

RADIATION DETECTION AND NUCLEAR INTERDICTION

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BACKGROUND



- No longer “business as usual”
- Federal, State, City and NGOs mostly focused on consequence management
- BNL GOAL - Strategy, technologies, and systems for interdiction for NY Metropolitan area

ASSETS – PORT AUTHORITY



- 15th largest port in the world
- 1.9 million containers
- 6000 containers/day
- Average of 2% inspected
- 139 million tons of cargo
- \$20 billion to regional economy

NEW YORK CITY

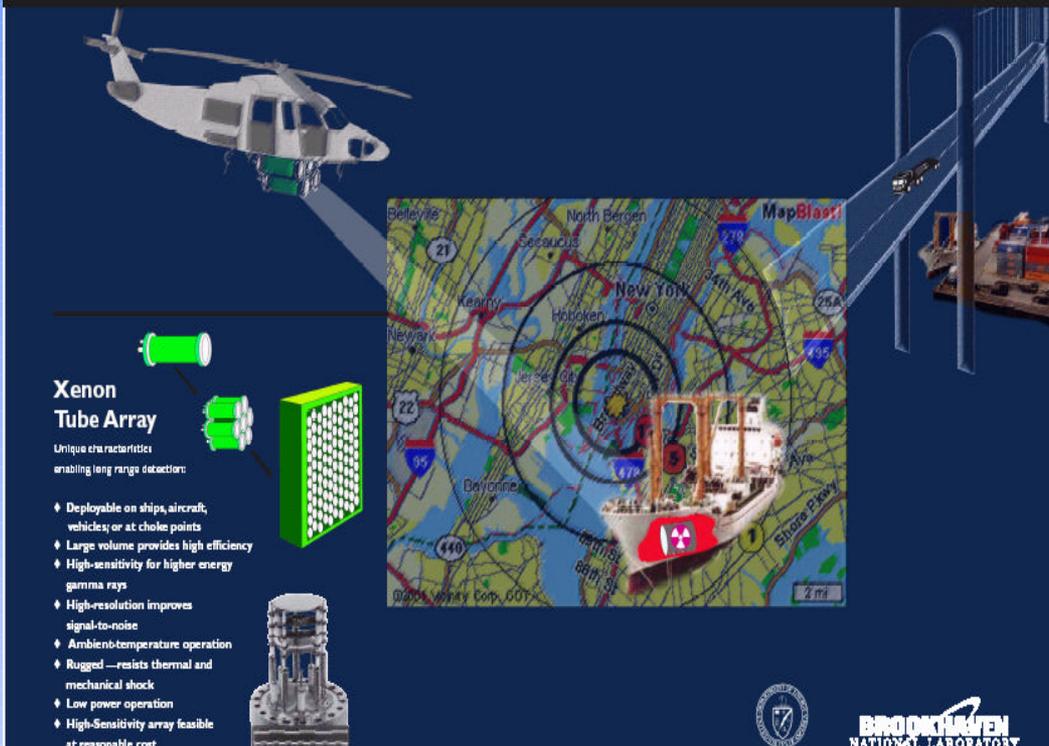


- 11 Bridges
- 4 Tunnels
- MTA
 - 1 million cars daily.
 - 468 passenger stations;
 - 29 subway lines and 235 bus routes;
 - 6076 cars and 4465 buses;
 - 686 miles of track; and
 - 27 rail-yards, 19 shops and 27 bus depots.

NEED

Detection of Clandestine Nuclear Devices Near Transportation Centers High-Pressure Xenon-Gas Gamma-Ray Detector Array

P. E. Vanler, L. Forman and G. Smith • Non-Proliferation and National Security Department • Brookhaven National Laboratory, Upton, New York, USA



Xenon Tube Array
Unique characteristics enabling long range detection:

- ◆ Deployable on ships, aircraft, vehicles, or at choke points
- ◆ Large volume provides high efficiency
- ◆ High-sensitivity for higher energy gamma rays
- ◆ High-resolution improves signal-to-noise
- ◆ Ambient-temperature operation
- ◆ Rugged —resists thermal and mechanical shock
- ◆ Low power operation
- ◆ High-Sensitivity array feasible at reasonable cost

BROOKHAVEN
NATIONAL LABORATORY

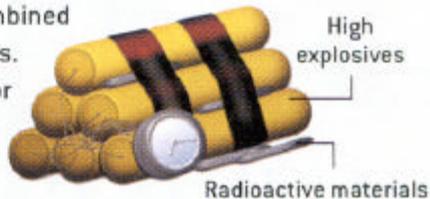
- Detect
- Warn
- Survey
- Track
- Locate
- Identify
- Validate
- Analyze
- Report
- Respond
- Interdict

MATERIALS OF CONCERN?

