Overview of International Safeguards Technology Development and Research at Sandia National Laboratories

SAND2010-7389C

Presented by

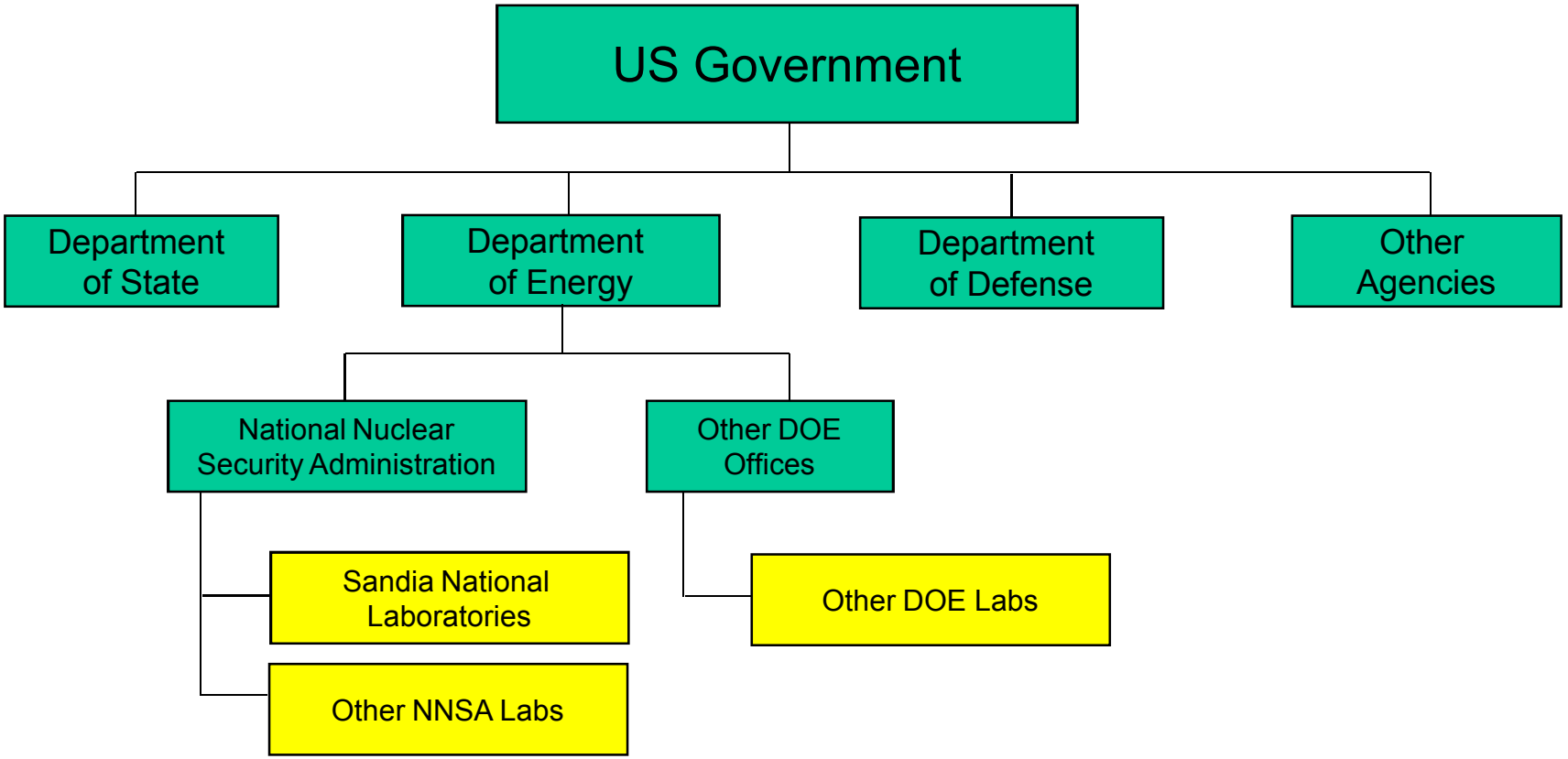
J. David Betsill

6th International Workshop on Nuclear Energy and Nonproliferation in East and Southeast Asia

27-29 October 2010, Gyeongju, Republic of Korea

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Relationship of Sandia National Laboratories to US Government



