



FAA/NASA Joint University

Program Quarterly Review

- Transportation Security R&D Initiatives of the Transportation Security Lab (TSL)
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Transportation Security Administration

Transportation Security Laboratory

William J. Hughes Technical Center

Atlantic City International Airport

NJ 08405





Transportation Security R&D Laboratory (TSL)

- **Located in Atlantic City, New Jersey**
- **Mandated under the provisions of PL 101-604 in 1990 and PL 107-71 in November 2001.**
- **Responsible for Research, Development, Engineering, Test & Evaluation Activities, and Technology Deployments.**
- **Staff is composed of scientists, mathematicians, engineers, and specialists.**
- **81 federal and 32 contract employees**

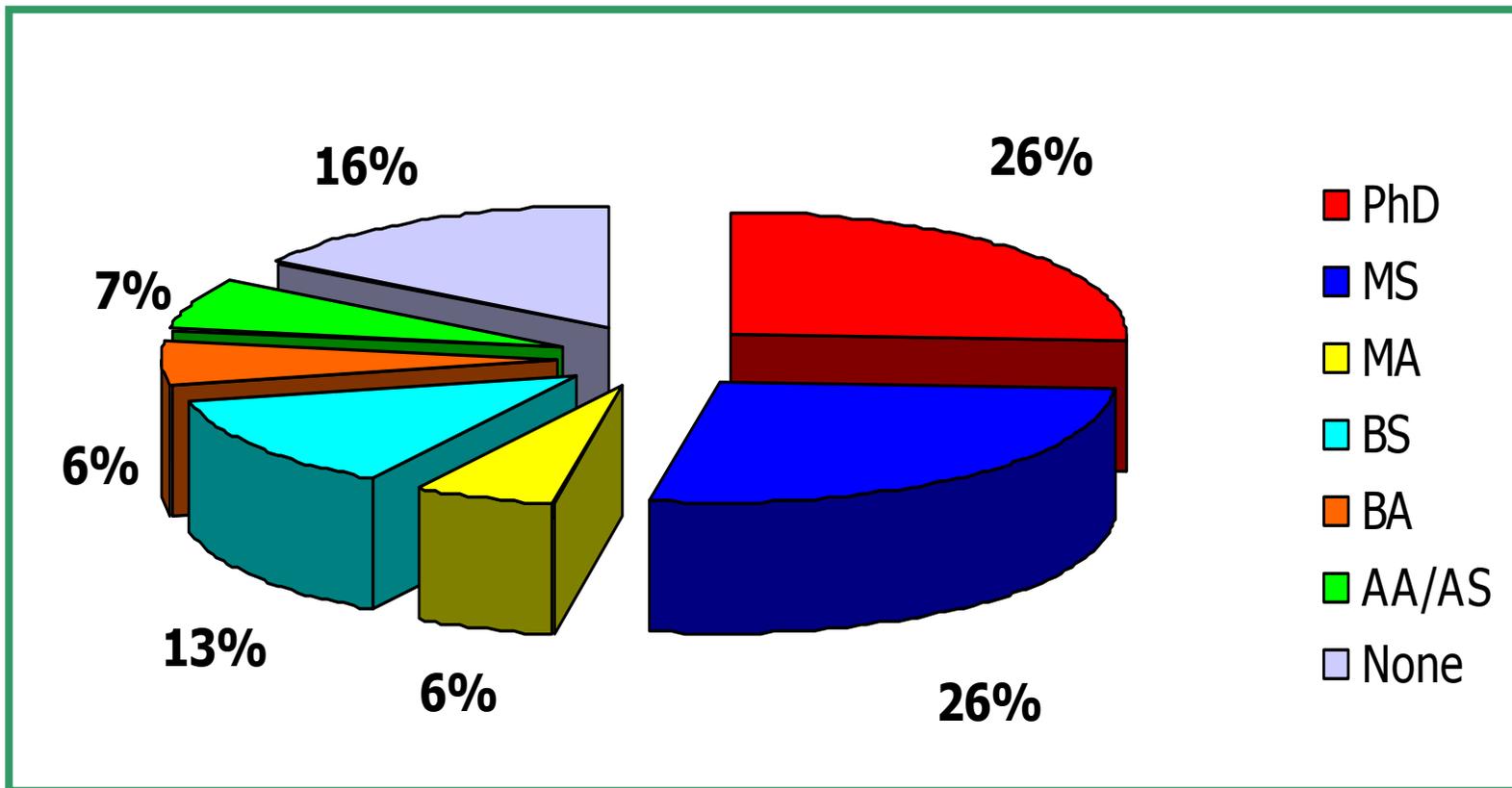


History

- **1970's – Hijacking**
 - ❖ **Metal Detectors**
- **Early 1980's – Explosives**
 - ❖ **TNA**
- **1988 – Pan Am 103**
 - ❖ **Mandated Current Lab**
 - ❖ **EDS and Trace**
- **1996– TWA 800**
 - ❖ **Created SEIPT**
- **2001 – 9/11**
 - ❖ **Today's Efforts**



TSA R,E&D Staff - Degree Types





Transportation Security R&D Laboratory (TSL)

Partnerships (Domestic)

- **DOE**
- **DOD**
- **TSWG (Technical Support Working Group)**
- **ATF**
- **US Secret Service**
- **US Customs**
- **DARPA**
- **NASA**
- **US Postal Service**
- **OST**



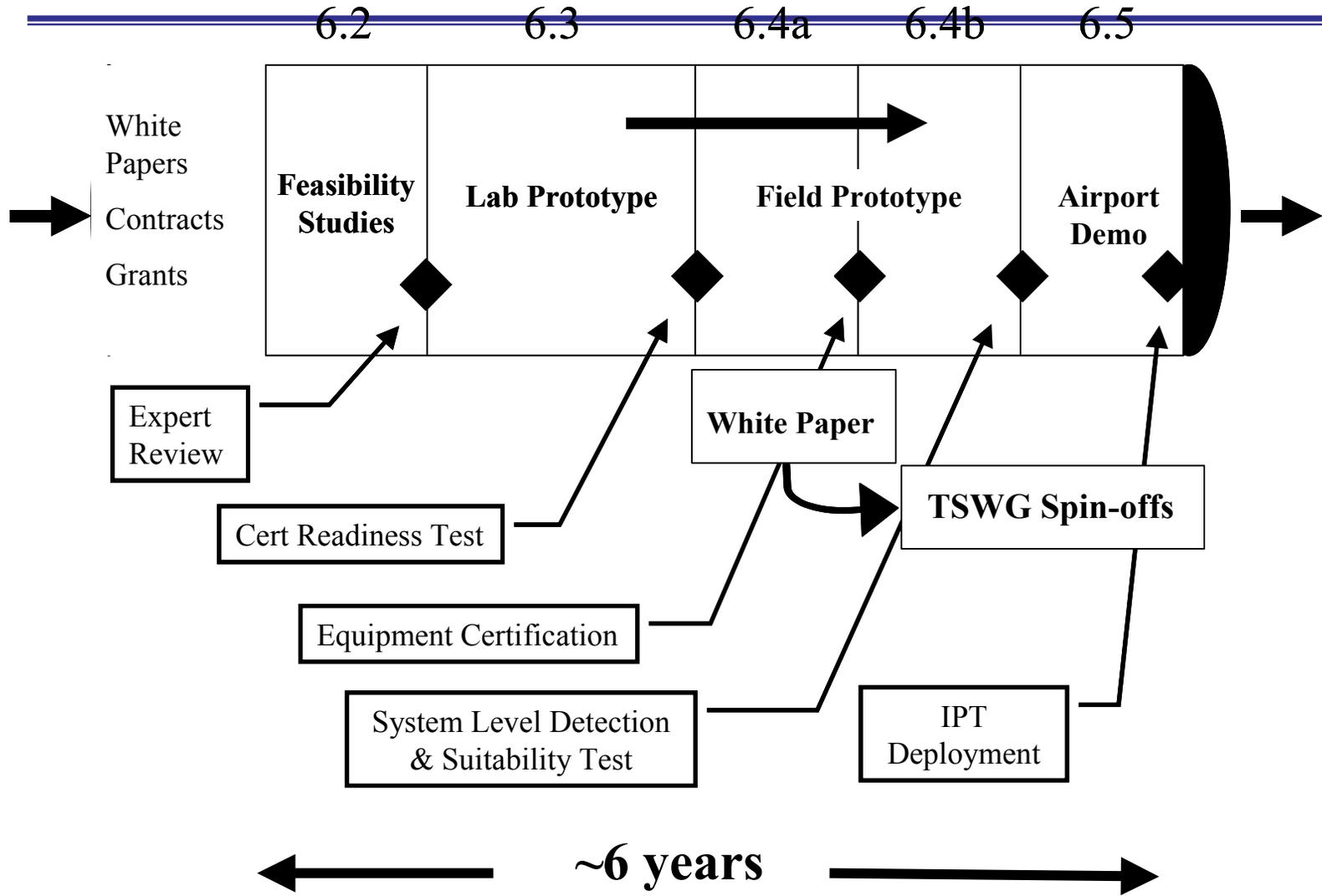
Transportation Security R&D Laboratory (TSL)

