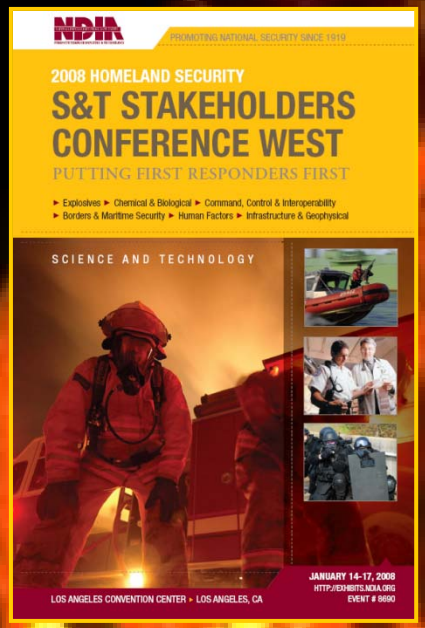

Chemical and Biological Division

Angela M. Ervin, Ph.D.
Program Manager
Chem Bio R&D Branch
Science and Technology Directorate
Department of Homeland Security

"Putting First Responders First"

Homeland Security
Science & Technology

Outline

- DHS S&T CBD Mission and Requirements
- Chemical Thrust Programs
- Current Projects
- Past Successes
- Future Project
- SBIR Projects
- Summary

Homeland Security

Chemical and Biological Division Overview

Mission: To increase the Nation's preparedness against chemical and biological threats through improved threat awareness, advanced surveillance and detection, and protective countermeasures.

Key 5 year deliverables:

- Integrated CBRN risk assessments
- Anticipation of future & unconventional threats
- Chemical infrastructure risk assessment
- Fully automated Gen 3 BioWatch
- Integrated CBRN facility protection
- National lead for operational biological and chemical forensics
- Decision tools and veterinary countermeasures for Foreign Animal Diseases (FADs)

Current BioWatch collects air samples & analyzes them in LRN lab

IPT Co-Chairs: OHA, IP
DHS Drivers: OHA, IP, I&A, CBP, NPPD, PLCY, DNDO, Interagency Gaps
End-Users: HSC, HHS, FBI, USDA, IC, EPA, local public health, critical facilities

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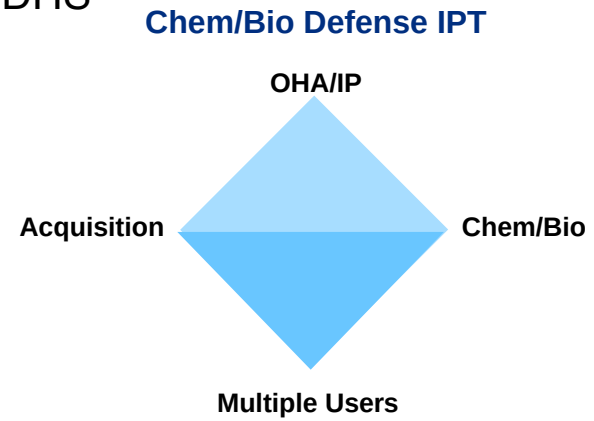
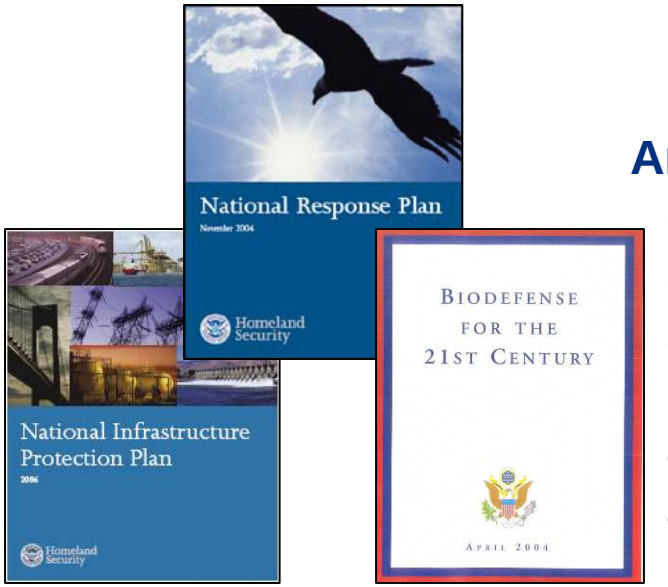
Where do our requirements come from?

