SAND2008-2852P

HOMELAND SECURITY & DEFENSE

# International Maritime and Border Security Technologies & Capabilities at Sandia National Laboratories

**May 7, 2008**

**Presented by**
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**International Maritime and Border Security Department**
**Sandia National Laboratories**
**Albuquerque, NM**

Sandia National Laboratories

# Sandia was created in 1948 to perform non-nuclear engineering, qualification, and test & evaluation for the U.S. nuclear weapons complex

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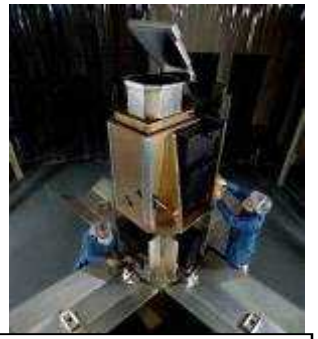
# Sandia National Laboratories Today

- **Six locations**
  - New Mexico
  - California
  - Hawaii
  - Nevada
  - Texas
  - Washington, D.C.
- **Workforce profile – 10,000 people**
  - 8600 permanent staff
    - 65% Science and Engineering
    - 50% PhDs/ Masters
  - 1300 sabbaticals, post docs, students, interns
  - 2200 contractors
- **500+ university collaborations**
- **Annual budget (2006) $2.3B**

Nuclear Weapons



Defense Systems and Assessments

Energy and Nonproliferation

Homeland Security & Defense

**Supported by a science, technology, & engineering base.**



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# Homeland Security & Defense Programs

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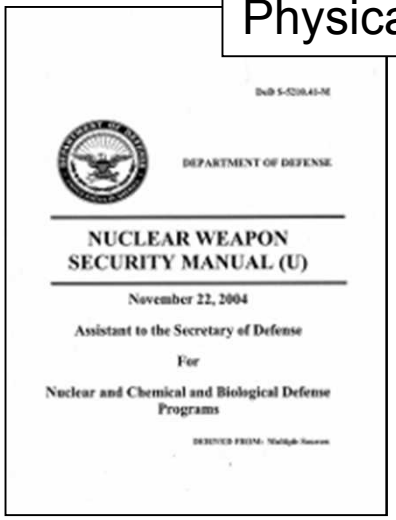
Physical Security


DEPARTMENT OF DEFENSE

NUCLEAR WEAPON SECURITY MANUAL (U)

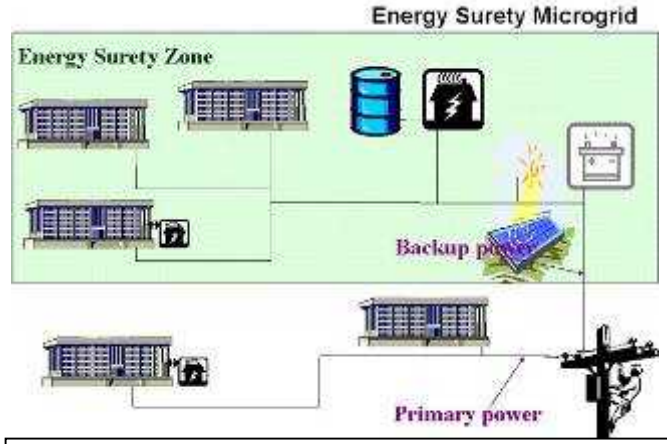
November 22, 2004

Assistant to the Secretary of Defense

For

Nuclear and Chemical and Biological Defense Programs

Chemical and Biological Defense




Base Infrastructure Protection

Force Protection

Radiological and Nuclear Defense

Borders Security



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# Borders Security Capabilities & Expertise

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## Field Testing

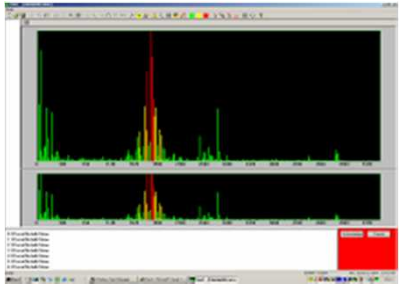
- Outdoor Test Facility (OTF)
- Intrusion Detection Sensor Field
- TEAMS Site