Partnerships (Other Governments)

- **Canada**
- **Israel**
- **United Kingdom**
- **France**
- **Germany**
- **Belgium**
- **Netherlands**
- **Italy**
- **Japan**
- **South Korea**
- **China**
- **Philippines**



The AvSec R&D Process





Transportation Security R&D Laboratory (TSL)

Checked Bags



Explosives Detection System (EDS) Comparison

Model	Weight	Power	Length	Width	Height	Field Throughput/Auto Mode	Cost
Invision CTX-9000 (High)	17,000 lbs.	380-480v 3 phase	15'8"	8'	7' 3"	400+ bags/hr	\$1.25M
L3 eXaminer 6000 (High)	8300 lbs.	208v 3 phase	17"	6' 9"	7'	400+ bags/hr	\$1.1M
Invision CTX-5500 (Medium)	10,407 lbs.	350-510v 3 phase	26'	6' 3"	6' 9"	175 bags/hr	\$900K
L3 eXaminer 6000 Stand-alone (Medium)	8600 lbs.	208v 3 phase	22'2"	6'9"	7'	175 bags/hr	\$1.09M
L3 eXamine 6000SE (Low)	7700 lbs.	208v 3 phase	16'2"	6' 9"	7'	139 bags/hr (max)	\$877K
Invision CTX-2500 (Low)	8307 lbs.	350-510v 3 phase	20'	6' 3"	6' 8"	129 bags/hr	\$650K
VCT-30 (ARGUS) (Low)	7000 lbs.	350-510v 3 phase	11'	6' 9"	7'	70 bags/hr (min)	\$450K

Notes:

1. CTX-9000 weight and dimensions reflect an integrated installation (no added weight or length for conveyors).
2. Examiner 6000 (High) weight and dimensions include two 5' tunnels.
3. CTX-5500 Weight and dimensions reflect a stand-alone installation (6' entry and 6' exit conveyors)
4. Examiner 6000 (stand alone) weight and dimensions include two 7' tunnels



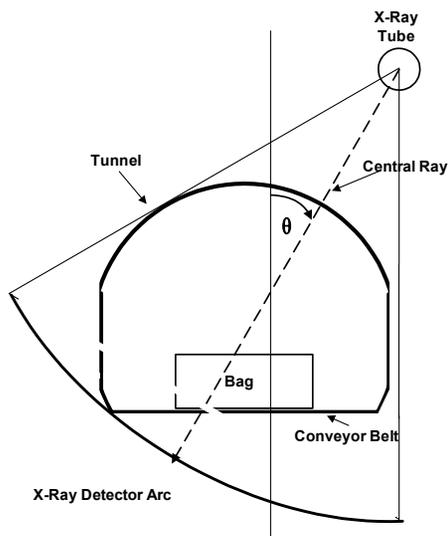
Bulk Detection Program Emphasis

- Enhance test and evaluation
 - ❖ Existing systems, emerging systems and combined technologies
- Improve detection accuracy
 - ❖ Broader threat coverage
 - ❖ Lower threat masses
 - ❖ Fewer false alarms
- Increase machine throughput
- Emphasize and improve cost effectiveness
- Long-term R&D