Directly from a Capstone Integrated Product Team (IPT)

- Co-chaired by DHS Office of Health Affairs (OHA) and DHS Infrastructure Protection (IP)
- Membership from other DHS operational arms
- Identified 50+ Capability Gaps for 2007





And they in-turn, base their requirements on

- Homeland Security Presidential Directives – 10, 7, 9, 18
- Congressional legislation & guidance
- National planning & implementation guidance – NIPP, NRP, NIMS, and the National Planning Scenarios
- Risk, vulnerability and mitigation studies
- Private, local, state inputs

Homeland Security

CB Division Chemical Thrust

THRUST	PROGRAM	PROJECT	Program Manager
Chemical	**Analysis**	Chemical Threat Analysis and Assessment	Famini
		Chemical Infrastructure Risk Assessment	Famini
	Detection	Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM)	Ervin
		Lightweight Autonomous Chemical Identification System (LACIS)	Ervin
		Surface Detector for Analytes with Low Volatility (LVPCDS)	Bansleben
		Integrated Chemical, Biological, Nuclear, Radiological, Explosive System Demo	Lustig

E-mail: First Name.Last Name@dhs.gov

CB Division Chem Thrust (cont)

THRUST	PROGRAM	PROJECT	Program Manager
Chemical	**Response and Recovery**	Decontamination R&D	Bansleben
		Facility Restoration Demonstration	Bansleben
		Fixed Laboratory Response Capability	Bansleben
		Portable High Throughput Integrated Laboratory Identification System (PHILIS)	Bansleben

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Chemical Security Analysis Center (CSAC)
Program Objective

Mission: To provide analysis and scientific assessment of the chemical threat against the American homeland and American public.

Objectives:

- **Chemical threat awareness, assessment and analysis**
- **Integration and analysis of chemical threat information and data**
- **Reachback capability to provide expert analysis support**
- **Science-based risk assessment**

Payoffs:

- **Centralized repository of chemical threat data**
- **Comprehensive S&T based assessments of chemical threat materials**
- **Centralized reachback capability for chemical threat information**
- **A prioritized assessment of chemical threats to provide guidance to Interagency activities**

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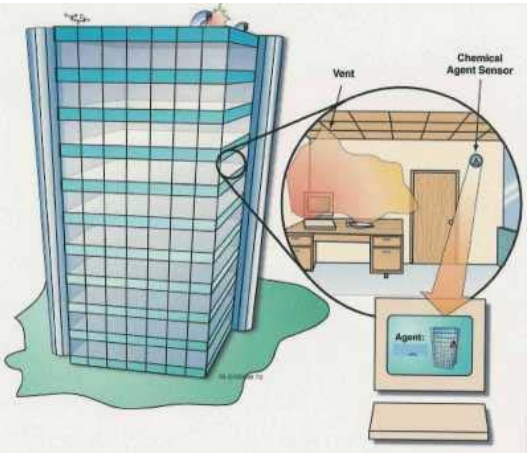
Program Manager: George Famini

Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM)



Objective: Develop, demonstrate, and commercialize a networked capability to continuously (24/7/365) and autonomously detect and identify, presence of a broad range of toxic chemical hazards for facility protection.