NNSA National Nuclear Security Administration

Sandia National Laboratories

Four Primary Mission Areas

- Maintenance of Weapons Stockpile
- Defense Systems and Assessments
- Energy, Resources, and Nonproliferation
- Homeland Security and Defense

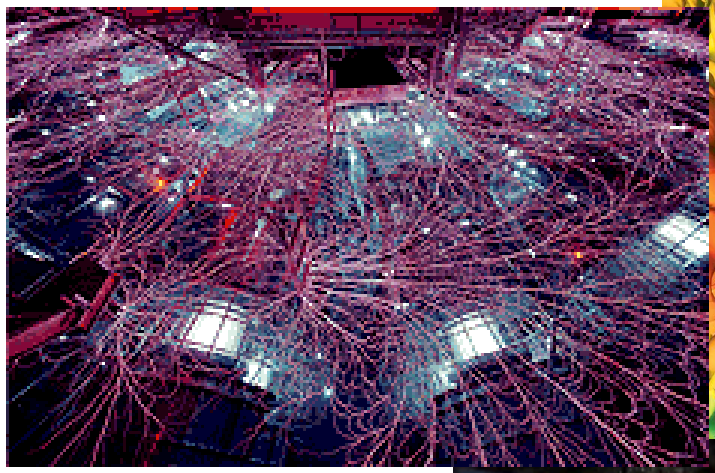
Helping our nation secure a peaceful and free world through technology

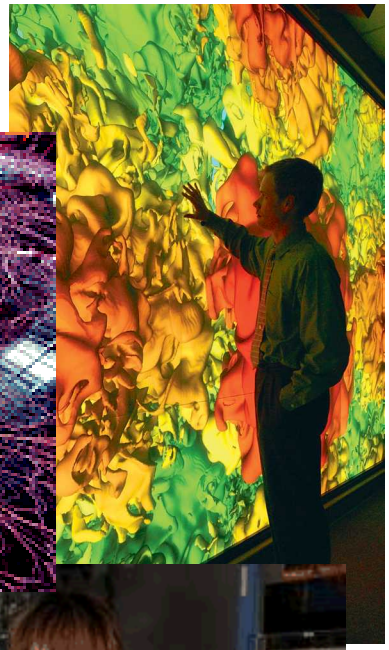
NNSA
National Nuclear Security Administration

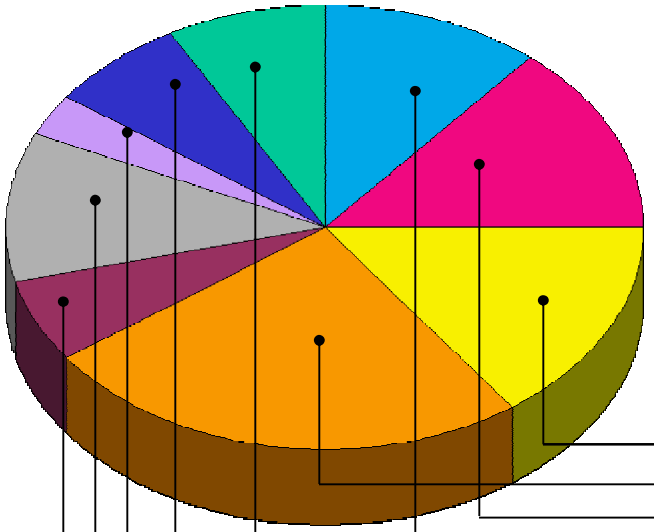
Sandia National Laboratories

Highly Skilled Workforce

- More than 8,600 full-time employees
- More than 1,500 PhDs
- More than 2,700 MS/MAs
- 2,200 on-site contractors







Mechanical Engineering - 16%
Electrical Engineering - 22%
Other Engineering - 15%
Other Science - 6 %
Physics - 6%
Chemistry - 6%
Math - 2%
Computing - 16%
Other Fields - 6 %

(2006 data)

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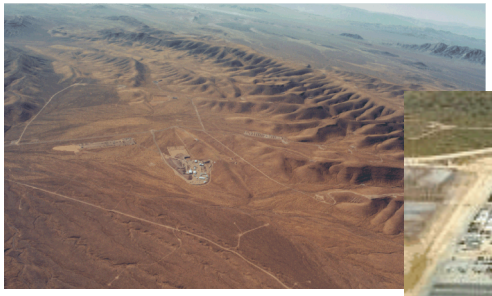
Distributed Facilities Meet National Needs

