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Topics in Homeland Security and Defense at Sandia National Laboratories

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29 January 2007

HOMELAND SECURITY & DEFENSE

Sandia National Laboratories

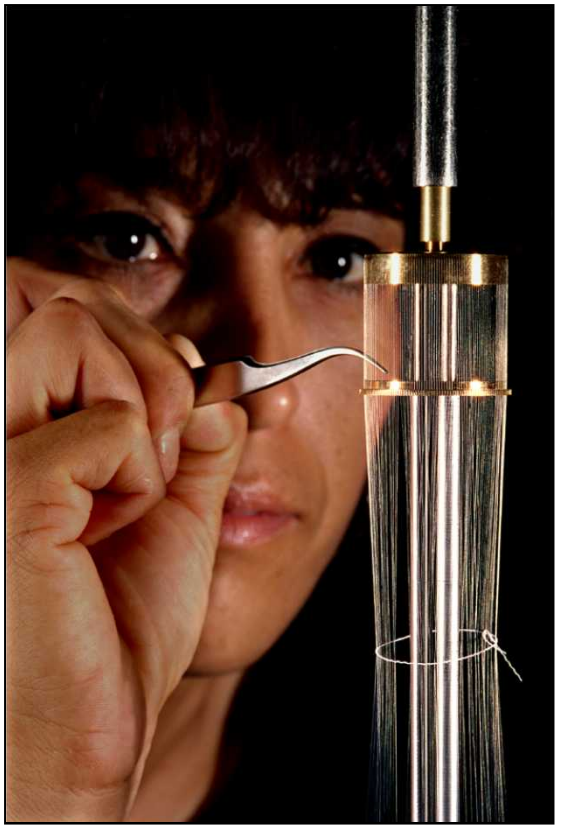
Outline

- **A few words about Sandia National Laboratories**
- **A broad description of our Homeland Security activities**
- **A broad overview of Chem/Bio National Security activities at Sandia**
- **Some specifics about the Rapidly Deployable Chemical Detection System (RDCDS)**

Our work is accomplished in collaboration with other DOE National Labs, many universities, other Federal labs, and commercial firms

Sandia is a DOE National Security Laboratory

- Our primary mission is nuclear weapons ordinance engineering
- We have large energy R&D programs
- We support major DOD program objectives
- We have growing programs in Homeland Security



Our contract is held by Lockheed Martin Corp

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Sandia has multiple sites with a unified program management system

- Albuquerque, NM
- Livermore, CA
- Tonopah, NV
- Amarillo, TX
- Carlsbad, NM
- Kauai, HI

The largest DOE lab
FY05 budget $2.4B
~12,000 people work at Sandia

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We develop and integrate advanced technologies and draw on the diverse expertise of our staff and partners to provide operational systems solutions

Chem/Bio National Security

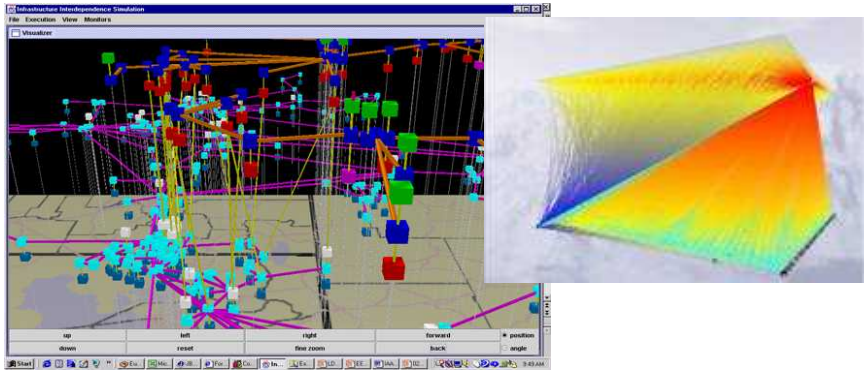
PROTECT/PROACT

Borders and Transportation Security

Operation Safe Commerce

Critical Infrastructure Protection

National Infrastructure Simulation and Analysis Center (NISAC)



Denial of service attack

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The Chem/Bio National Security Program draws on diverse Sandia capabilities

- Systems analysis
- Detection and detection systems
- Forensics and attribution
- Biological Countermeasures
- Biomedical R&D
- Decontamination & restoration
- Systems demonstrations and deployments

Sponsors:
DHS: S&T/CB
DOD: JSTO/CBD, JPEO/CBD, DARPA, DTRA
NIH, DOE, and other federal agencies