Challenges:

- *Selectivity* for target agents and against common backgrounds
- *Wide dynamic range*: IDLH to PEL
- *Speed:* target <1 min (IDLH)/15 min (PEL)
- *System cost:* $1,000/10k units

Schedule:

- FY04: Initiated program
- FY05: Down-select for lab prototype
- FY07: Down-select for "field" prototype
- FY08: Complete "field" prototypes
- FY09: Complete field testing, IT&E
- FY10: Down-select for "operational" prototype
- FY11: Complete OT&E, transition

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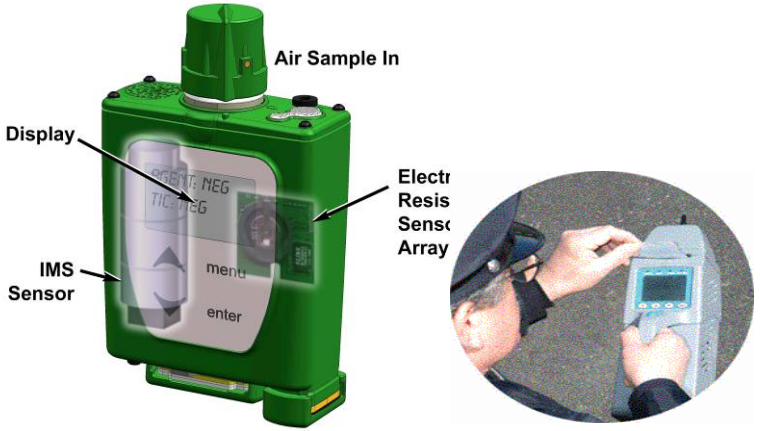
Program Manager: Angela Ervin

Lightweight Autonomous Chemical Identification System (LACIS)

Objective: Develop, demonstrate, and commercialize a networked responder capability to detect and identify a broad range of toxic chemical hazards to assess a scene for contamination and provide guidance on PPE use.



Challenges:

- *Selectivity* for target agents and against common backgrounds
- *Wide dynamic range:* IDLH to LOD
- *Speed:* ≤ 10 min warm-up
  ≤ 2 min response (IDLH & LOD)
- *System cost:* $2,000/10k units

Schedule:

- FY04: Initiated program
- FY05: Down-select for lab prototype
- FY07: Down-select for "field" prototype
- FY08: Complete "field" prototypes
- FY09: Complete field testing, IT&E
- FY10: Down-select for "operational" prototype
- FY11: Complete OT&E, transition

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Program Manager: Angela Ervin

TIC List for Prototype Testing

TIC	CAS No.	IDLH (mg/m^3)*	PEL (mg/m^3)**
Hydrogen cyanide (AC)	74-90-8	55.27	11.05
Cyanogen chloride (CK)***	506-77-4	50	0.6
Chlorine (gas)	7782-50-5	29	2.9
Ammonia	7664-41-7	208.96	34.83
Ethylene oxide	75-21-8	1441.41	1.8
Arsine	7784-42-1	9.56	0.2
Formaldehyde	50-00-0	24.56	0.92
Acrolein	107-02-8	4.59	0.23
Acrylonitrile	107-13-1	184.47	4.34
Phosgene	75-44-5	8.09	0.4
Sulfur dioxide	7446-09-5	262	13
Hydrochloric acid	7664-93-9	74.5	7

Documentation for Concentrations:
* NIOSH Chemical Listing and Documentation of Revised IDLH Values
** NIOSH Pocket Guide to Chemical Hazards
*** Extrapolated and estimated from AC data

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Program Manager: Angela Ervin

CWAs and Interferents for Prototype Testing

CWA	CAS No.	IDLH (mg/m^2)	PEL (mg/m^2)
Sarin (GB)	107-44-8	0.1	$3x10^{-5}$
Tabun (GA)	77-81-6	0.1	$3x10^{-5}$
Nerve Agent (VX)	50782-69-9	0.003	$1x10^{-6}$
Sulfur Mustard (HD)	505-60-2	0.7	0.0004
Lewisite (L)	541-25-3	0.23*	0.003

