Department of Homeland Security

Science & Technology Directorate

Emergency Preparedness & Response

Christopher Doyle

Deputy Program Director

A Roadmap for Integrated Modeling & Simulation for Emergency Response

Homeland Security

Department of Homeland Security Mission

- **Prevent terrorist attacks within the US**
- **Reduce vulnerability**
- **Minimize damage, assist in recovery**
- **Enhance “normal” functions**
- **Ensure economic security is not diminished**
- **Monitor connections with illegal drug traffic**

General DHS Organization Structure

Secretary
Deputy Secretary

- Coast Guard
- Secret Service
- Citizenship & Immigration & Ombuds
- Civil Rights and Civil Liberties
- Legislative Affairs
- General Counsel
- Inspector General
- State & Local Coordination
- Private Sector Coordination
- International Affairs
- National Capital Region Coordination
- Counter-narcotics
- Small and Disadvantaged Business
- Privacy Officer
- Chief of Staff

Information Analysis & Infrastructure Protection

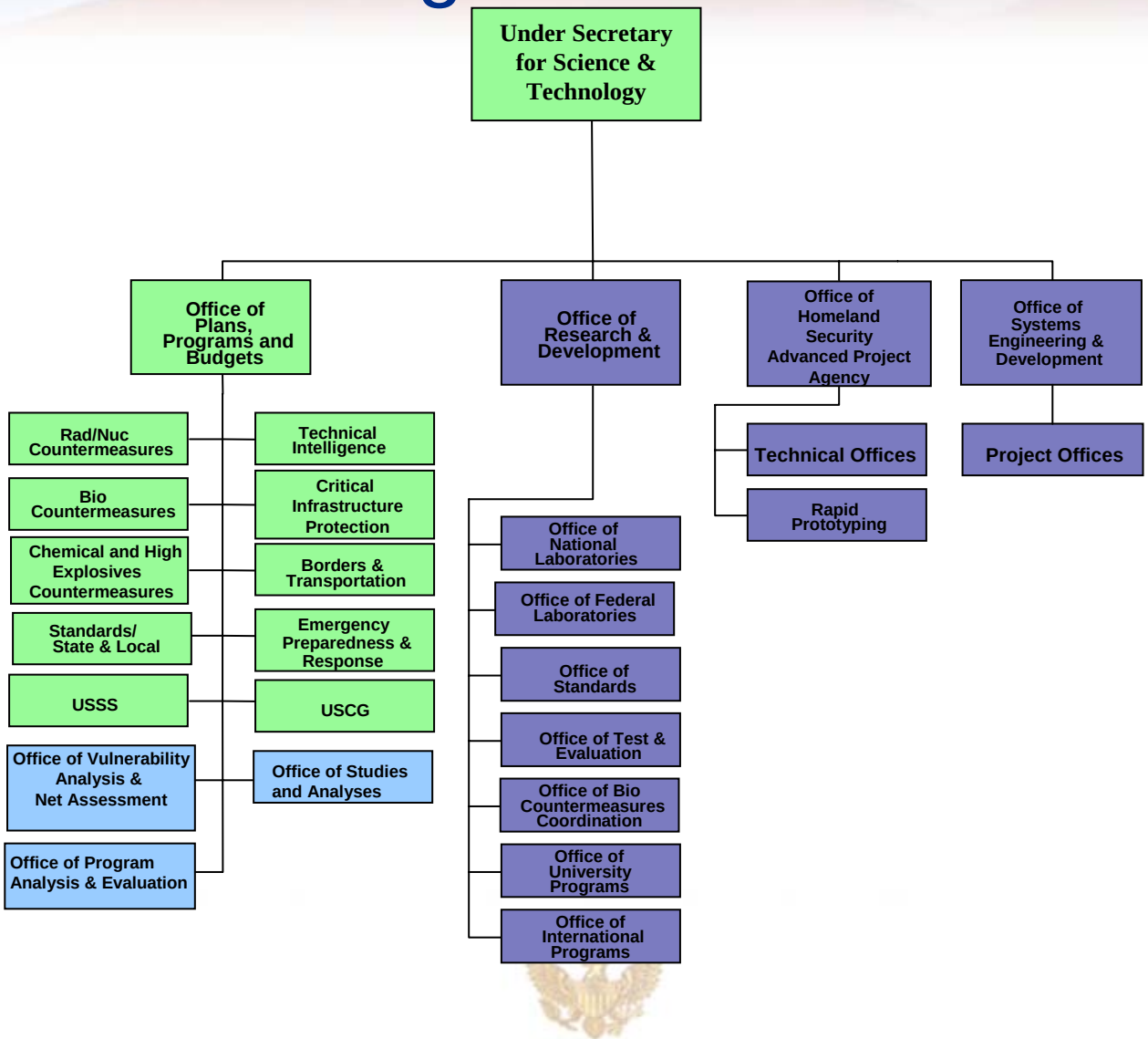
Science & Technology

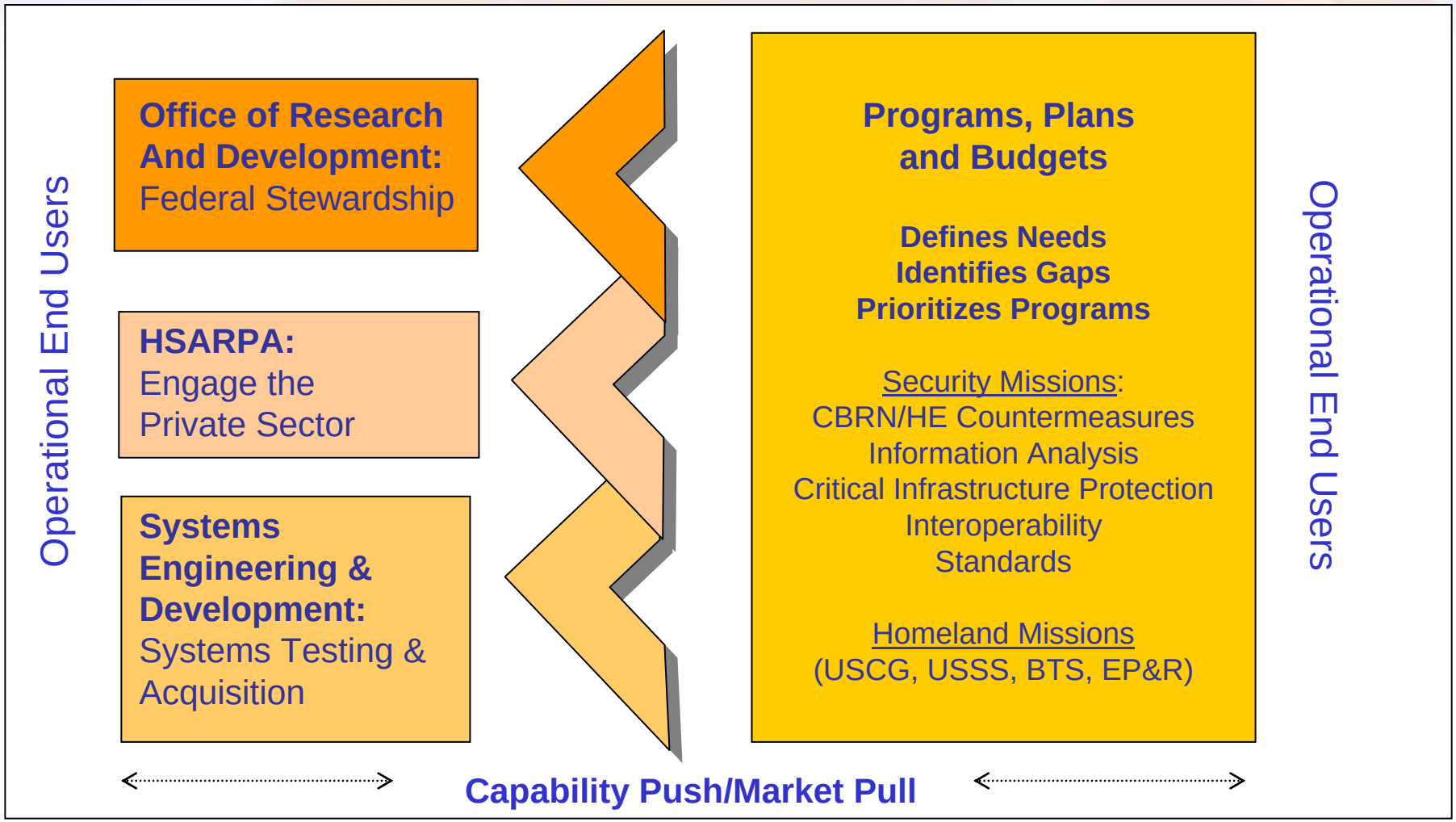
Border & Transportation Security

Emergency Preparedness & Emergency Response

Management

S & T Organization Chart



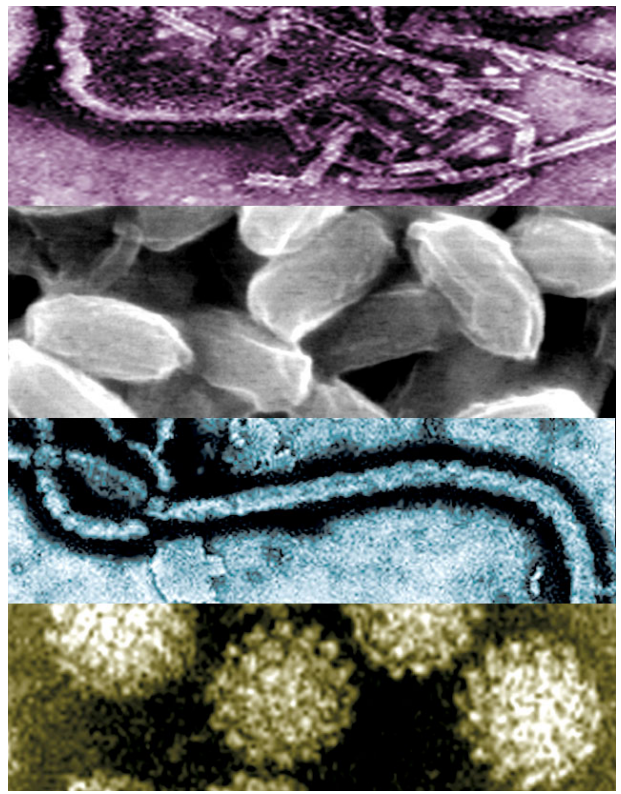

Operational End Users
Office of Research And Development: Federal Stewardship
HSARPA: Engage the Private Sector
Systems Engineering & Development: Systems Testing & Acquisition
Programs, Plans and Budgets
Defines Needs
Identifies Gaps
Prioritizes Programs