## Specialized Facilities

- Environmental Testing Complex
- Port of Albuquerque/Livermore Container Terminal

## Relevant capabilities and expertise

- Systems analysis
- Systems modeling
- Red teaming
- Tunnel detection
- Synthetic Aperture Radar
- UAVs
- Underwater monitoring





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# Field Testing: Outdoor Test Facility

**OTF provides flexible operational test capabilities**

- Integrated test site
- Command center
- Sensor testing
- Camera testing
- Radar testing
- Communications systems testing

**Integrated Test Site**

**Data Fusion & Communications System Testing**

**Sensor Testing**

**Camera Testing**

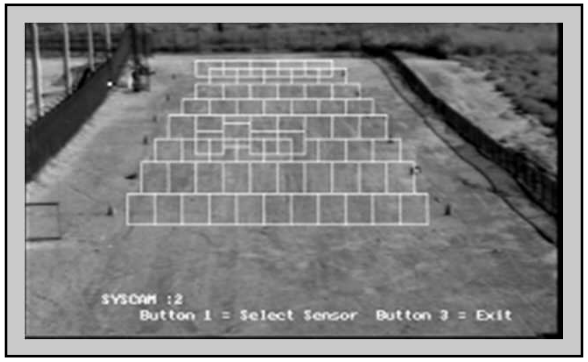
# Field Testing: Intrusion Detection Sensor Field

**IDSF is a multi-purpose area for testing performance and concepts applicable to physical security sensors**

- Exterior security sensors
- Interior security sensors
- Assessment capabilities

**Capabilities**

Facility Characterization
On-site test beds
System Design
Installation Oversight
Alignment and Calibration
Acceptance Testing
Maintenance Training




Intrusion Detection Sensor Field

# Field Testing:
# Technical Evaluation Assessment Monitor Site (TEAMS)

**TEAMS provides a stable, flexible, multi-purpose area to test concepts applicable, but not limited to, radiation, biological, chemical, and explosive sensors**

- Cooperative SNL/DTRA facility
- CONOPs development
- Background measurements
- Performance measurements
- Calibration, testing
- Radiation sources

# Specialized Facilities: Container Security Evaluation

## Port of Albuquerque

**PoA provides a multi-purpose area to conduct functional, performance, and defeat testing for maritime security devices.**

- Cargo Containers
  - 20-ft, 40-ft,40-ft Hi-Cube,
  - Steel & Aluminum
- Infrastructure
  - Communication
  - Lighting

| TECHNICAL OBJECTIVES | | |
|---|---|---|
| **Objective** | **Goal** | **Threshold** |
| Detect a hole in the container | 9 sq in | 36 sq in |
| Time to detect hole in the container | 1 sec | 3 sec |
| Time to detect door open status | 1 sec | 1 sec |
| Linear distance to detect door open | 1 inch | 1 inch |
| Time to detect person(s) [> 50lbs/110 lbs] | 2 hrs | 2 hrs |
| Probability of Detection (Pd) of an alarm event | 0.9 | 0.75 |
| Probability of False Alarm (Pfa) | 0.0001 | 0.001 |
| False Alarm Rate (Rfa) | 1 fa per 10k trips | 1 fa per 1k trips |
| Operational Availability (Ao) | 0.99 | 0.95 |
| Power Source Duration | 10 Years | 30K Hrs |
| Cost/Trip | <$50 | <$175 |