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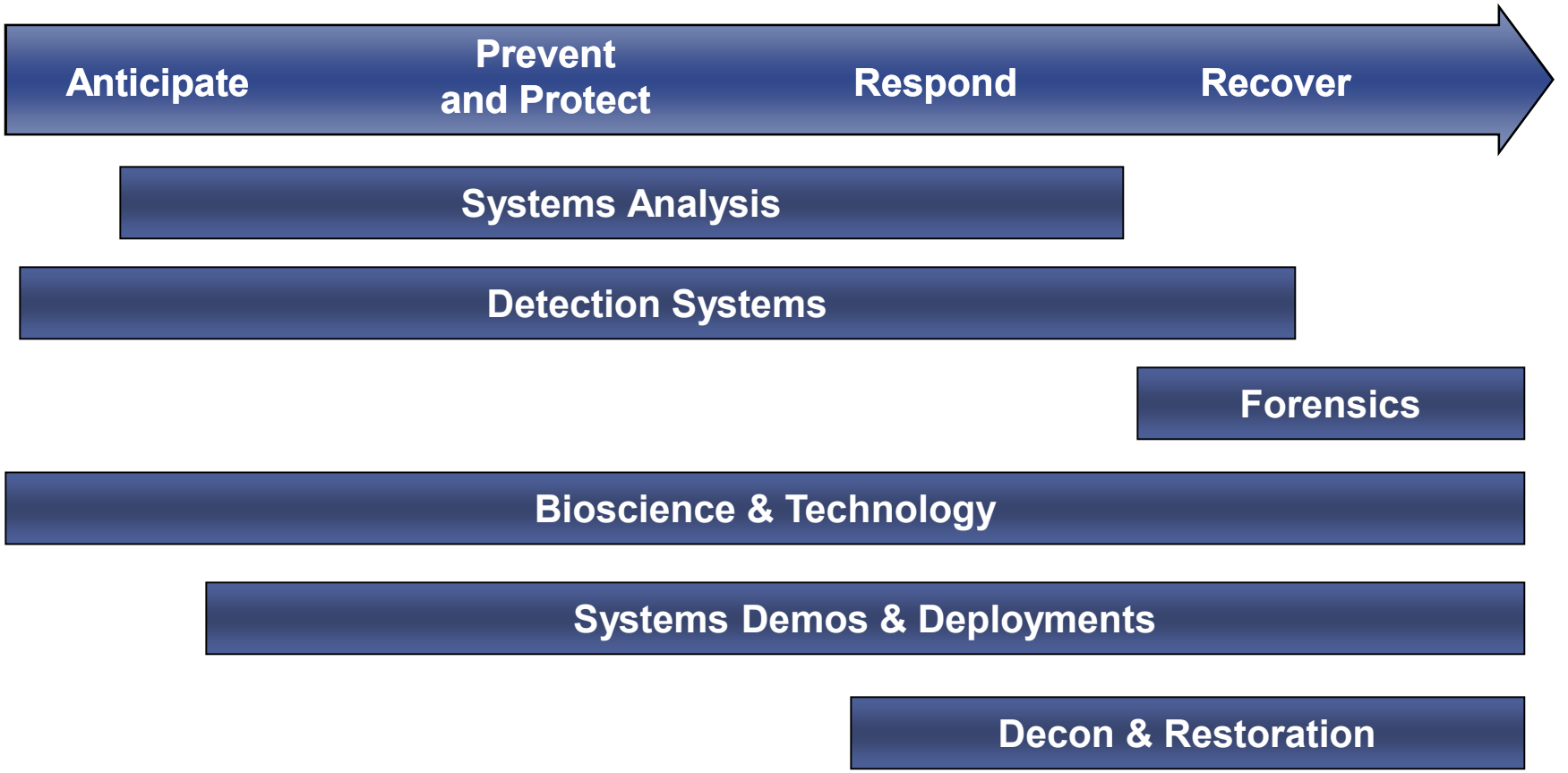
Our CB CM Activities Cover the Spectrum of Concern



Our activities range from directed research through development, prototyping, and test to commercialization or transition to government users.

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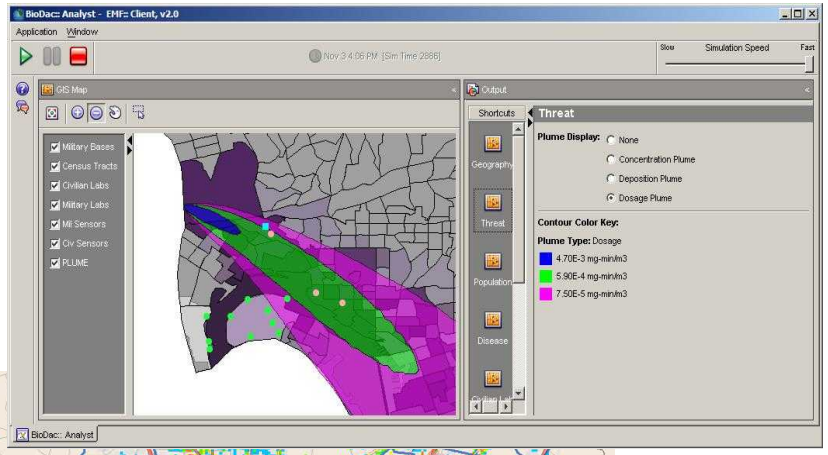
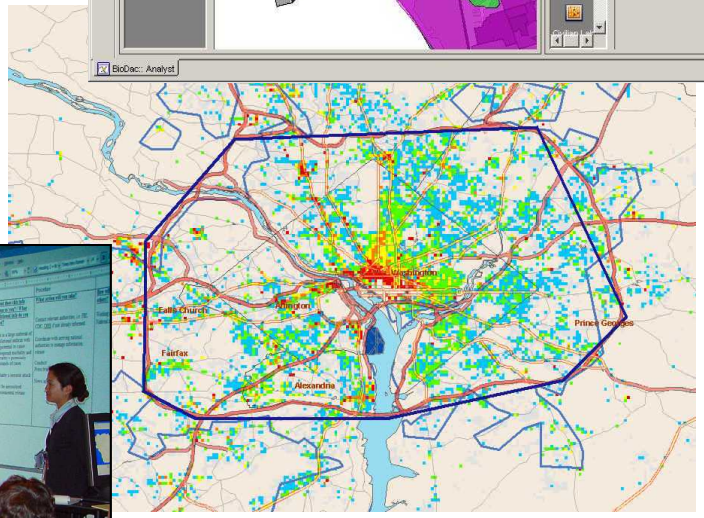
Systems analysis informs decisions, sets priorities, establishes requirements

- Urban Biodefense Architectures
- Weapons of Mass Destruction Decision Analysis Center (WMD DAC)
- Reference Scenarios
- Risk analysis
- Source term modeling





Biodefense system requirements & configurations

Urban warning and response system planning and evaluation

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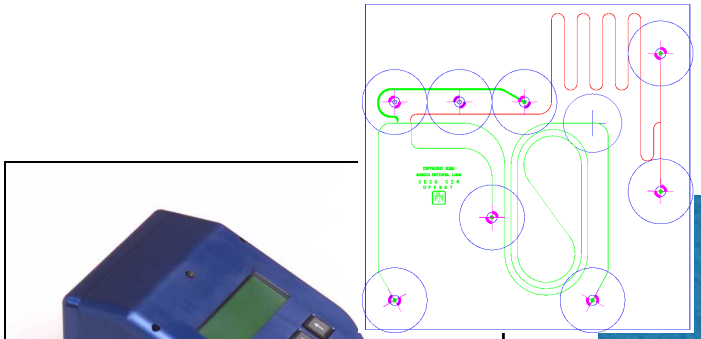
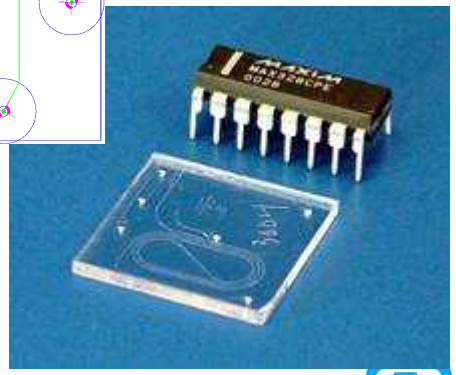
Rapid, accurate agent detection and identification is critical