DIRTY VERSUS NUCLEAR BOMBS

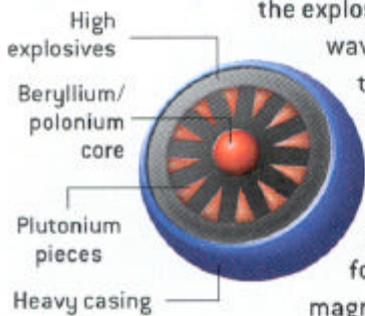
People sometimes confuse radiological with nuclear weapons

A **DIRTY BOMB** is likely to be a primitive device in which TNT or fuel oil and fertilizer explosives are combined with highly radioactive materials. The detonated bomb vaporizes or aerosolizes the toxic isotopes, propelling them into the air.



A **FISSION BOMB** is a more sophisticated mechanism that relies on creating a runaway nuclear chain reaction in uranium 235 or plutonium 239. One type features tall, inward-pointing pyramids of plutonium surrounded by a shell of high explosives. When the bomb goes off, the explosives produce an imploding shock wave that drives the plutonium pieces

together into a sphere containing a pellet of beryllium/polonium at the center, creating a critical mass. The resulting fission reaction causes the bomb to explode with tremendous force, sending high-energy electromagnetic waves and fallout into the air.

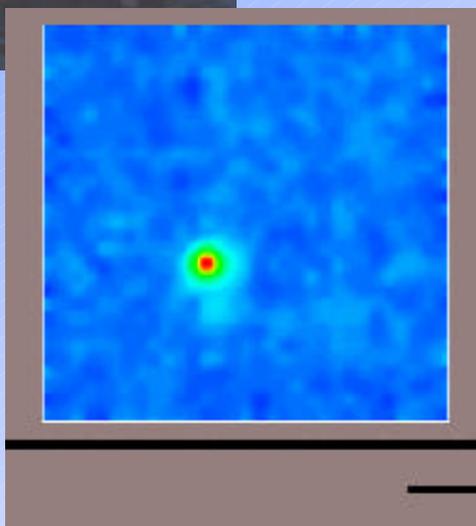


- Special nuclear materials
 - Pu, U, and other fissile isotopes
 - 200 g of Pu (10^7 gammas/s)
 - 400 g of U-235 (5×10^6 gammas/s)
- Other radioactive materials
 - Co-60, Cs-137, Sr-90

Dilbert Says



LEVELS OF DETECTION

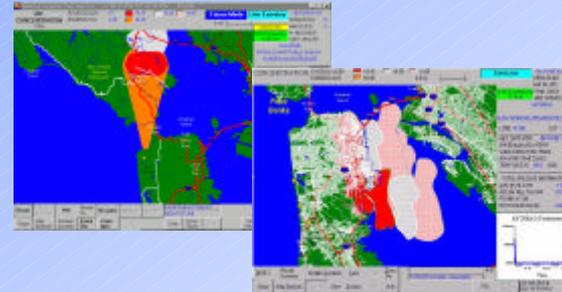


- **1st Level - Early Warning**
- **2nd Level - Differentiate, Track, and Identify**
- **3rd Level - Detailed Measurements to Locate, Confirm, and Respond**

SAMPLE OPERATING SPECIFICATIONS

The Holy Grail

- *Rapid Response*
 - Non-cooperative & Aggressive
- *High Fidelity*
 - Good discrimination capabilities
- *Range w/o Resolution Loss*
 - Detection ranges commensurate with reactionary gap distances
- *Minimum False Positives/Zero False Negatives*



RADIATION DETECTION REQUIREMENTS

Rad. Type	Fixed	Hand-Held	Pocket
Gamma	0.1 $\mu\text{Sv/h}$ in 1 s	0.2 $\mu\text{Sv/h}$ in 3 s	1.0 $\mu\text{Sv/h}$ in 2 s
Neutron	20,000 n/s 2 m away in 10 s	20,000 n/s 0.25m away in 10 s	NA
False Alarm	0.01%	1/min	1/12 hrs

DETECTORS MUST....