## Livermore Container Terminal

**OT&E of Container Security Devices**

**Advanced Container Security Device R&D**

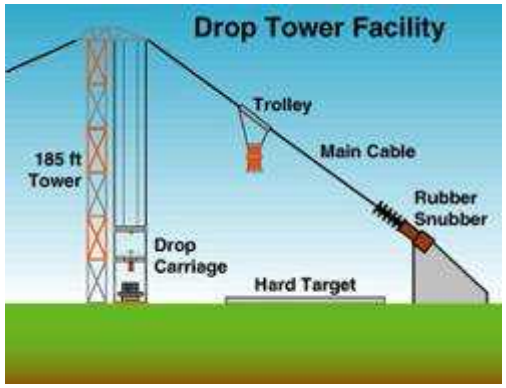
**Partnership with Port of Oakland**

- Deploying systems
- Est. baseline conditions & OT&E in CA- HI trade lanes

# Specialized Facilities: Environmental Test

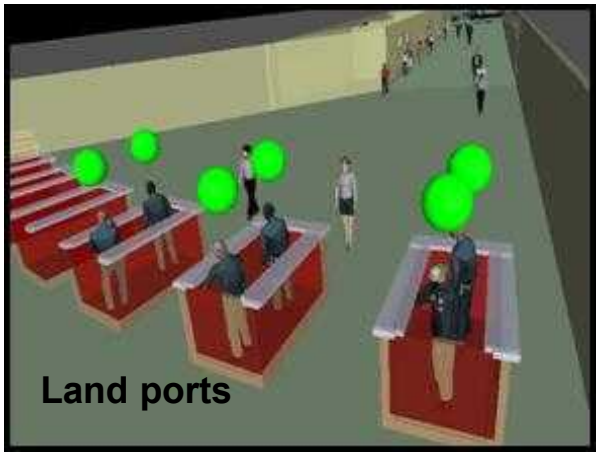
**Environmental testing of component-level assets to full systems**

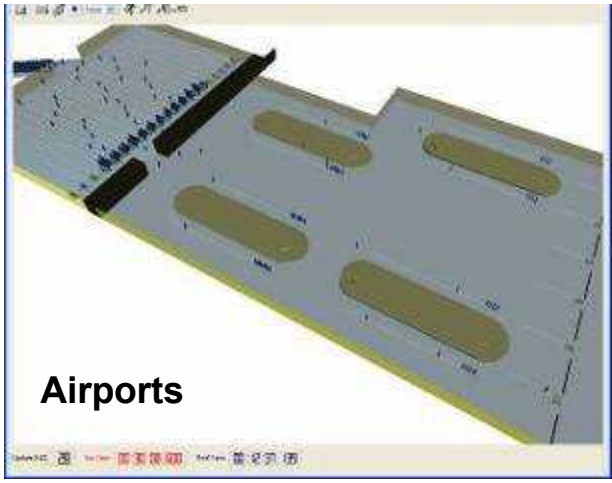
- Mechanical shock
- Temperature testing
- Vibration testing
- Radiation testing
- Salt fog