- **Microanalytical Systems**
  - Chem & bio point identification
  - Handheld or autonomous
  - Agents and indicators
- **Microsensor systems**
  BioBriefcase
  - Next gen bio autonomous
- **Adv Bioaerosol**
  - Point biotrigger
- **Aura/ARES**
  - Standoff LIF detection
  - Bio signatures

Standoff biodetection





µanalytical systems

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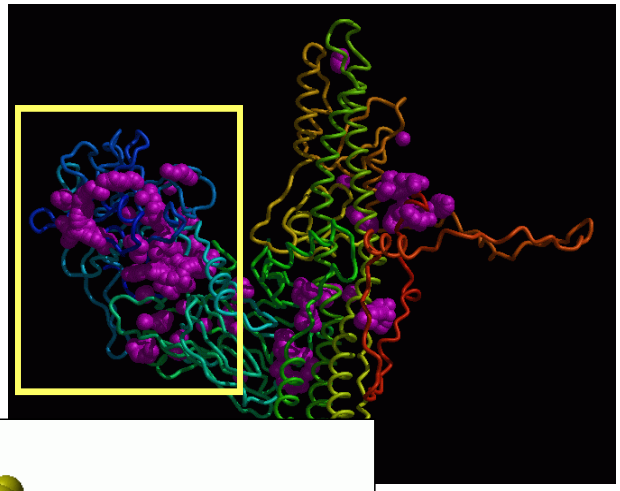
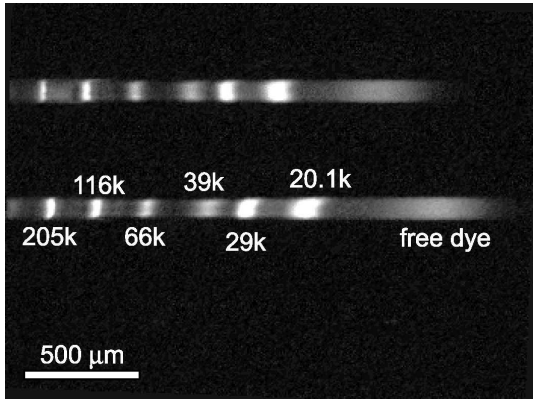
Our biotechnology projects emphasize improvements in countermeasures

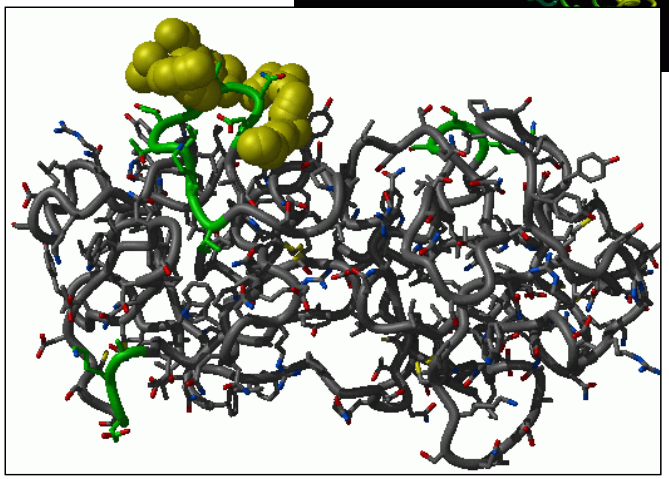
- Next generation biosignatures
  - Proteomics-based
  - Virulence markers
- Assay platform prototypes
- Dealing with the unknown threat
- Medical diagnostics
- Therapeutics
- Immune system activation & control

Identification and assessment of robust proteomic signatures



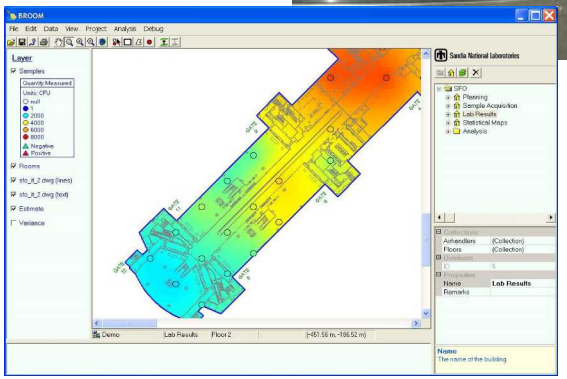


Biomarker analysis with µfluidic devices



Design of advanced assays and therapeutics

Decontamination & Restoration provide a systems approach to rapid recovery from an event



- Decon technologies: Sandia Decon Foam
  - Advanced formulations
  - Advanced applications
- Restoration Systems
  - Sampling and sample handling
  - Tools
  - Standards
  - From *Facilities to Cities and installations*