Security Missions:
CBRN/HE Countermeasures
Information Analysis
Critical Infrastructure Protection
Interoperability
Standards
Homeland Missions
(USCG, USSS, BTS, EP&R)
Operational End Users
Capability Push/Market Pull

S&T Research Agenda

- **Bio-Countermeasures**
- **Chemical Countermeasures**
- **Radiological and Nuclear Countermeasures**
- **High Explosives**
- **Standards**
- **SAFECOM**
- **Threat and Vulnerability, Testing and Assessment**
- **Critical Infrastructure Protection**
- **Homeland Missions**

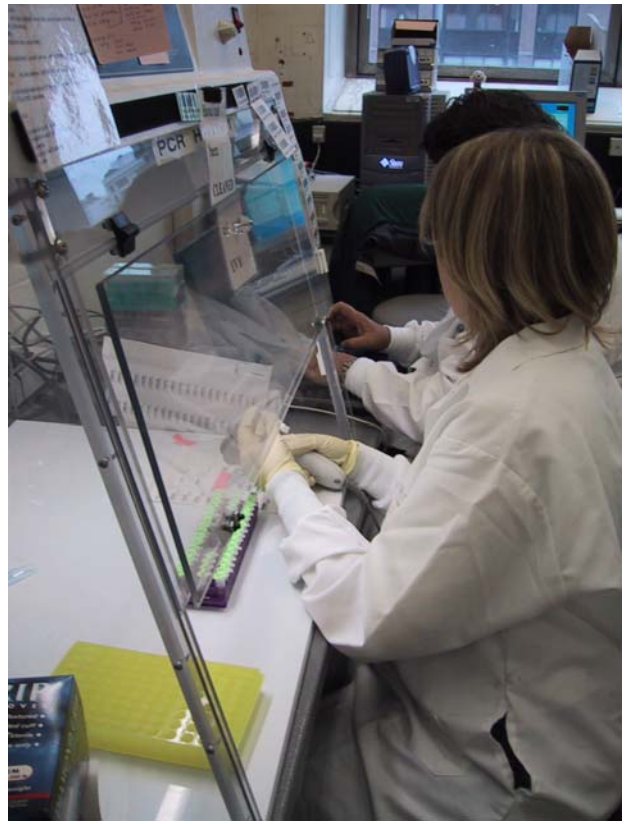
Bio-Countermeasures

- **Urban monitoring including BioWatch**
- **Detection technologies**
- **Decontamination and restoration**
- **Forensics and attribution**
- **National agro-bioterrorism strategy**