*...PLAY WELL
WITH OTHERS*

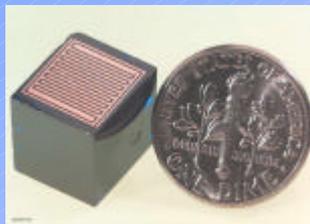
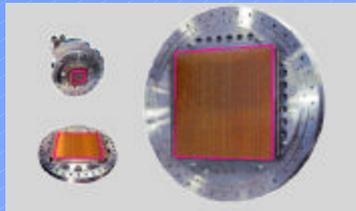
CONCEPTUAL NETWORK

Sensors

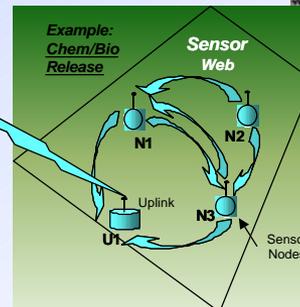
Distributed Network

Data Analysis Center

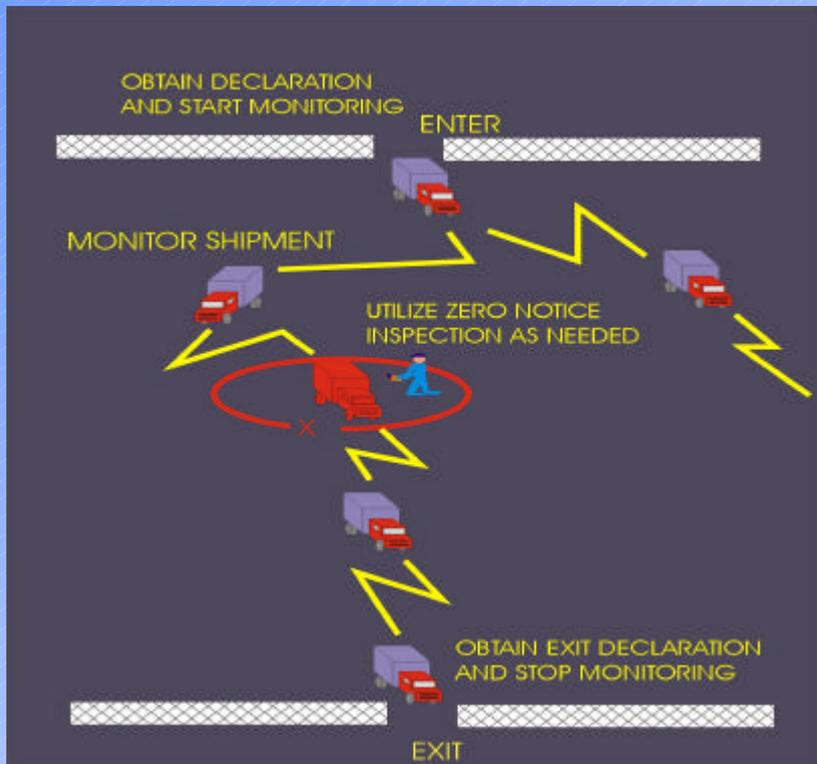
First Responders



Data Uplink



MONITORING SYSTEM



- **Multi-Functional**
- **Integrated and Automated**
- **Comprehensive Detection and Analysis**
- **Adjust to Background**
- **Flexible**
- **Redundancy**
- **Data Transfer and Communication**
- **Improve Effectiveness and Efficiency of Limited Specialized Organizational/Personnel Assets**

