

Sensor Technologies For Border and Cargo Security

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MITRE Sponsored Research



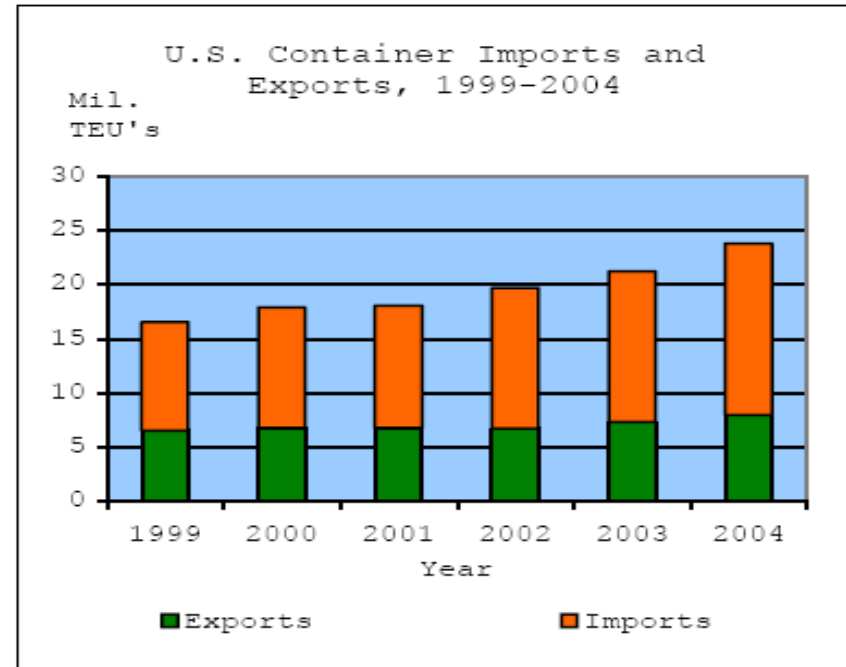
**MITRE
Technology
Program**

Problem

- **The United States needs a screening system that can detect and intercept chemical, biological, radiological, nuclear, and explosive (CBRNE) materials, weapons, narcotics, and other contraband at ports of entry (POEs).**
- **Today only spot check inspection is performed because of the large volume of cargo that enters the country and the lack of an automatic detection and screening capability**

Background

- Vast amounts of cargo enter the US by land, sea and air:
 - For example, 16 million containers enter the US every year
 - This equates to 128 million metric tons
- The amount of material is simply too large to thoroughly search
- Ease of smuggling makes this a prime target for terrorists
 - 650 confirmed cases of illicit trafficking in nuclear and radiological materials between 1993 – 2004 worldwide
 - Biological, Chemical, Nuclear, Radiological, and Explosive materials are all significant threats