* AEGL 2 value at 30 min., www.epa.gov/oppt/aegl/chemlist.htm

LACIS Phase II Interferents
Diesel Exhaust
Second Hand Smoke
Aqueous Film-Forming Foam (AFFF)
Gasoline (87 octane) exhaust

ARFCAM Phase II Interferents
Zep Perimeter Floor Stripper
Windex
Clorox Bleach
Diesel Exhaust
Paint Fumes (Glidden America's Finest Interior Latex Flat Wall Paint - HM1224 White)

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Program Manager: Angela Ervin

Current ARFCAM and LACIS Technologies

ARFCAM	IMS	DMS	GC
Bruker Daltonics	✓		
Smiths – Watford	✓		✓
Hamilton Sundstrand	✓	✓	

IMS = Ion Mobility Spectrometry
DMS = Differential Mobility Spectrometry
GC = Gas Chromatography
MS = Mass Spectrometry

LACIS	IMS	Chemi-resistors	Metal Oxides	MS
SRD Corp			✓	
Smiths – Edgewood	✓	✓		
Purdue University				✓

Homeland Security

Program Manager: Angela Ervin

Low Vapor Pressure Chemical Detection Systems (LVPCDS) Project

LISA Manportable – ITT Industries
(Laser Interrogation of Surface Agents)

Program goal: Develop, field-test, and transition to commercialization existing state-of-the-art and next-generation systems that can detect toxic, low vapor pressure chemicals without contacting the contaminated surface.

Begin Phase II, development of a Fieldable Prototype - January 2008

Homeland Security

Program Manager: Donald Bansleben

LVPCDS Objectives and Payoffs

Capabilities

- Rapidly detect and identify persistent chemical compounds (vapor pressures ≤ 10^{-4} Torr) on a variety of surfaces
  - Include WMD and CBRNE threats
- Nominal stand-off working distance 3 meters from source without contacting the contaminated surface
  - Uses UV-Raman backscatter
- Manportable (<20 kg) detection system
- Few to no consumables – Battery operation for 1 hr (rechargable)

Payoffs

- Fill an existing gap in chemical countermeasures detection capabilities for emerging threat agents

Homeland Security

Program Manager: Don Bansleben

Integrated CBRN(E) Detection System

Background

- Seven US Senators letter to the Department of Homeland Security (DHS) "encouraging DHS to quickly move forward in ***developing and deploying a city-wide Weapons of Mass Destruction detection, alert, and emergency communications system***," and stating that there is a "critical need to deploy tested and reliable integrated sensor networks linked to high-volume alert systems."

- House and Senate legislation has tasked DHS' Science and Technology (S&T) Directorate to investigate the feasibility of integrating CBRNE countermeasure detection devices and systems to counteract all CBRNE threats within focused regional areas.

- Appropriations language required DHS D&T to integrate its maturing systems with other tools and to work with other departments that may have existing systems or relatively ***mature prototype systems***.