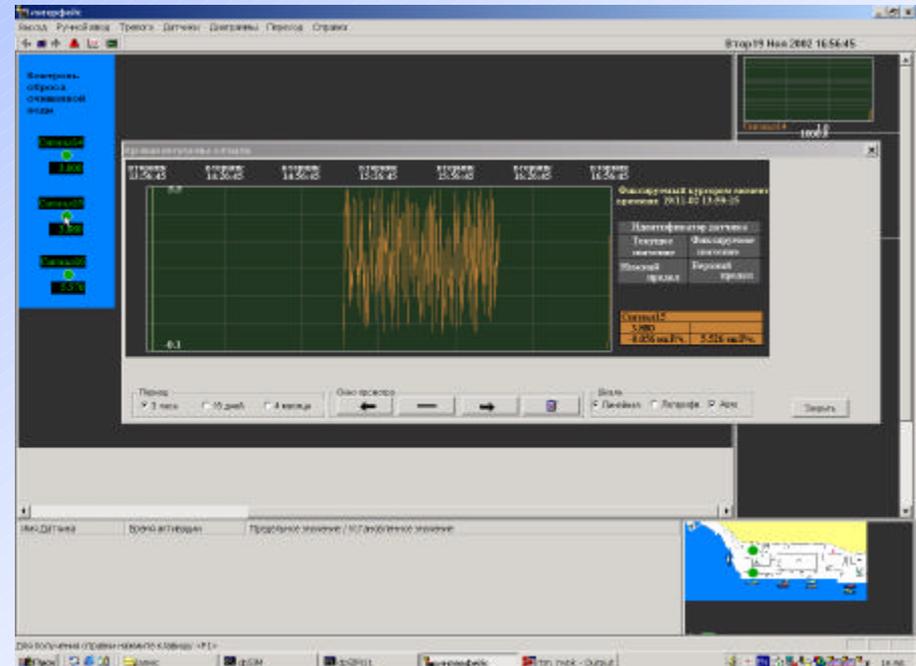
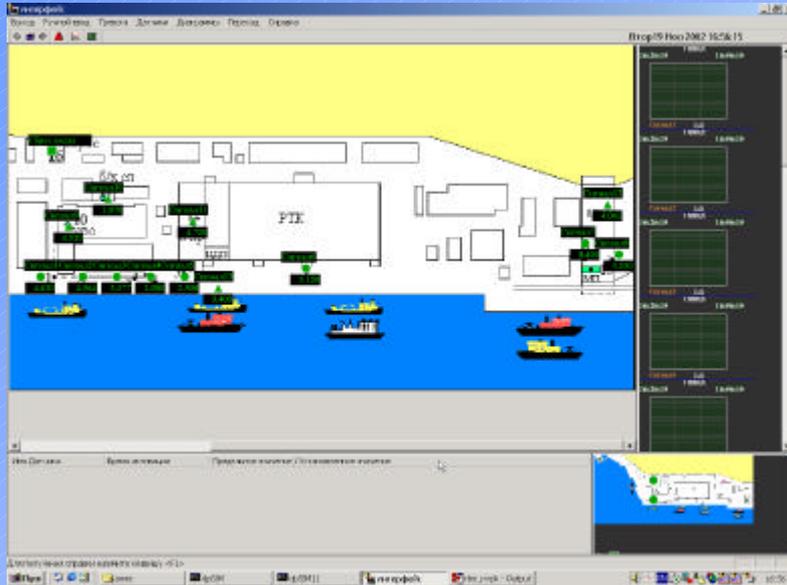
SMART MONITORING SYSTEMS ARE NEXT

- Integrate sensors into a single network.
- Provide vital quality information directly to users in a timely, actionable manner on networks tailored to unit task and purpose.
- Standard is see first, understand first, act first, and finish decisively.
- Architecture rapidly fuses and routes information in real-time to users.
- Requires improved multi-spectral sensors, on-board processing, automated pattern analysis, and sensor collaboration.