Objectives

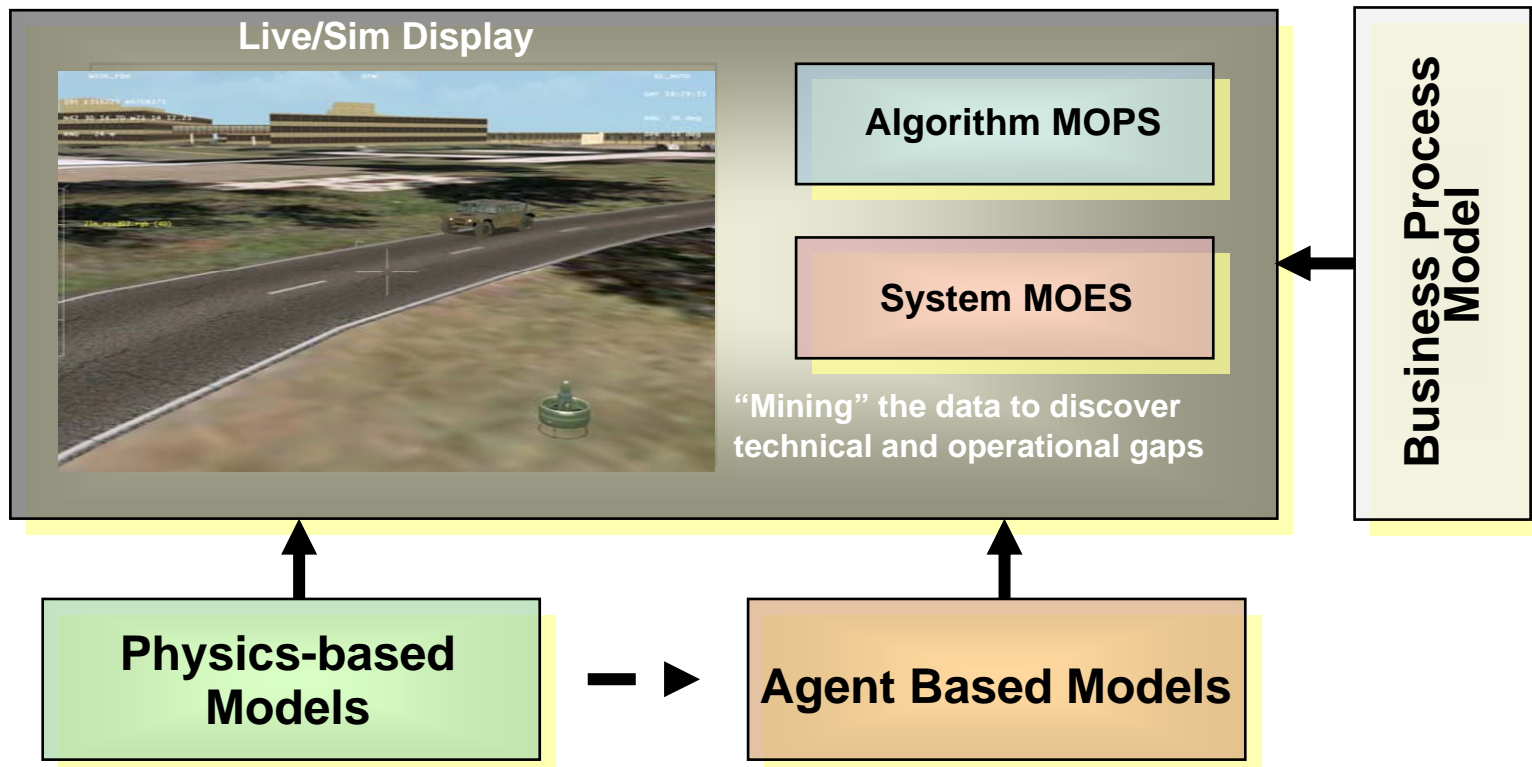
- **The project will use modeling and simulation to aid in the analysis and development of concepts for effective use of a multi-sensor system that will detect, help screen, and intercept CBRNE materials, weapons, narcotics, and contraband at U.S. Ports of Entry.**

Activities

- **The project will leverage MITRE's Netted Sensor Research Initiative Testbed and additional physics-based models to analyze how a network of heterogeneous CBRNE sensors can be used in conjunction with terahertz imaging to detect and intercept materials of interest.**
- **This modeling effort will be supplemented with evaluation of sensor data collections to validate model parameters**

Highlight: Modeling and Simulation

- Employ a common test bed infrastructure for evaluating system proposals for a variety of environments, sensor lay downs, processing modalities, and operating modes
- Combine the strengths of physics, agent-based, and business process models with the ability to simulate and incorporate live sensor data and powerful visualization tools



Highlight: A Layered Defense

- **1st Line**
 - Intelligence based risk assessment
 - **Autonomous network of passive sensors**
 - **Chemical, Biological, Nuclear, Explosive sensors**
 - **802.11 interface for relaying events to central location**
- **2nd Line**
 - Active portal sensors at choke points
- **3rd Line**
 - Physical inspection of suspect material

Autonomous Sensors



Active Portals



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Outcomes

- **Extend MITRE's existing simulation testbed to include signatures, both primary and *secondary*, and sensor models for CBRNE detection**
- **Performance analysis (via simulation) for selected scenarios and sensor suites**
 - **Container security & personnel screening**
- **Identify secondary signatures with potential for improving performance for selected scenarios**
- **Identify sensor combinations with performance improvement potential using fusion techniques**

Impacts

- **A system that can screen the large amount of cargo entering the United States at borders and POEs will contribute tremendously to improving homeland security.**
- **This system would function as part of an overall layered defense system to detect CBRNE, weapons, and contraband.**

Future Plans

- Currently have physics based models for RADAR, IR, Acoustic, Magnetic, and Seismic sensors
- Build signature models for materials of interest
 - Radiation transport codes (complete)
 - Gaussian plume model (complete)
 - IR and UV spectral signatures (publicly available)
- Identify sensors which have best performance potential
 - IMS, MS, LIBS, ...
- Construct models for radiation sensors
 - Work with National Labs to identify and integrate any existing models
- Construct models for scanning sensors
 - X ray, Gamma ray, Neutron, Terahertz
- Construct models for chemical and biological sampling sensors
 - MEMS, UV Fluorescence, IMS, SAW, Lidar, HSI, etc