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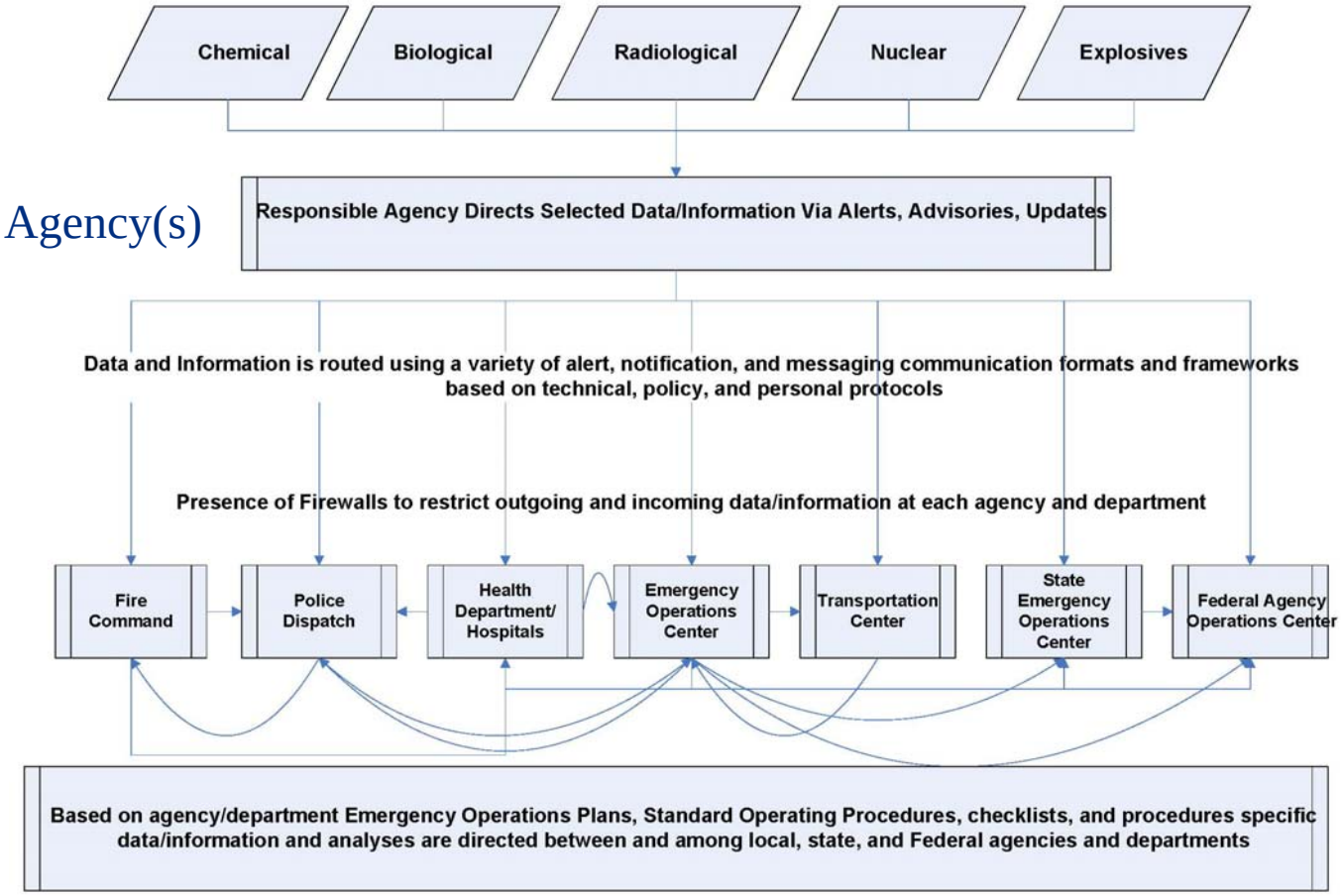
Program Manager: Teresa Lustig

CBRN(E) Data/Information Flow

Detectors

Data Sharing Agency(s)

Responding Agencies



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Phase I: Architecture Study

- Identify and investigate existing fielded CBRN(E) systems whose interface should be addressed
  - Seattle, Los Angeles, Chicago, New York & Boston
  - Accommodate detection systems outside of BioWatch, BWIC and PROTECT
- Review Concepts of Operations

Phase II: Phased City Pilots

- Develop prototype executable operating systems
  - command control software
  - communications
  - support for video
  - data transfer to respond through OPEN/IPAWS/NIEM/HAN
  - ***interoperability to other communication systems***
- Perform initial prototype execution testing of the reference implementation open architecture system software
  - focus on information brokering and alerting/situational awareness interfaces
  - provide methods to incorporate new families of detectors and information systems.

Homeland Security

Program Manager: Teresa Lustig

Benefits to Pilot Cities

1. ***Provide a process for electronic sharing of actionable CBRN(E) information*** through open architecture options and existing communication systems ***using information exchange standards***.