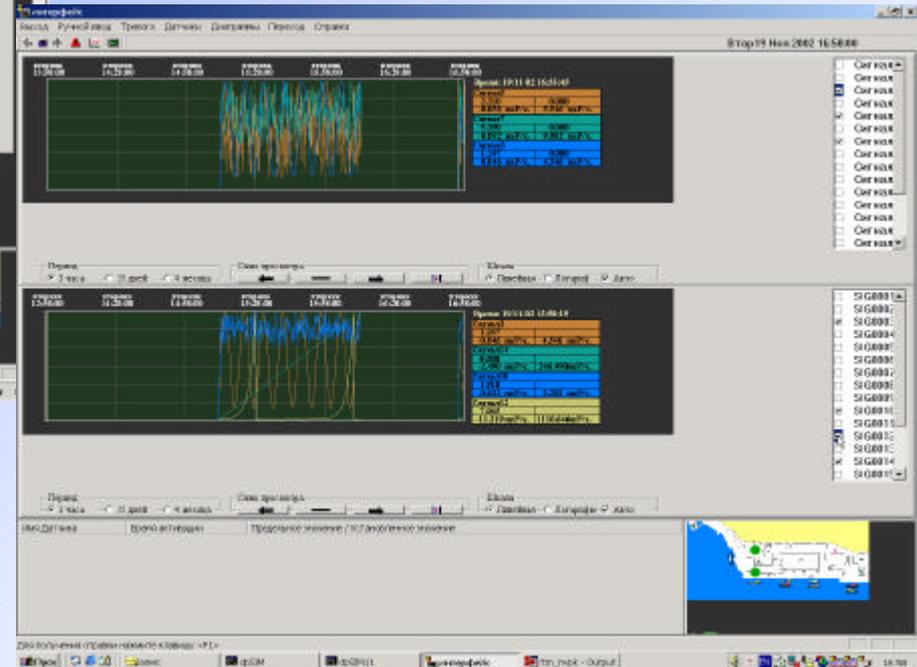
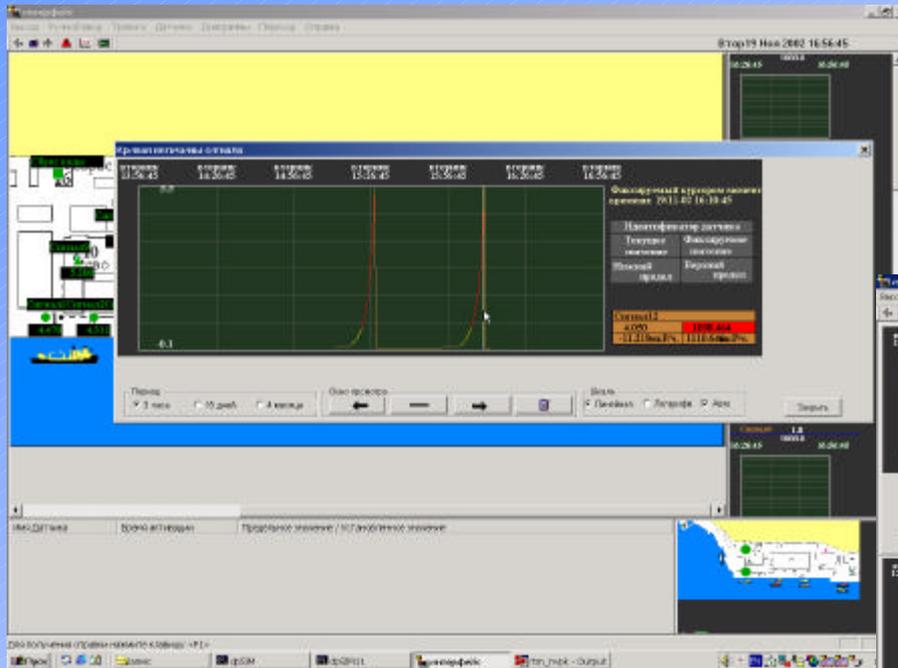
If We Can Do It in Murmansk, We Can....



AMEC PICASSO RADIATION MONITORING SYSTEM



AMEC PICASSO RADIATION MONITORING SYSTEM (Cont'd)



PROGRAMS AND ORGANIZATIONS

ACTIVITY	ORGANIZATION
Tech Deployment	USCS, DOT, USCG, DOJ
Review of Current Tech.	USCS, DTRA, DOT, DOJ
Training/Procedure Dev.	DOT, DTRA, DOJ, USCS
Methodology Studies	NNSA , DOT, DTRA
Pilot Programs	USCS, DTRA, EPA, DOT
Detector Capability Studies	USCS, DTRA
Detector Development	NNSA , DTRA , USCS, DOJ