X-ray and Computerized Tomography (CT)

- **Generalized detection based on density/mass/volume**
- **CT is still the only certified technology**
- **Development will increase speed, decrease cost**

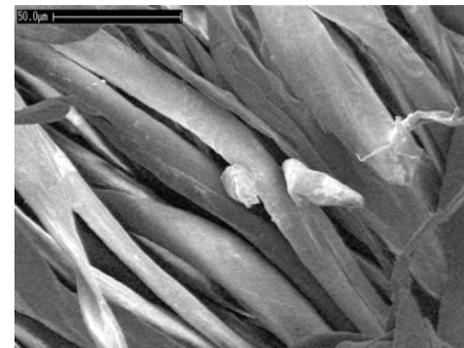


CTX 9000





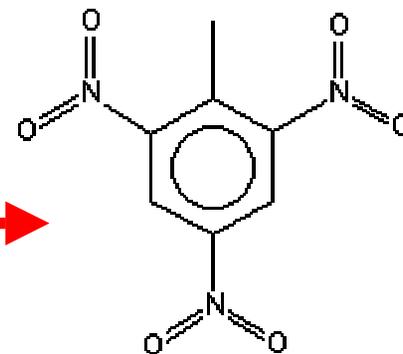
Trace Detection



C-4 particle on cloth at 400X

Trace Program:

- **Explosives**
- **Chemical Agents**
- **Biological Agents**
- **Nuclear**



Vapor molecule of TNT



Trace Laboratory/TSL



A Unique Laboratory Capable of R,D,T&E in the area of Trace Explosives. Supports Government Agencies, Universities, and Private Companies, World-wide

**Trace Standards development
Test and Evaluate new ETDs
Trace Acceptance/Certification
Testing
Support Deployment Operations and
Industry with Analytical Standards**