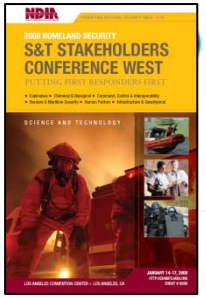
2. ***Integrate and leverage existing stand-alone CBRN(E) systems***.

3. ***Bundle CBRN(E) sensor/collector information*** onto an already supported infrastructure ***with cost savings and increased effectiveness***.

4. ***Enable city agencies to rapidly share decisions made in detection, crisis management, and response***, as well as utilize impact assessment tools and impact area videos.

5. ***Enable city agencies to easily share critical information*** using advanced communication standards-compliant software applications and standards-based messaging and protocols.

Facility Restoration Operational Technology Demonstration (OTD): Restoration of Major Transportation Facilities Following a Chemical Agent release



- Develop a systems approach to restoration of critical transportation facilities following a chemical agent release
  - Develop efficient planning tools
  - Identify sampling methods
  - Identify decontamination methods
  - Develop analysis tools
- Pre-plan the restoration process at a representative critical transportation facility – LAX (Partner Airport)
- Avoid delays inherent in Hart Building anthrax clean-up

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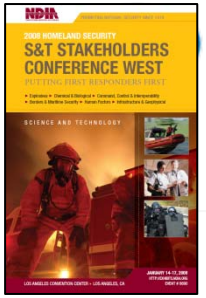
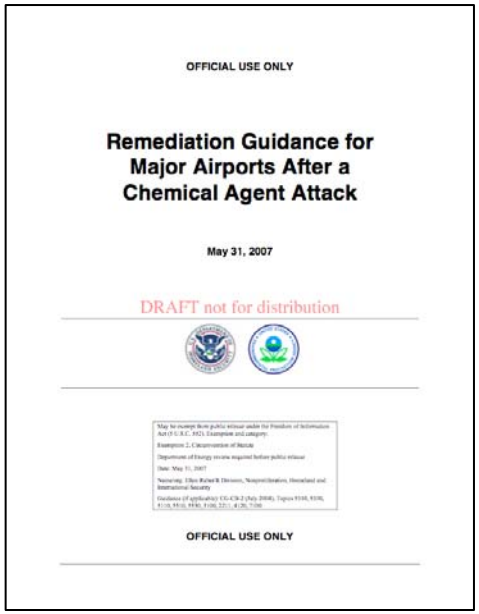
Program Manager: Don Bansleben

OTD will develop a template Restoration Guidance Document



Development of a site-specific remediation plan for LAX that forms basis of a generic remediation plan 'template' for use by other facilities



OFFICIAL USE ONLY

Remediation Guidance for Major Airports After a Chemical Agent Attack

May 31, 2007

DRAFT not for distribution

OFFICIAL USE ONLY

Draft guidance is currently under review by 13 Federal, State and local agencies

- The OTD 'pre-plans' the recovery process by developing a comprehensive remediation plan
  - All phases of the operation are examined
  - Reduce the time before restoration can begin
- Key issues can be addressed before an incident occurs
  - Capability gaps are identified/resolved
- Planning templates can speed the process and help all stakeholders better understand the issues
  - Identify necessary resources (personnel, equipment, and consumables)
  - Make key decisions (e.g., decon versus replacement, waste management)
  - Determine sampling protocols and methods
  - Obtain "buy-in" from stakeholders