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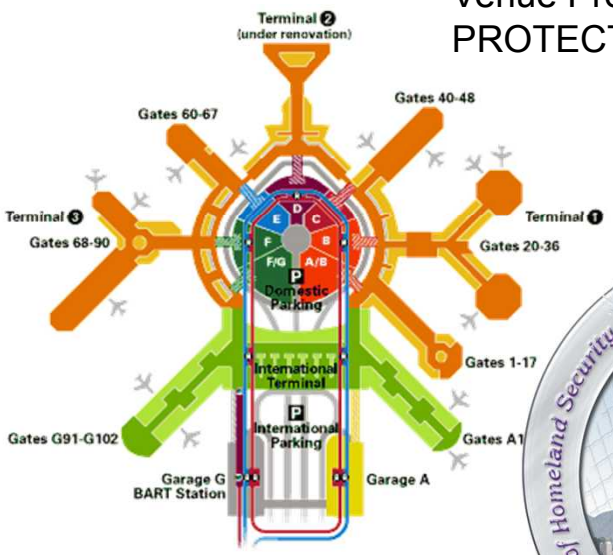
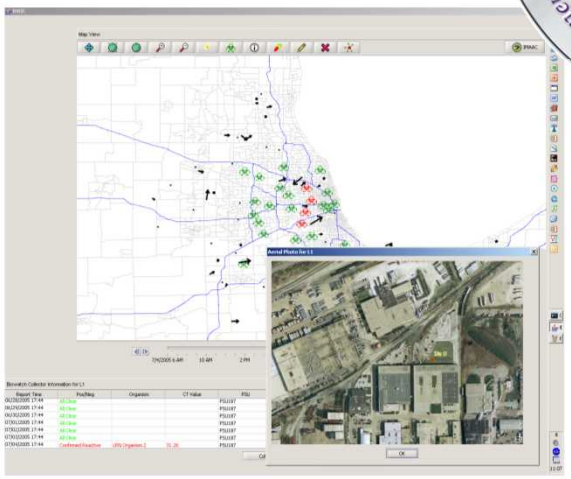
We are heavily involved in large system demonstrations and deployments

- **Our focus is on systems solutions**
- **End-to-end evaluations of systems in a variety of problem domains**
  - Warning systems
  - Response systems
  - Situational Awareness
  - Agriculture threats
- **Deep user involvement**
- **We provide deployable approaches**
  - "Spiral" developments

Venue Protection:
PROTECT/PROACT/etc



Integration of Civilian and Military capabilities and CONOPS



BWIC:
Urban
Situational
Awareness

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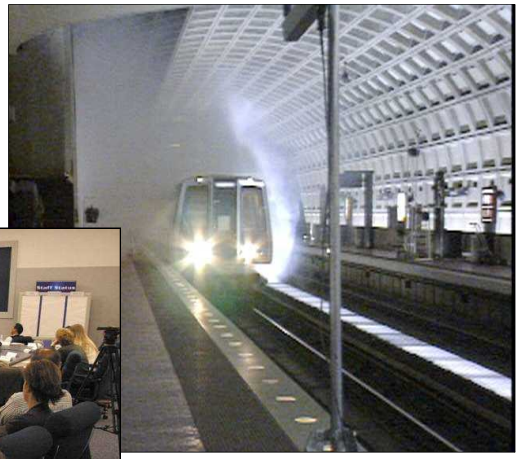
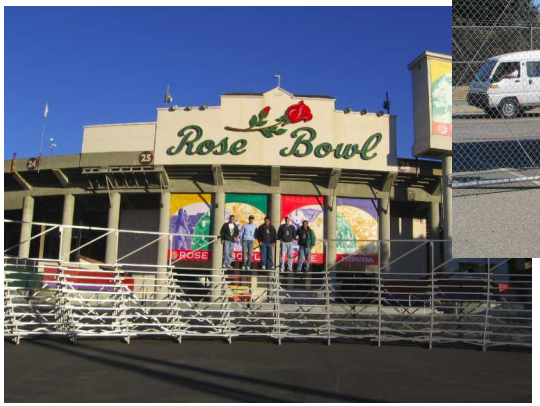
We are heavily involved in large system demonstrations and deployments

- **Facilities hardening and defense**
  - PROTECT
  - ProAct
  - BioWatch Extensions
  - DOE facilities
  - OFA facilities
- **Urban warning and response**
  - BioWatch
  - Biodefense Initiative
  - BioNet
  - BioWarning and Incident Characterization (BWIC)
- **Deployable detection systems**

Characterization & Hardening



Exercises



RDCDS

RDCDS: DHS Requirements

- **Detect target chemicals ≤ 1 min below IDLH***
- **Mitigate false alarms**
- **Operate autonomously for one week**
- **Weather-resistant**
- **Operational today for special events**

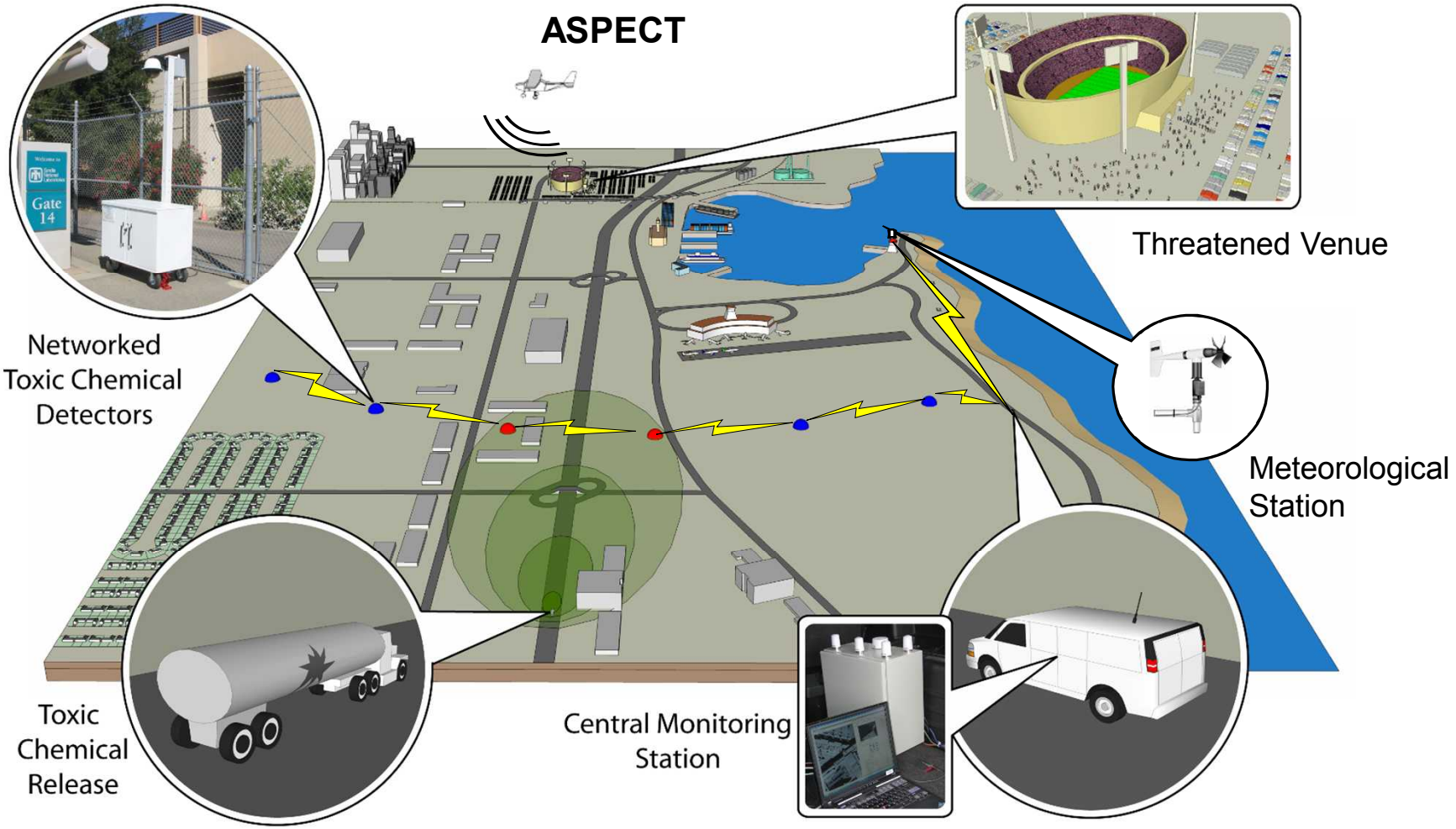
* ***Immediately Dangerous to Life and Health – 30 minutes to escape***

