-style-type: none"> <li>• Mission Needs Analysis</li> <li>• Operational Requirements Development</li> <li>• Key Performance Parameters</li> <li>• Technology Foraging</li> </ul>	<ul style="list-style-type: none"> <li>• Training/Tuning Sets</li> <li>• Algorithm Development Support</li> </ul>	<ul style="list-style-type: none"> <li>• Safety data collection and assessment</li> <li>• Conventional and HMEs</li> </ul>	<ul style="list-style-type: none"> <li>• System Performance:               <ul style="list-style-type: none"> <li>• Detection Rate</li> <li>• False Alarm</li> </ul> </li> <li>• Excursion Testing</li> <li>• Characterization Studies               <ul style="list-style-type: none"> <li>• Vulnerabilities</li> </ul> </li> <li>• Rapid Responses</li> <li>• Limited Assessments</li> </ul>	<ul style="list-style-type: none"> <li>• Development and maintenance of QC standards for system assessments</li> </ul>

TSL Provides SME Support Throughout Lifecycle to Reduce Risks

# DT&E's Value Added

- “Getting under the hood”
  - DT&E Test Engineers learn the basic technology
  - Determine technology’s inherent strengths and weaknesses
  - Early engagement in requirements generation, system design phase
- Develop rigorous test methodology and test articles
  - Identify limits of detection
  - Test systems to ensure mitigation of vulnerabilities
- Provide specific and detailed feedback to OEMs for each test
  - Strengths and weaknesses that require detection improvement
  - Recommendations for focused data collection by OEMs
  - System design suggestions
- Results to IT&E for informed decision to accept or not accept system into certification testing

**DT&E provides actionable info to OEMs, IT&E, & Stakeholders**

# Benefits of Early Collaboration Between Test Engineers and OEMs

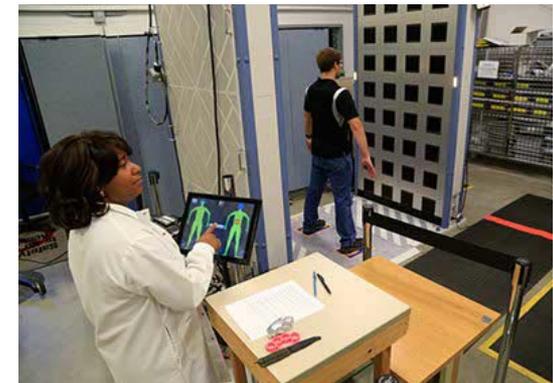
- Recent DHS S&T TSL experience has shown that early coordination and collaboration with OEMs:
  - Identifies system weaknesses sooner
  - Increases system performance (i.e., improves detection, reduces false alarm rates) quicker
  - Decreases the number of testing iterations
  - Decreases the time systems require to become certified
- Actual examples of each of these areas are given in the following slides

## Early Collaboration with OEMs Benefits

**The United States Government does not endorse products or manufacturers. Trade or manufacturers names appear herein solely because they are considered essential to the objective of this briefing**

# Advance Imaging Technology Examples

- Worked with OEM to develop an algorithm that detects a specific threat in a targeted location for the L-3 ProVision 100 system.
- Provided feedback that resulted in the revision of an OEM's ConOps that resulted in a 10X reduction in invalid scans.
- Supported algorithm development resulting in a 22 percentage point decrease in False Alarm rate for the Rohde & Schwarz QPS 100 system.



**Early DT&E has been shown to ID system weaknesses sooner**

# Bottle Liquid Scanner Examples

- Supported vendor algorithm training and testing that resulted in the development of an algorithm with increased detection of an homemade explosive (39 percentage points) and a (9 percentage points) reduction in the false alarm rate.
- Supported vendor system development that resulted in an increase in overall detection (7 percentage points) while maintaining the false alarm rate.



**Early DT&E has been shown to improve system performance**

# X-ray Based Technology Examples

- From 2008-2013, the mean number of testing iterations before a checked baggage system became certified was approximately 7.0 iterations.
- From 2013-2015, the mean dropped to approximately 2.3 iterations.
- This trend has continued with CT-based carry-on baggage scanners. Mean iteration is currently at 2.0 iterations before they become certified.



**Early DT&E has been shown to reduce the number of testing cycles**

# Explosive Trace Detection Example

- The DT&E Chemistry Branch staff worked closely with Implant Sciences scientists assisting them identify system performance gaps (i.e., false alarm issues and detection shortcomings) from Nov 2011 through Jan 2013.
- This led to the Quantum Sniffer QS-B220 system becoming certified in approximately half the time historically required.



**Early DT&E has been shown to reduce time to system certification**

# Moving Further Left

- DT&E scientists and engineers are moving even further left.
- Actively engaged with DHS Explosives Division Program Managers, who oversee new technology development
- Participating in Long Range BAA evaluations
- Attending project kickoff meetings
- Being invited to design reviews
- Witnessing OEM in-house testing during system development

# Summary

- Advantages to getting DT&E scientists and engineers involved earlier in system design, development, and testing
  - Finding weaknesses and vulnerabilities earlier in the system lifecycle,
  - Cost savings to both the government in terms of testing resources for iterative test cycles and OEMs in the number of algorithm modifications, and
  - Reduced deployment schedule risks by maturing and certifying systems quicker and putting them in the hands of end users more expeditiously.
- Collaboration between industry partners and government DT&E staff are better than they ever have been.
- Not as far left as we would like but we are making strides in the correct direction.

# Questions

Thank you for your attention.

Questions?

# Transportation Security Lab Contacts

Mr. Michael Snyder  
Branch Chief, X-ray Inspection DT&E  
[Michael.Snyder@hq.dhs.gov](mailto:Michael.Snyder@hq.dhs.gov)  
Office: 609-813-2764  
Cell: 609-576-4773

Ms. Seyhun Byrne  
Division Chief, DT&E  
[Seyhun.Byrne@hq.dhs.gov](mailto:Seyhun.Byrne@hq.dhs.gov)  
Office: 609-813-2725

Dr. Christopher D. Smith  
Director, TSL  
[Christopher.D.Smith@hq.dhs.gov](mailto:Christopher.D.Smith@hq.dhs.gov)  
Office: 609-813-2707



# Homeland Security

---

Science and Technology