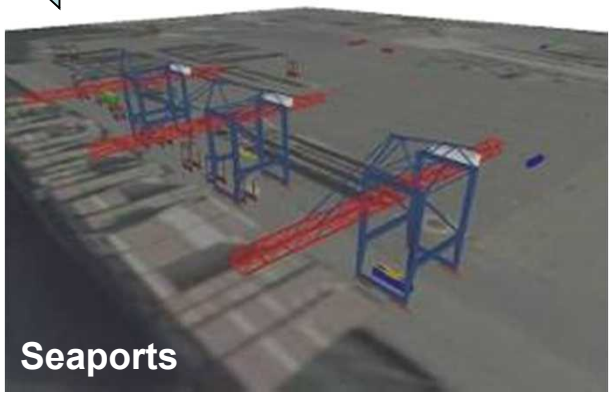

## Facilities in NM, CA, NV, and HI

# Modeling and simulation tools provide systems analysis of security and operations at US borders




Integrated SoS Models and Analysis





Economic Models



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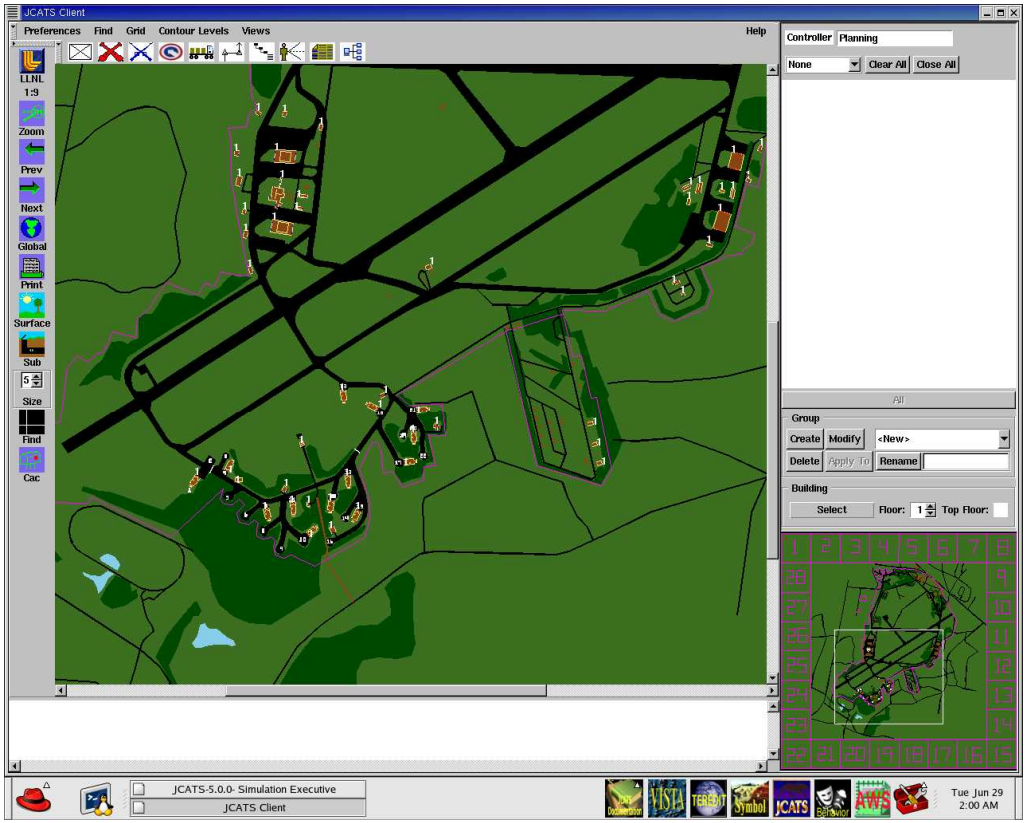
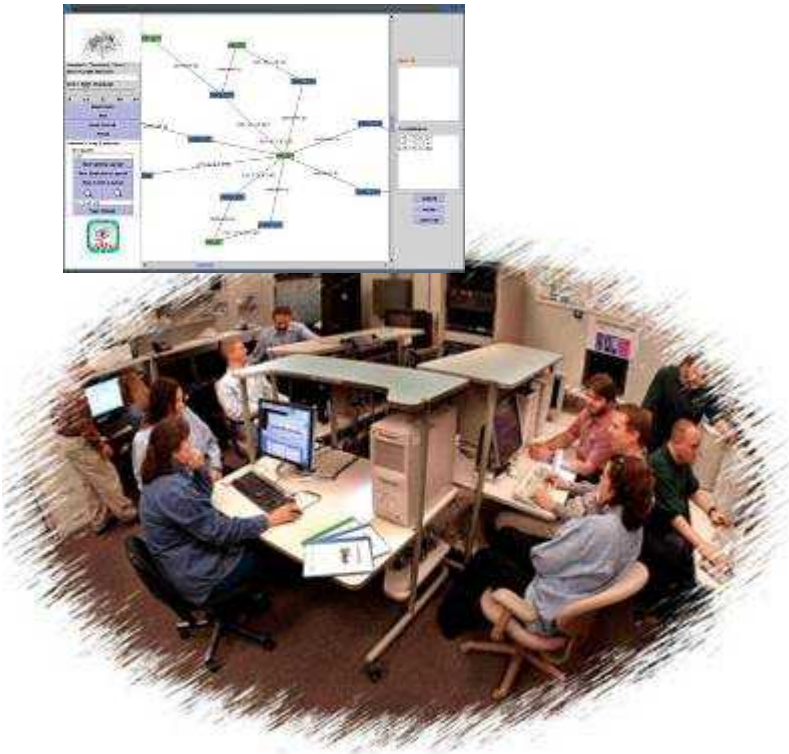
# Sandia has capabilities to assess effectiveness of protection systems and perform red team assessments