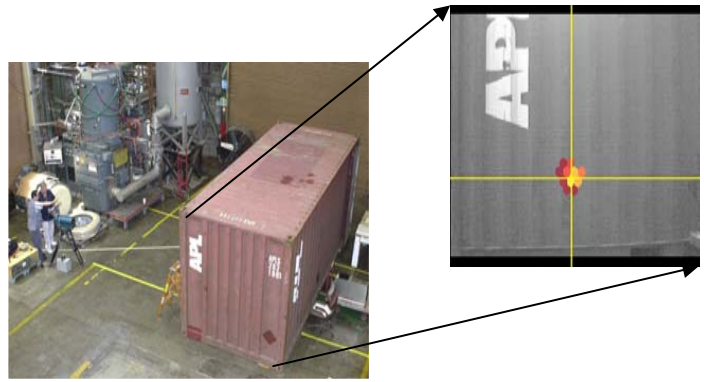
Chemical Countermeasures

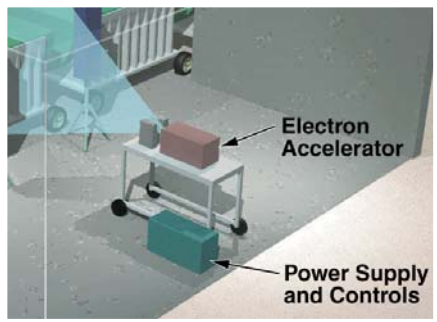
- **Key characteristics sought**
  - **Rapid response**
  - **Low false alarm rates**
  - **Wide area releases**
- **Facility protection**
- **Chemical characterization and detection**
- **Response and restoration**



Rad/Nuc Countermeasures

- Nuclear smuggling assessment
- Defeat surreptitious intrusion
- Detectors and sensors
  - –Materials advances
  - –Prototype pilot demos
  - –Sensor network applications
  - –Collective analysis of multiple sensor data
- Attribution
- Active interrogation
- Passive detection improvements (COTs and new technologies)





High Explosives Countermeasures

- **Detectors**
  - –Next generation – bulk, trace, combination
  - –Repackaging COTS for new purposes
  - –Novel technologies – stand-off and imaging technologies
- **Systems Approach**
  - –Different suites for different applications
  - –Hardening aircraft
  - –Hardening fixed facilities
- **Applications**
  - –Civil aviation
  - –Other transportation modes
  - –Bridges and tunnels
  - –Heavily populated areas

Standards

- **Matrixed support**
  - **SAFETY Act implementation**
  - **Detection and information exchange tools**
  - **Training and certification for first responders**
  - **Bio agent detection**
  - **Rad/nuc material detection**
  - **Consequence assessment and risk analysis**

SAFECOM

- **E-Gov program to help first responders achieve short-term interoperability and long-term compatibility in communications**
- **Coordinated national strategy and supporting architecture for interoperable communications**
- **Outreach to local, state and Federal public safety agencies**
- **Equipment reliability**

Threat Vulnerability Threat Assessment

- **Advancing intelligence and information analysis capabilities**
- **Biometrics**
- **WMD assessments**
- **Cyber security**
- **Advanced scientific computing**
- **Mapping and warning systems R&D**
- **Behavioral research**

Critical Infrastructure Protection

- **Self-correcting systems**
- **Self-defending systems**
- **Automated response platforms**
- **Video motion detection**
- **Multi-sensor warning systems**
- **Defeat insider adversaries**

Homeland Missions

National security special events

Protectees and facilities

Hardening targets

Investigation and apprehension

U.S. Secret Service

Smuggled contraband

Next generation non-intrusive inspection systems

Interoperable communications

Border and Transportation Security

Safe Cities

Command and control

Personal protection for first responders

Emergency Preparedness and Response

Maritime traffic and navigation

Detection technologies

Wide-area surveillance

Ballast water verification

U.S. Coast Guard

An effective deterrent against CBRN threats is key to the success of the Department of Homeland Security

An effective deterrent requires:

Detection **Intel Analysis** **Response** **Preparedness**

Layered defense providing barriers and impediments through effective *detection* at our borders and within our infrastructure

Integrate a broad range of data for analysis enhancing our national ability to *interdict* through conventional Intel and law enforcement means

Robust response capable of rapid identification, search, and neutralization to *deny the intent* of potential terrorist events

Provide technologies and trained personnel to *minimize* the medical and environmental consequences

Objectives of the EP&R Portfolio

- **Enhance mission of all EPR operational units through targeted RDT&E and systems engineering and development**
- **Provide S&T capability and technologies to enhance the situational awareness and emergency operations missions**
- **Partner with operational end-users to identify requirements, develop and field capabilities to counter threats and enhance mission operations**
- **Provide scientific underpinnings for public readiness and state, local, and federal emergency responders training & education programs with respect to CBRN and other emerging threats**

Support from Modeling and Simulation

M&S Objective for Emergency Preparedness and Response:

A system of interoperable, versatile modeling, using real time inputs, integrated with simulation capabilities to inform the emergency preparedness, response and recovery activities, in operations, training or exercises, and demonstrate consequences of decisions.

A system of interoperable, versatile modeling, using real time inputs, integrated with simulation capabilities to inform the emergency preparedness, response and recovery activities, in operations, training or exercises, and demonstrate consequences of decisions.

System

- **Interface with multiple models for multiple events**
- **Interface of simulations from different levels**
- **Multiple sources of data with different formats**
- **Compatible with end-to-end studies**
- **Guide sensor location**

A system of interoperable, versatile modeling, using real time inputs, integrated with simulation capabilities to inform the emergency preparedness, response and recovery activities, in operations, training or exercises, and demonstrate consequences of decisions.

Interoperable, Versatile Modeling

- **Ability to model for various environments**
- **Ability to characterize the incident with modeling**
- **Pattern recognition**
- **Multiple scales**
- **Can digest data from multiple formats**

A system of interoperable, versatile modeling, using real time inputs, integrated with simulation capabilities to inform the emergency preparedness, response and recovery activities, in operations, training or exercises, and demonstrate consequences of decisions.

Real-Time Inputs

- **Realistic situational awareness is dependent upon modeling using current data from observation networks**
- **Ability to quickly mine for meteorological and environmental data**
- **Limitations and uncertainties of modeling because of data need to be quantified**

A system of interoperable, versatile modeling, using real time inputs, integrated with simulation capabilities to inform the emergency preparedness, response and recovery activities, in operations, training or exercises, and demonstrate consequences of decisions.

Integrated with Simulation Capabilities

- **Simulations must be customizable/adaptable to different jurisdictions and scalable**
- **Must allow for multi-dimensional inputs from various users**
- **Must be seamlessly integrated with modeling**
- **Should be able to generate scenarios**

A system of interoperable, versatile modeling, using real time inputs, integrated with simulation capabilities to inform the emergency preparedness, response and recovery activities, in operations, training or exercises, and demonstrate consequences of decisions.

Integrated with Simulation Capabilities (cont.)

- **Limited time and resources to conduct field exercises in required quantity or the complexity needed for training decision makers**
- **Lack of effective mechanisms for simulating inter-agency coordination**

A system of interoperable, versatile modeling, using real time inputs, integrated with simulation capabilities to inform the emergency preparedness, response and recovery activities, in operations, training or exercises, and demonstrate consequences of decisions.

To Inform

- **M&S outputs must be geared toward decision makers**
- **Systems must be interoperable to maximize the common operating picture vertically and horizontally**
- **Outputs must be complete**

A system of interoperable, versatile modeling, using real time inputs, integrated with simulation capabilities to inform the emergency preparedness, response and recovery activities, in operations, training or exercises, and demonstrate consequences of decisions.

Consequences of Decisions

- **“What if” scenarios at critical nodes**
- **See impacts on others’ decisions**
- **Cascading effects**

EP&R Portfolio
Technology Integration at the system level

- **Examine the "system" at an operational level**
  - **Effectiveness**
  - **Human interface**
  - **Operation & Maintenance**
  - **Training**
  - **Regional vs. local**

- **Allows full-system evaluation**
  - **Avoid developing stovepipes**
  - **Exploit available synergies among technologies**

- **Assist the transition of DHS-developed technologies**

Conclusion

Validation!