DHS List of Potential Threats

Acrolein	Parathion
Acrylonitrile	Nitric Acid
Ammonia	Phosgene
Arsine	Phosphine
Boron trifluoride	Phosphorus trichloride
Cyanogen Chloride	Sulfuric Acid
Diborane	GA (Tabun)
Hydrogen chloride	GB (Sarin)
Hydrogen cyanide	GD (Soman)
Hydrogen sulfide	HD (Mustard)
Methyl chloride	HN (Mustard)
Chlorine gas	GF
Methyl parathion	VX

RDCDS

Detect-to-Warn Chemical Detection



- Real-time plume prediction

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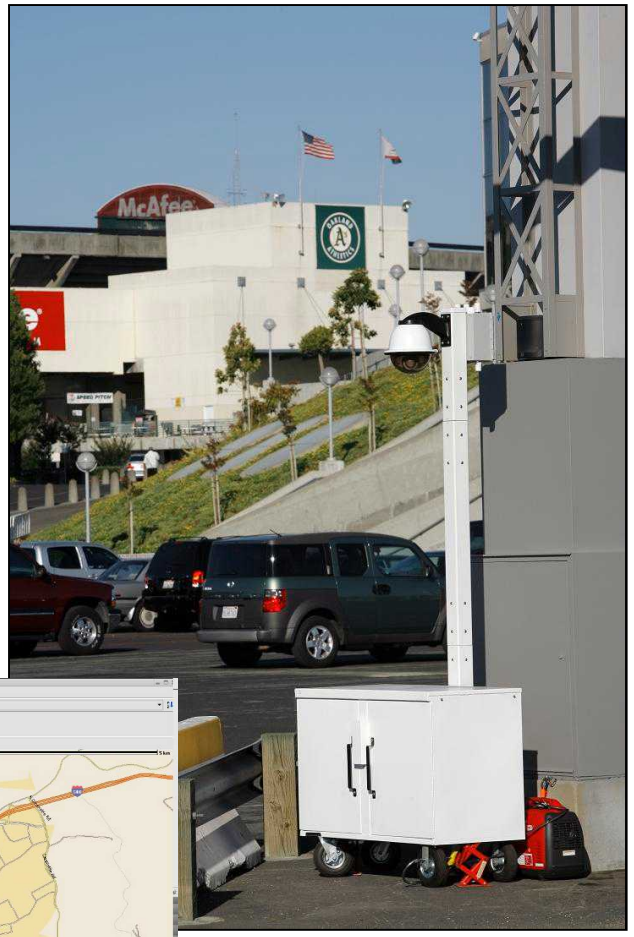
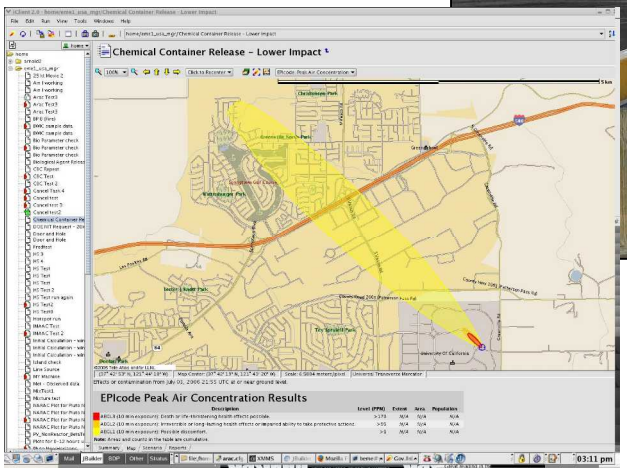
Overview

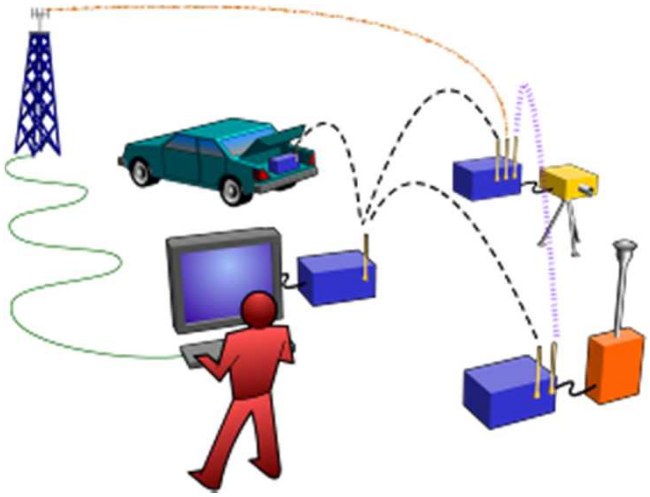
- Eight detector nodes, each with:
  - 8 chemical detectors (complimentary)
  - Live Video
  - Multiple communications channels
- Three meteorological stations and one sodar
- NARAC/iClient
  - Plume projection tool