Joint Conflict and Tactical Simulation (JCATS)

- Large-scale, theater-level simulations
- Smaller force-on-force interactions



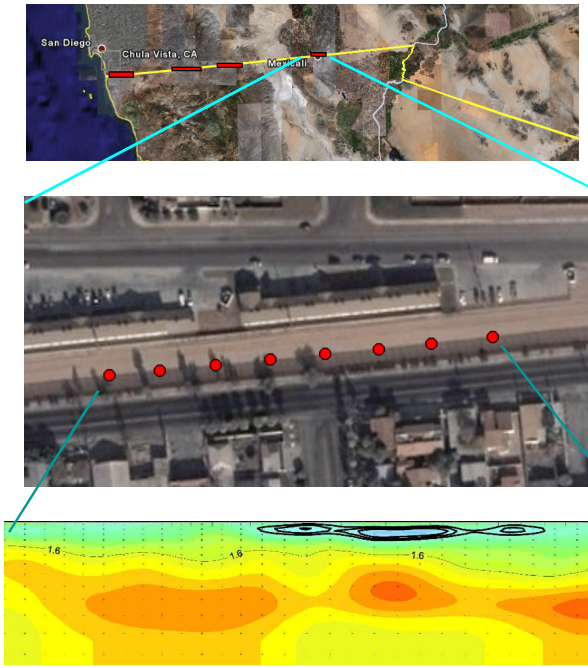
Red Teaming

- Flexible tool for current or dynamic threats
- Measurable, reproducible, and actionable results

# Sandia has efforts assessing current methods for tunnel detection and developing new techniques

- **Current technology assessments**
  - Seismic and acoustic sensors for detecting people
  - Active geophysical techniques such as gravity gradiometry, EM resistivity and gradiometry, seismic reflection
  - Experience in underground characterization from Otay/Mesa/Calexico with NORTHCOM, DOE waste remediation and energy exploration, and DoD hard target defeat

- **Development of advanced systems**
  - Systems analysis of tunnel construction to identify high-risk sections of border
  - Tunnel finding/monitoring system such as instrument intelligent passive seismic, acoustic and EM sensor systems
  - Monitor for specific tunnel detection
    - Use complete signatures of tunnel construction activity
  - Use background noise to create subsurface images
    - Direct tunnel imaging
    - Change detection



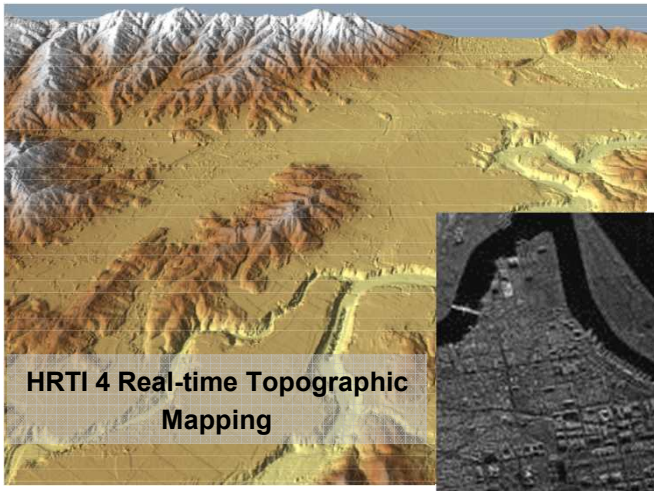
# Sandia's capabilities allowed us to quickly develop and execute a T&E program for underwater detection

- **Multi-vendor, multi-customer tests**
  - NOAA Facility, Lake Washington, WA
- **Demonstrate performance in detecting & identifying humans**
- **Evaluate heuristic deployment, automated alarming**
- **Range of real-world operations & conditions**