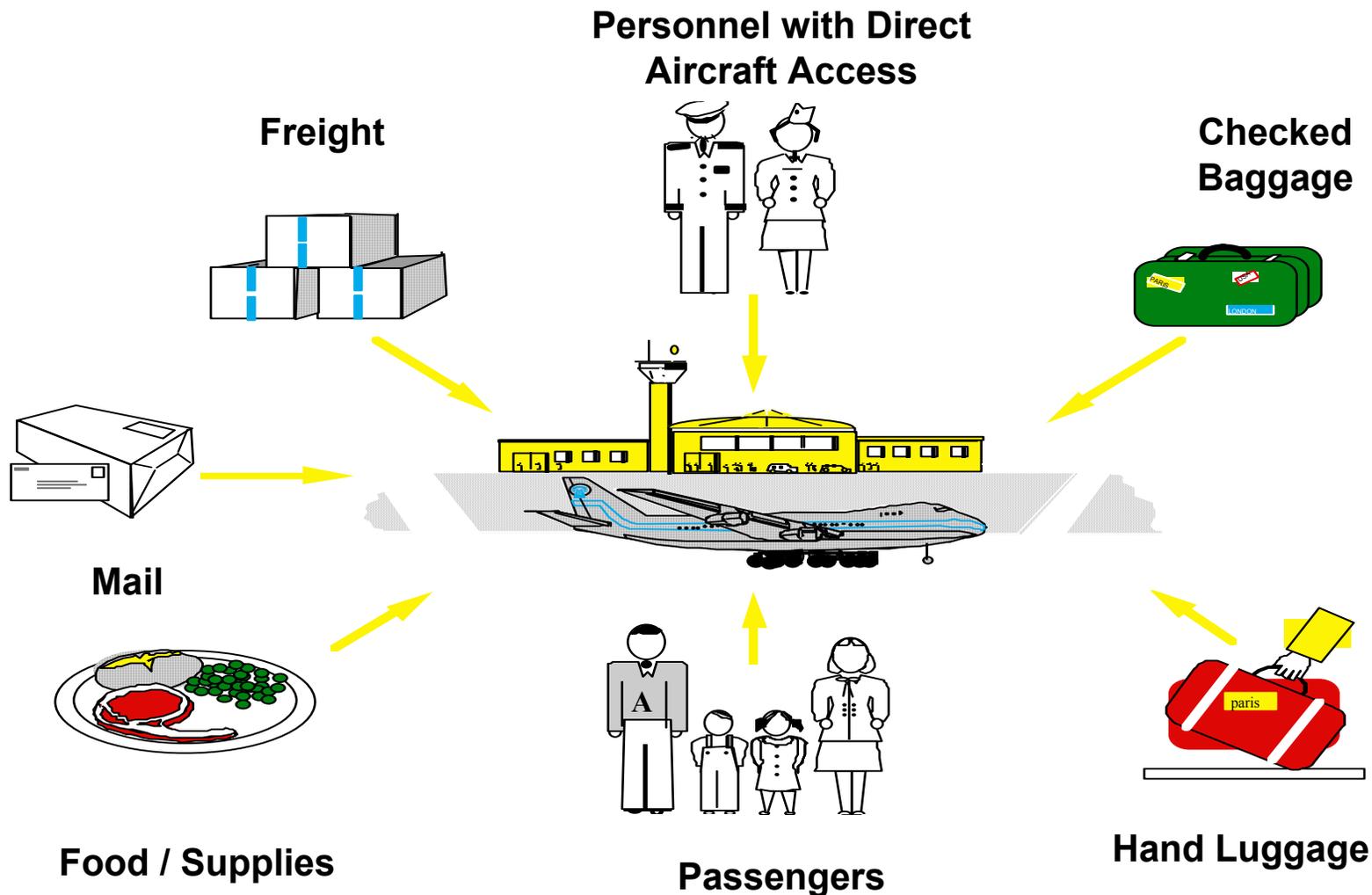
TSA Canine R&D

- **Objective**
 - ❖ **Perform research to better understand olfaction based explosives detection and to improve canine detection performance through optimal training practices.**
- **Projects:**
 - ❖ **Quality Control Aids (with TSWG): Develop non-explosive training aids to supplement current training kit. Aids reproduce odor signature of threat quantity of explosives.**
 - ❖ **Breeding Program (with DoD and Australian Customs): Provide consistent supply of exceptional single purpose detection dogs.**
 - ❖ **Generalization (with TSWG): Determine dog's ability to generalize between similar scents and different quantities of odor.**
 - ❖ **Olfaction Research: Increase knowledge of canine olfactory system.**





Vectors for the Introduction of Threats





Next Generation Checkpoint Security

Checkpoint Vector



Communications Technology Program

Current Efforts

- Airline/Airport Ground Vehicles Identification, Locating and Tracking (Including Driver/Duty Shift Authentication) Utilizes Active RFID, GPS and Secure Wireless Comm (SFO & EWR).
- Off-Terminal Passenger and Baggage Check-In and Screening (Includes Passenger Pre-Enrollment Via Internet, Physical Enrollment and Biometrics Capturing, Issuance of Traveler Smart Card and RFID Baggage Tags and EDS Checked-Baggage Screening and Transportation to Make-Up Rooms) (SFO-Rental Car Facility)



Aircraft Hardening – Explosive Vulnerability

B-737 TEST (SEP '00) – Passenger Cabin





Aircraft Hardening – Explosive Mitigation

COMPARISON STANDARD/HARDENED (SIDE DOOR)



Explosive Mitigation – Threat Containment Unit



- **Designed to Safely Contain the Detonation of an Improvised Explosive Device (IED) Inside a Piece of Passenger Luggage**
- **Intended for use in Conjunction with Explosives Detection Equipment for Passenger Luggage Screening at Airports**





Support of ATSA and Aircraft Rapid Response Team

- **Program “Feeds” both “Ends” of Explosives Detection by Providing Requirements (explosive mass) and Mitigation Solutions**
- **Working with Government of Israel on Hardened Cockpit Door Designs**
- **Investigating Various Aspects of Cabin Monitoring/Communication System Technology (i.e., “Rear-View Mirror”, cabin-to-ground data transfer, wireless alerting, etc.)**
- **Evaluating Less-than-Lethal Weapon Technologies for use in Aircraft**



Human Factors and Behavioral Science

Program Background

➤ Mission

- ❖ To evaluate and improve human performance within the transportation security system.