Integrated Sensor Management (ISM) provides reliable communications

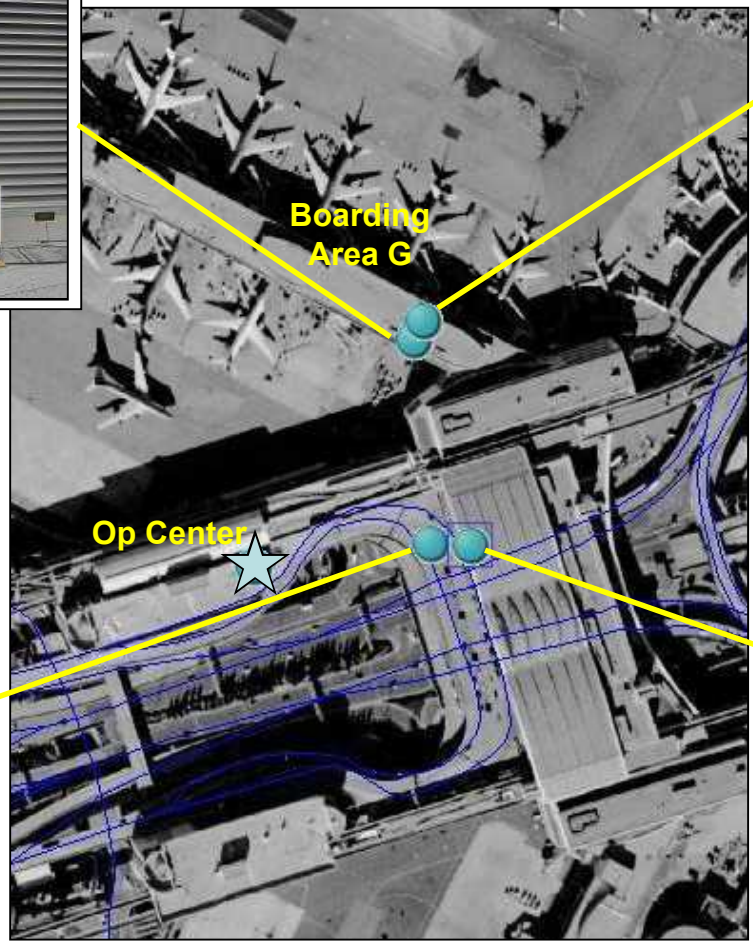
- **Peer-to-peer ad-hoc network infrastructure**
- **Redundant communication paths guarantee message delivery**
  - Ethernet, 802.11x,
  - Freewave Spread Spectrum RF
  - CDMA 1xRTT
- **Secure, role-based system access**



SFO 6-Day Testing of SNIFFER Prototype

Jan 2005

HVAC
INTAKE



HVAC
RECYCLE

Passenger Drop-off

Ticketing

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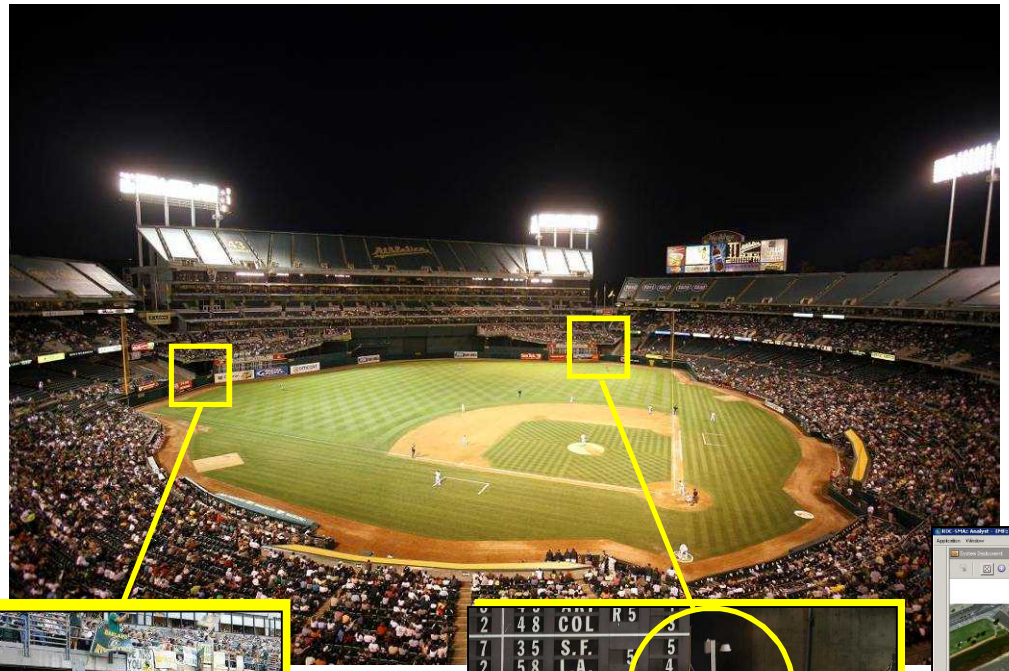
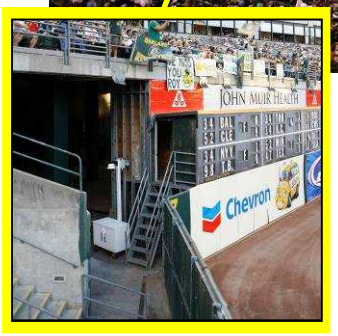
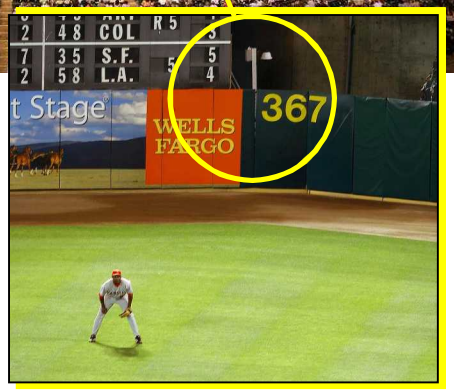
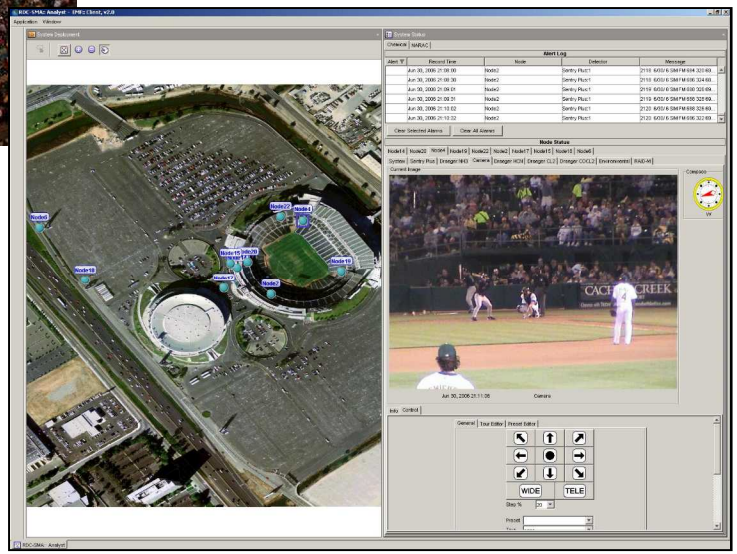
McAfee Coliseum Testing – July 2006