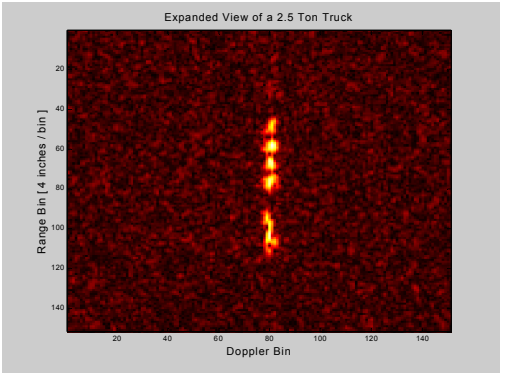
# Sandia Synthetic Aperture Radar Systems

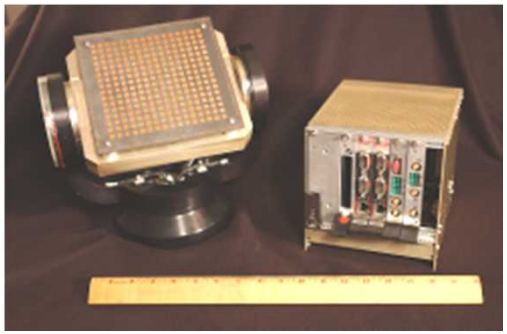
## Novel Real-time SAR and Interferometric SAR

- Two decades experience
- Multiple frequency bands (VHF, UHF, L, S, X, Ku, Ka)
- Ultra-fine resolution (4”)
- Real-time Exploitation (Coherent Change Detection, Aided Target Recogntion, Ground Moving Target Inidcation)
- Full system development
- Miniaturized systems
- Fielded operational systems


HRTI 4 Real-time Topographic Mapping


Coherent Change Detection





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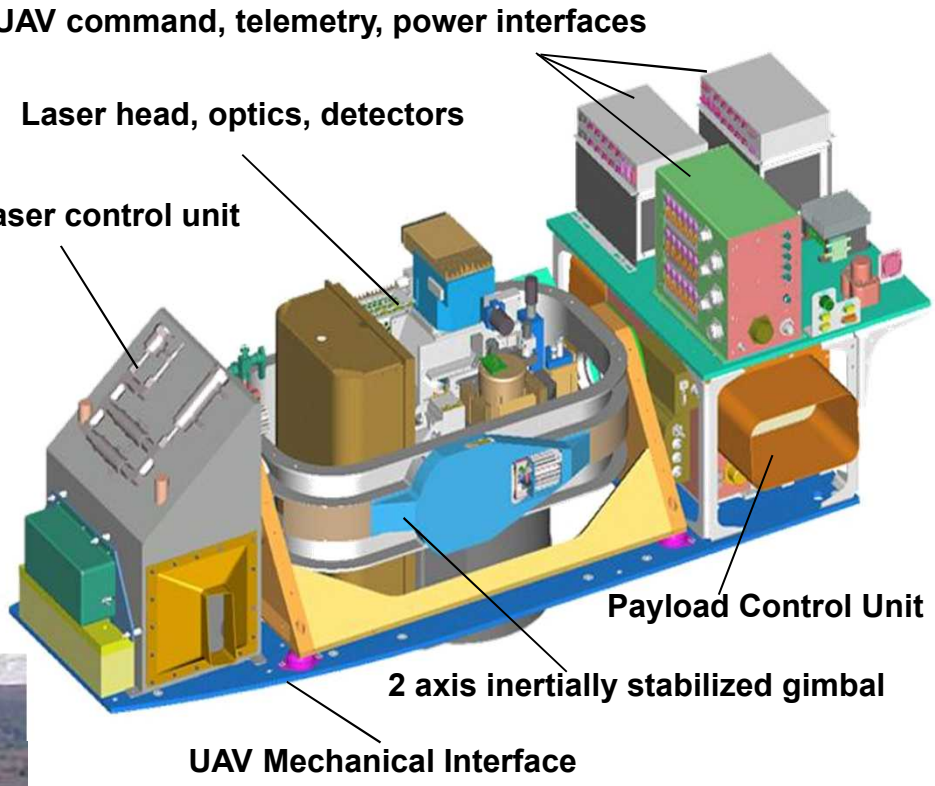
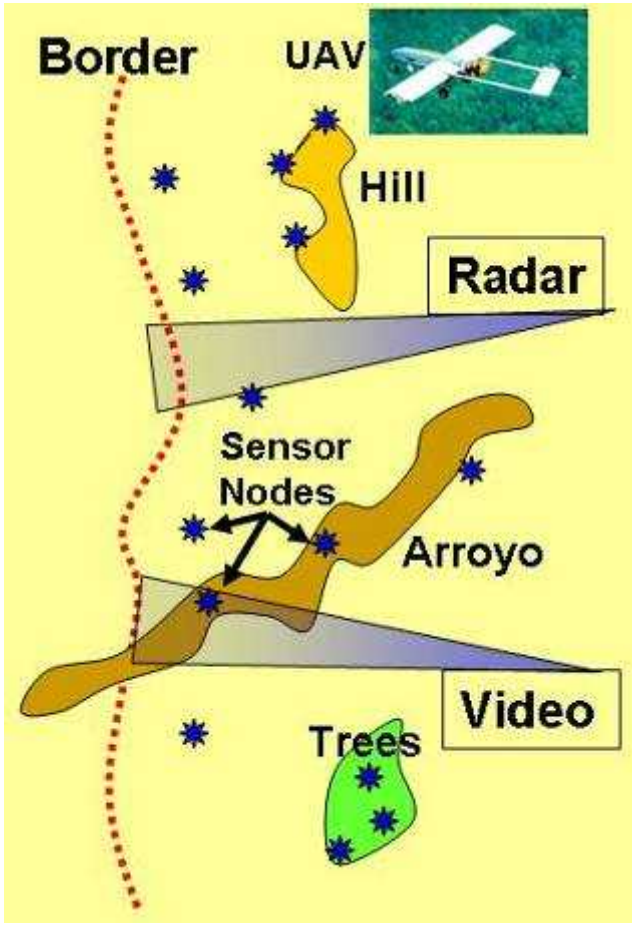
# Sandia has developed UAV-based instrumentation payloads and T&E of UAV systems and operations