➤ Research and Development Goals:

- ❖ Enhance Operator Capabilities
- ❖ Improve Person-Machine Performance
- ❖ Increase Human-System Effectiveness



Human Factors and Behavioral Science

Major Efforts in Support of 107-71

- **Research grants to academia (7 active grants).**
- **Assessment of backscatter portals.**
- **Cargo training development.**
- **Screeener test development & implementation (XISST, SRT, IMT).**
- **Screeener training development input.**
- **AS&E 101zz backscatter X-ray assessment.**
- **EDS alarm resolution protocol development.**
- **ARGUS System Qualification Testing (SQT).**
- **ETD-Operator effectiveness (Norfolk Studies).**
- **Fitness-for-duty efficacy.**
- **Screeener Thermos and prosthetics detection.**
- **Assessment of proposals and unsolicited inputs.**
- **CAPPS II (requirements and evaluation).**
- **Next Generation of EDS human factors.**



Airport Security Technology

- **Airport Access Control Pilot Program**
 - ❖ **20+ Airports (ATSA section 106d)**
 - ❖ **75 Volunteers (by August 1 deadline)**
 - ❖ **Evaluate “new and emerging technologies”**
 - **Biometrics (iris, finger, face, hand, voice)**
 - **Anti-piggyback (detectors and controls)**
 - **Surveillance (digital video, video analysis)**
 - ❖ **Competitive selection of System Integrator (in progress)**



Airport Security Technology

➤ Other Major Program Activities

- ❖ **RTCA Standards Committee – Airport Access Control**
- ❖ **R&D - Perimeter Security Technology**
 - **ASDE3 Ground Radar as Security Sensor (JFK demo planned)**
 - **Advanced Video Processing (Sarnoff Labs at LaGuardia)**
 - **Helena Airport – proposal for advanced sensor field/wireless network**
- ❖ **Video Tracking (demo at Knoxville)**
- ❖ **Suspicious Behavior Detection Technology (demo at Providence)**
- ❖ **Analysis Tools Development**
 - **Modeling and Simulation (passenger and baggage flow)**
 - **Vulnerability and Risk Assessment**



Cargo

➤ **Program Requirements**

- ❖ **Develop and Conduct a Research and Development Program to Provide Enhanced Security for Cargo in Air, Land and Maritime Modes of Transportation**

➤ **Key Philosophy**

- ❖ **Work within the Scope of Current Industry Cargo Operations to the Extent Possible while Enhancing Security**

➤ **Challenge**

- ❖ **Cargo Throughput is Distributed versus Centralized Throughput locations for Checked Bags and Checkpoints**



Cargo Program Plan

➤ **Goal**

- ❖ **Develop and Implement an Integrated Research and Development Plan that is Regularly Reevaluated to Address Changes in Threat and Security Technology in Order to Satisfy Operational Requirements in the Future**

➤ **Approach**

- ❖ **Identify the Operational Gap (i.e. the Difference Between how we Operate Today and how we Need to Operate in the Future) and Identify Information and Security Technologies that may help Close the Gap**

➤ **Threat**

- ❖ **Mass Disruption of Economy**



Secure Flow

➤ Vision

- ❖ **A holistic, integrated methodology that addresses all Security Vectors, allowing People, Baggage, and Cargo to move via various Transportation Systems in a secure fashion, while maintaining an “ease of access” to these diverse systems through innovative technology.**



Current or Recent Areas of Collaboration

➤ MIT:

- ❖ Coded Aperture Array for Imaging of explosives (Dept. of Physics)
- ❖ Positive Passenger Baggage Matching, Feasibility Study. Aviation Security Operations Research (Arnold Barnett)
- ❖ MIT/Lincoln Labs: Florescent Detectors for TNT detection



Potential Areas of Collaborative Research

- Sensor Development: Trace Explosives Detectors
 - Artificial Nose
 - Enhanced Sampling for particles
 - Nanotechnology for explosive detectors
- Signal Processing of Images, e.g. Coded Aperture or other techniques



Potential Areas of Collaborative Research

- Human Factors Fundamental research
- System Analysis of Checked baggage flow, checkpoint design, overall security information
- Integration of security information, “switch-board” concept of security measures depending on status of sensors