Goals

- Address and resolve operational issues
- Determine effect of interferents associated with venue-class

- Packed in 3 hrs
- Set-up in 7 hrs
- Operated by 2-person team

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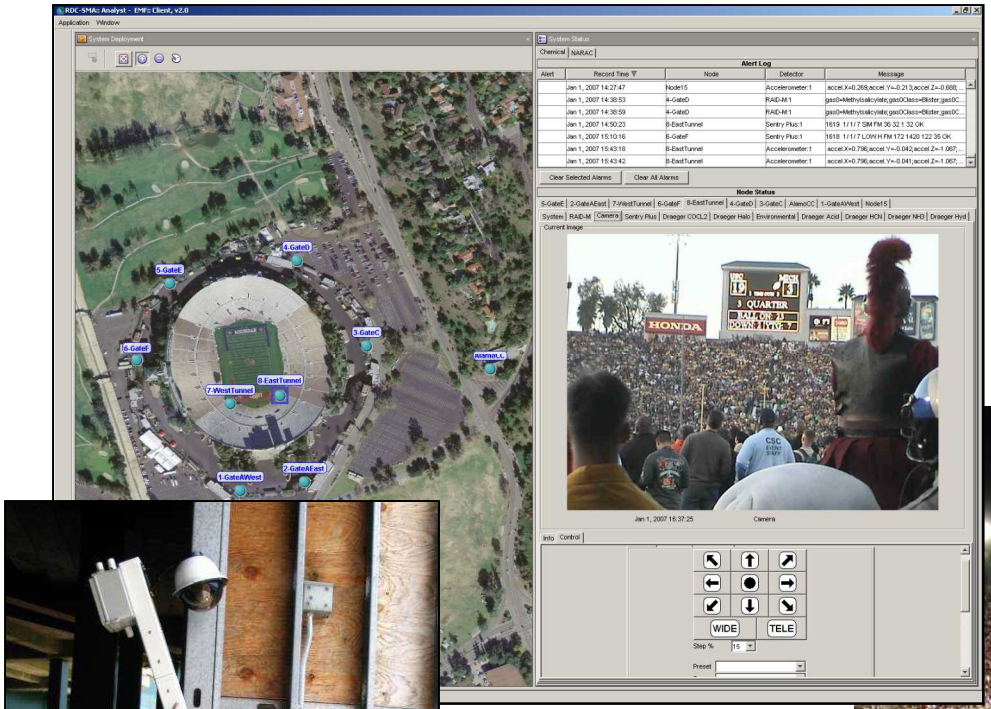
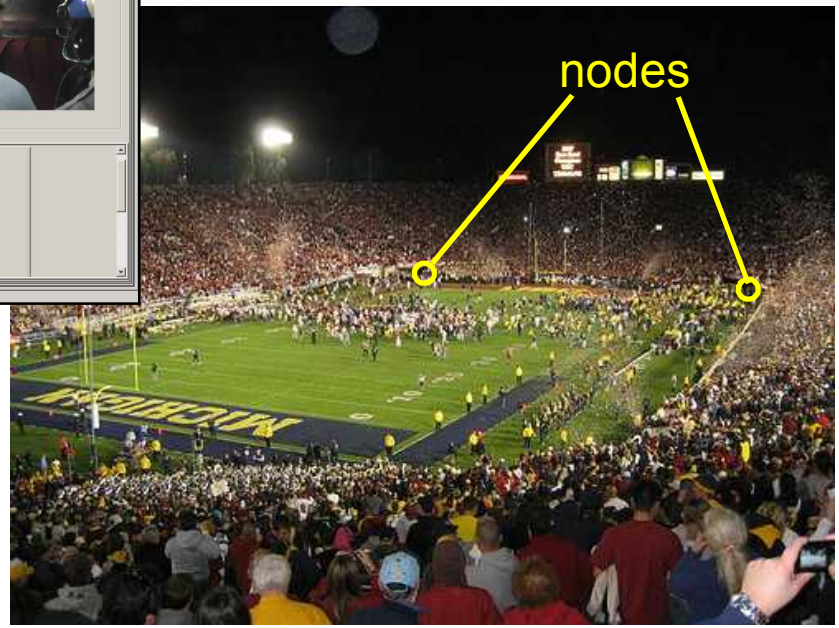
Testing against Chemical Releases (Aug 2006)