- Over 20 yrs experience
- Data collection in more than 460 operational flight hours
- WMD proliferation missions
  - Chem/bio stand-off detection
- Climate prediction and climate change assessments
- Working relationship with UAV manufacturers




# Networked Detection Systems For Virtual Presence/Extended Defenses



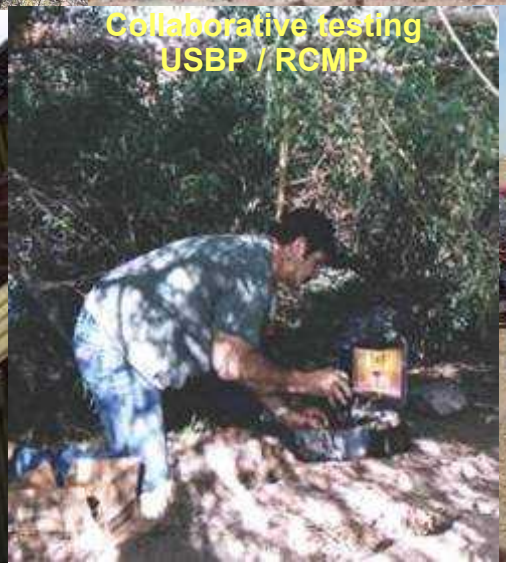

- **Sandia is performing OT&E and Field Development Evaluations for VPEDs components, and subsystems for DOE and DoD programs.**
  - **Radar systems**
  - **Thermal imaging**
  - **IP video**
  - **Wireless communications**
  - **Ground sensors**
  - **Algorithms for data processing**
  - **VPS architecture and systems**
- **Networked systems solutions**

21st Century Border Solutions require 21st Century Technology and Systems: Networked Sensors, Data Fusion, Decision Support

# Sandia is involved in field testing and cooperative T&E efforts at the borders









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