PARTNERS



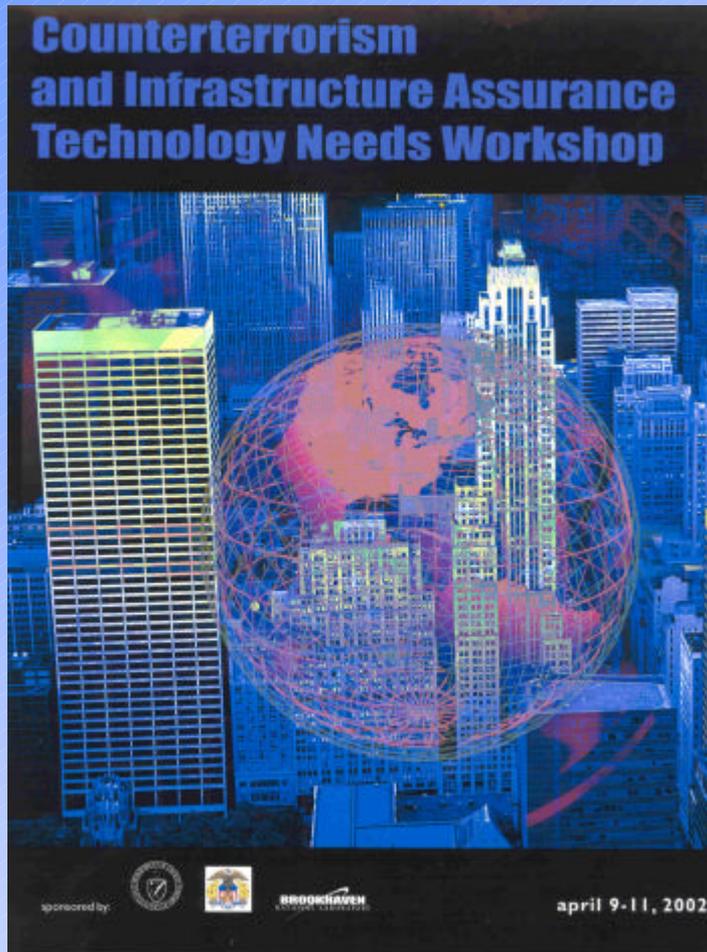
- Federal
 - NNSA/DOE
 - DTRA
 - US Customs
 - US Coast Guard
 - DHS
- State and Local
 - Port Authority of NYNJ
 - NYS Office of Public Security
 - NYC Office of Emergency Management
- Private Sector
 - Northrup Grumman
 - EDO
 - Symbol Technologies

RESOURCE DOCUMENTS



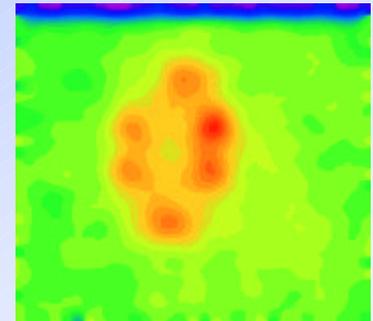
- “Making the Nation Safer: The Role of Science and Technology in Countering Terrorism”
- “OSTP/OHS/NSC Combating Nuclear Smuggling Interagency Working Group”
- “Fieldable Nuclear Detector Technology”
- “National Strategy for Homeland Security”

BNL IS RESPONDING

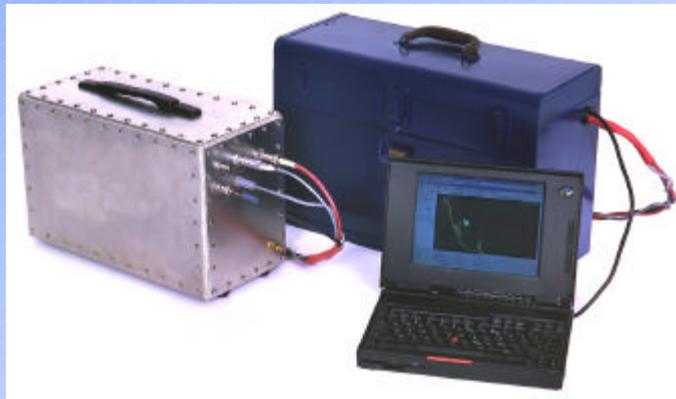


BNL IS RESPONDING – Cont'd

Position Sensitive Thermal Neutron Source Locator



Large Xenon Gamma Detector



Room-Temperature CZT



BNL ENTRANCEWAY - PROPOSED



NYC Anti-Terrorism Needs



Ground Zero

(BNL Viewgraph of Aug. 9, 2001)

- **Threat/Vulnerability/Consequence Assessments**
 - System Tools
 - Prioritization Approaches
 - Optimization Strategies
 - Hardware/Staffing Recommendations
- **Integrated Response Tactics**
 - Within/Among City Entities
 - Within/Among Private/State/Federal Entities
- **Training/Consulting**
- **Autonomous Monitoring and Detection Systems**
 - Man-portable
 - Building
 - Nuclear/Chem/Bio Agents
 - Secondary Indicators (Hospital visits, medical supply sales...)

THE RISK OF FAILING IS UNACCEPTABLE