- **System performance confirmed**
- **59 releases (6 different chemicals)**
  - 1 to 15 kg/hr
  - Chemical warfare agent surrogates
  - Toxic industrial chemicals (Cl_2 and NH_3)
- **Chemicals detected within 30 seconds**

Most Recent Deployment:
Rose Bowl 2007 in Pasadena, CA





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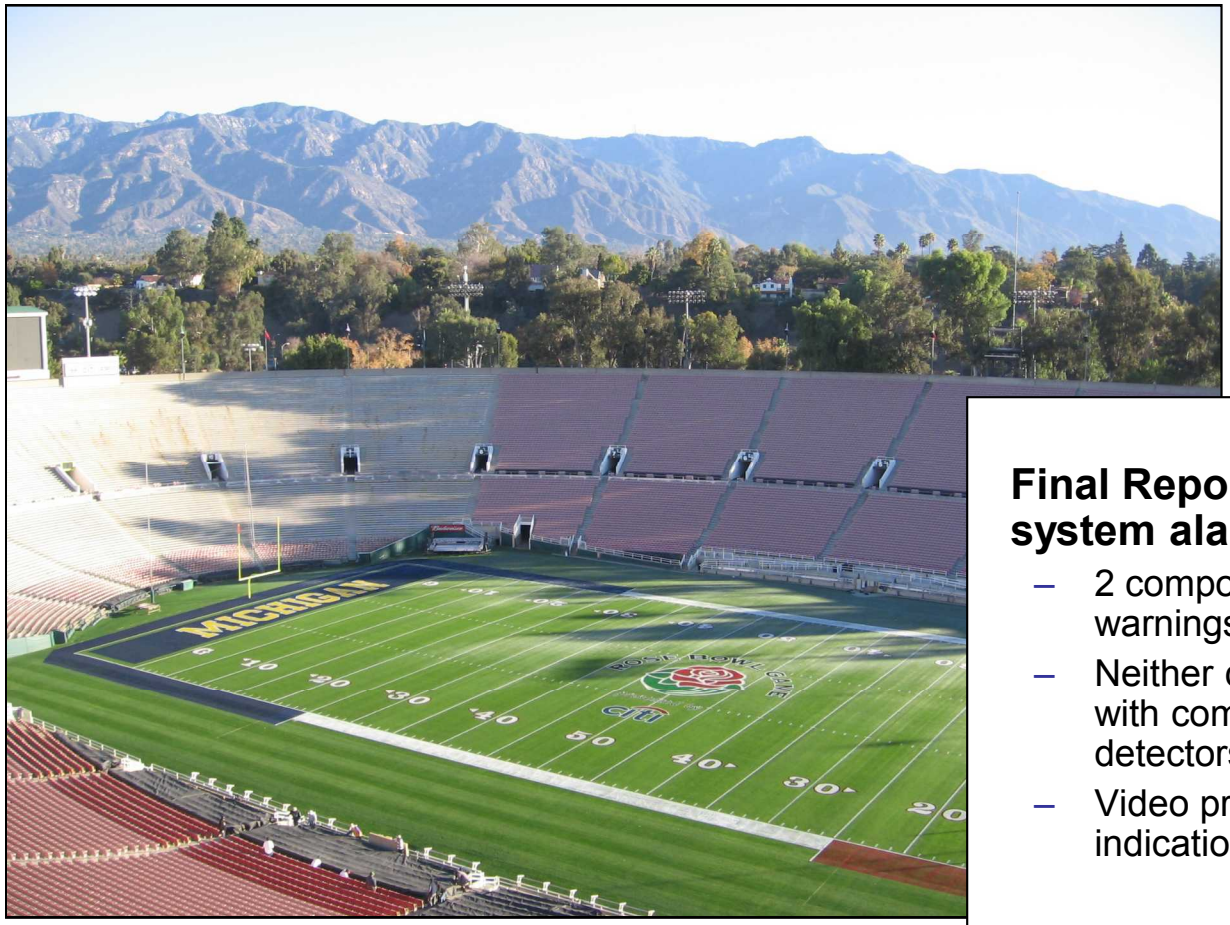
Rose Bowl 2007 – New Years Day



Final Report – No system alarms

- 2 component warnings
- Neither confirmed with complementary detectors
- Video provided no indications

The System is Now an Operational DHS Asset

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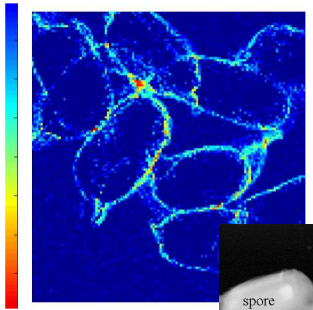
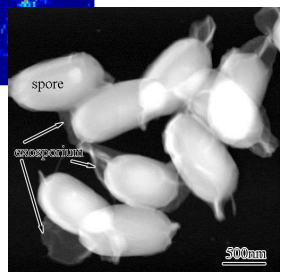
For everything we do, the objective is development and demonstration of operational capabilities

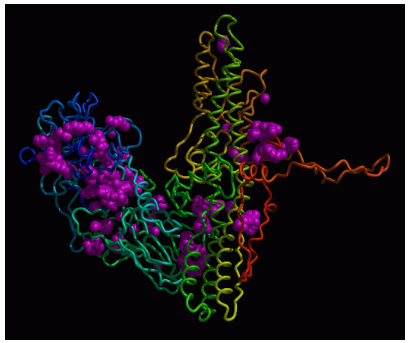
Decon Technologies and systems





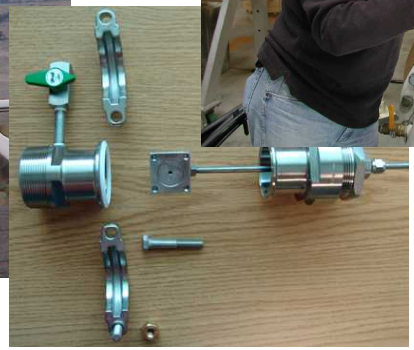
Bioforensics methods & protocols

Sensor systems



Public Health Actionable Assays

Validated Sampling Procedures



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