A Remediation Plan must to able to handle multiple contamination scenarios

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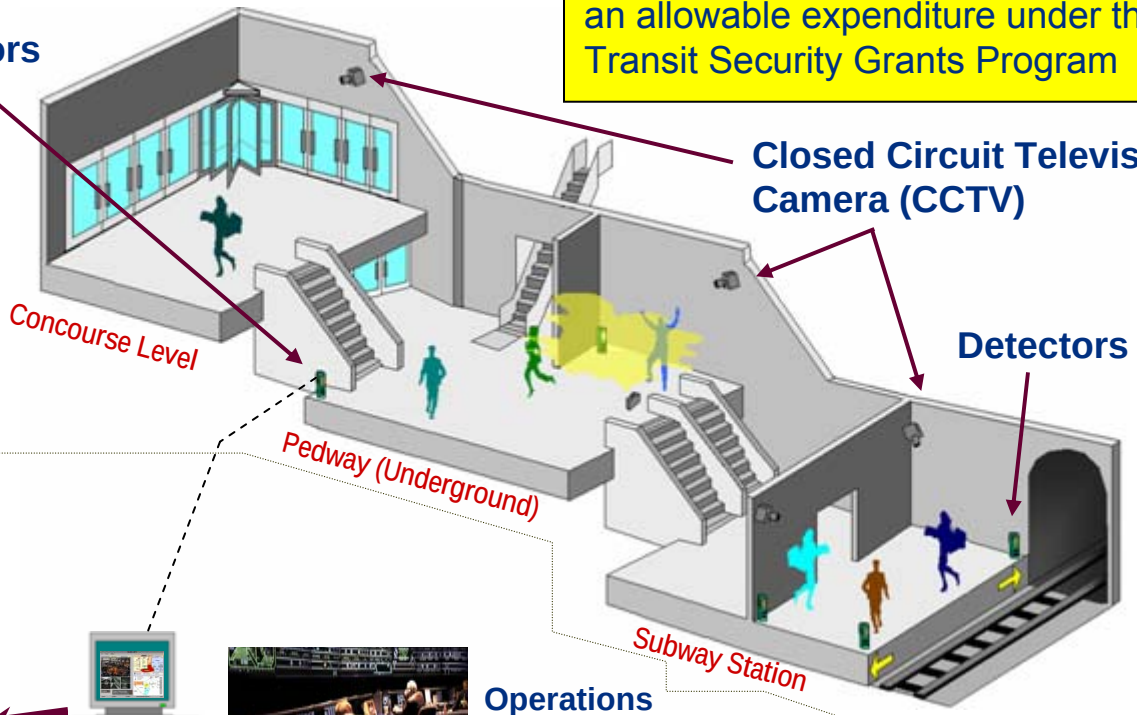
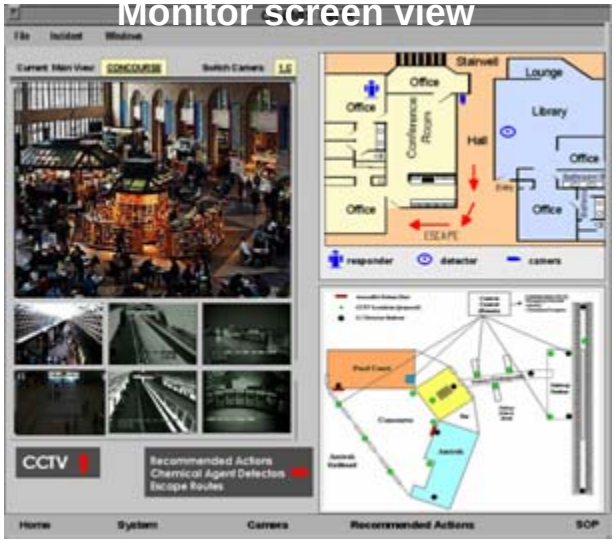
Program Manager: Don Bansleben

PROTECT: Chemical Early Warning System for Transit Systems

Demonstration completed 2003

This program has transitioned and is an allowable expenditure under the Transit Security Grants Program





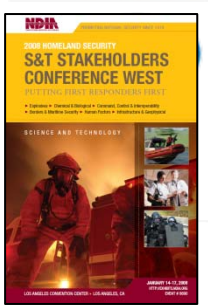
Fiber Optic Link

Operations Control Center (OCC)

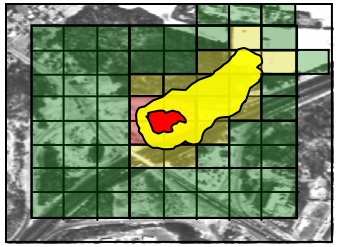
External Fireman Jacks

Homeland Security

Portable High-throughput Integrated Laboratory Identification System (PHILIS)



- Mobile lab system that can be rapidly deployed to the site of significant chemical event
- State-of-the-art analytical instrumentation to rapidly determine identity of chemical contaminants such as Toxic Industrial Chemicals (TICs) and Chemical Warfare Agents (CWAs)
- High-throughput capacity enables mapping of area to establish extent of contamination
- Capable of supporting site recovery and restoration following an event
- *Transitioned to EPA in 2007*



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Program Manager: Don Bansleben

Non-Intrusive Container Monitor

Provide rapid and efficient determination of the contents of suspicious containers in cargo or passing through security portals of various types.

Performance objectives

- Enhance security at portals within and at the perimeter of key infrastructure elements
- Promote the interception and confiscation of illicit materials by a variety of customs, law enforcement, and responder personnel

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FY09 Start Date

Small Business Innovation Research Program

- *The Small Business Innovation Research program (SBIR) Program was established by Congress in 1982. It funds early-stage R&D at small technology companies and is designed to:*

  - *Stimulate technological innovation*
  - *Increase private sector commercialization of federal R&D*
  - *Increase small business participation in federally funded R&D*
  - *Foster participation by minority and disadvantaged firms in technological innovation*

Three Phased Program

Phase I: Project feasibility	6 months up to $100,000
Phase II: Project development to prototype	2 years up to $750,000
Phase III: Commercialization	Commercialize, with non-SBIR funds, the technology in military and/or private sector markets

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Related Chem SBIR Projects

- SBIR 6.1 – 005: Human Detection for Cargo Shipping Containers
  - Phase I – Demonstrated the feasibility of the proposed concept to accurately and reliably detect humans within shipping containers.
  - Phase II – Design, develop, fabricate and test a prototype device.

Offerors	Proposed Concepts
Applied Nano Tech	Gated-metal oxide for CO_2 and O_2
Giner Inc.	Electrochemical for CO_2 and O_2

- SBIR 7.1 – 007: Improved Chemiresistor Sensing Arrays for Detection of Small Molecule Gases
  - Phase I – Provide a feasibility report describing the proposed analytical approach, based on a microarray sensor platform, that will compensate for current limitations, stabilize drift, and increase lifetime.

Offerors	Proposed Analytical Approach
Carbon Solutions Inc	Functionalized SWNTs
Next Dimension Tech Inc	Phthalocyanine-based polymers
NSC Technology	Nanostructured thin-film assemblies
Seacoast Science, Inc	QSPR-guided polymer development

- SBIR 7.2 – 006: Robust Algorithm Development for Multidimensional Chemical Analysis
  - Phase I awards under negotiation.

Homeland Security

Program Manager: Angela Ervin

In Summary

S&T Chem-Bio efforts are part of a national strategy as reflected through the requirements of the DHS operational offices

We have already made a difference with first generation systems, e.g.,

- Chem risk assessments to help prioritize national investments
- Developed and transitioned to operation bio and chem detection systems (BioWatch, PROTECT, RDCDS, PHILIS)
- Operational forensic capabilities
- Improved protocols and tools for protecting transportation facilities

We are currently developing the next generation tools & systems to meet DHS and National requirements

http://www.hsarpabaa.com

Homeland Security

Annual DHS Chem/Bio Conference

- 28 Jan – 01 Feb 08
- The St. Anthony – Wyndham Hotel, San Antonio, TX

http://www.wyndham.com/hotels/SATST/main.wnt

Emails: Carl.Newman@associates.dhs.gov and Robert.Plemons@associates.dhs.gov

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