Albuquerque,
New Mexico

Kauai Test Facility,
Hawaii

Tonopah Test Range,
Nevada



Yucca Mountain,
Nevada

WIPP, New Mexico

Pantex, Texas

Livermore, California

National Nuclear Security Administration

Sandia National Laboratories

Global Security & Engagement Programs

Sandia National Laboratories

Creating sustainable technology-based system solutions through International cooperation to reduce the threat of WMD proliferation and terrorism

Nuclear/Radiological Threats

Biological Threats

Global Security Engagement

Program Focus Areas

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Sandia Science & Technology Base

International Business Infrastructure

Capabilities

Cooperative Monitoring Centers

Global Security Engagement and International Safeguards

Highlighted areas indicate past and present Global Security Engagements

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International Safeguards Cooperation at SNL

- **Support Nonproliferation Goals of DOE/NNSA**
  - National Nuclear Security Administration (NNSA)
  - Office of Global Security Engagement and Cooperation
- **Bilateral Cooperation Agreements**
  - U.S. Department of Energy and international partners
  - Euratom, ABACC
  - Japan, Korea, France, Brazil, Argentina, Australia, & other countries
- **Direct support to IAEA's Department of Safeguards**
  - U.S. Program of Technical Assistance to Agency Safeguards (POTAS)
    - Extra budgetary assistance
    - IAEA requests for support

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SNL Specializes In Critical Aspects of International Safeguards

- **Equipment and Information Security**
  - Timely, accurate, and trusted information assessments
  - Authentication, encryption, tamper indication, and system design
- **Remote and Unattended Monitoring**
  - Unattended Safeguards instruments at facilities worldwide
  - Secure remote communication by internet, satellite, or telephone
- **Vulnerability Assessments**
  - Rigorous independent testing

SNL Core Capabilities for International Safeguards

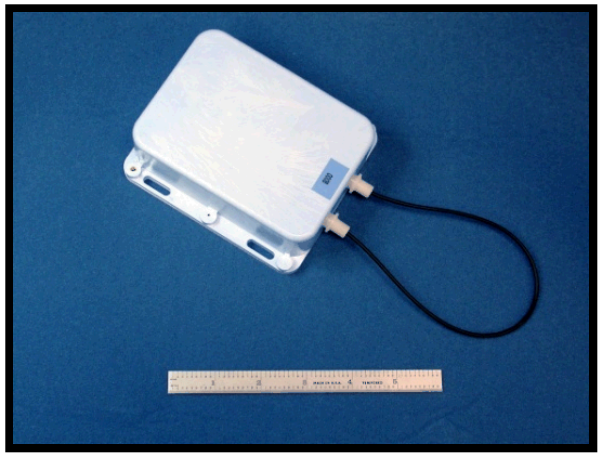
- **Subject-matter Expertise**
  - Chemical analysis, materials science, cryptography, many others
- **Containment and Surveillance (C&S) Technologies**
  - Maintain "Continuity of Knowledge"
  - Tamper detection
- **Onsite Inspection and Managed Access**
  - Readiness procedures and training
    - Host and inspector
- **Geological Repository Safeguards**
  - C&S methods applied to geological repositories
    - Seismic detection, satellite imagery, other technologies
  - SNL repository experience
    - Waste Isolation Pilot Plant (WIPP)
    - Yucca Mountain
  - Participation in IAEA's ASTOR working group
    - "Applications of Safeguards to Geologic Repositories"

Long-Term Engagements: SNL Staff Members Seconded to International Safeguards Assignments

- Cost-free expert to the IAEA Safeguards Training Section (1993-1995)
- Unit Head at the IAEA Seibersdorf Analytical Laboratory (2004-present)
- Cost-free expert to the IAEA Seals Unit (2000-2005)
- IAEA Cost Free Expert (2002-2007)
- JAEA International Research Fellows (1997-2009)

Remotely Monitored Sealing Array (RMSA) Enables Remote Monitoring of Storage Facilities

- **RMSA is an active-loop seal**
  - **IAEA Safeguards application**
    - **Authenticated & encrypted wireless transmission**
    - **Advanced tamper indication and communications**
  - **Low power consumption**
    - **4-5 years on one battery**
  - **Easy to install**
  - **Low life-cycle cost**
- **Joint Effort**
  - **Developed by *Sandia***
  - **Manufactured by *Canberra***



RMSA pre-production prototype

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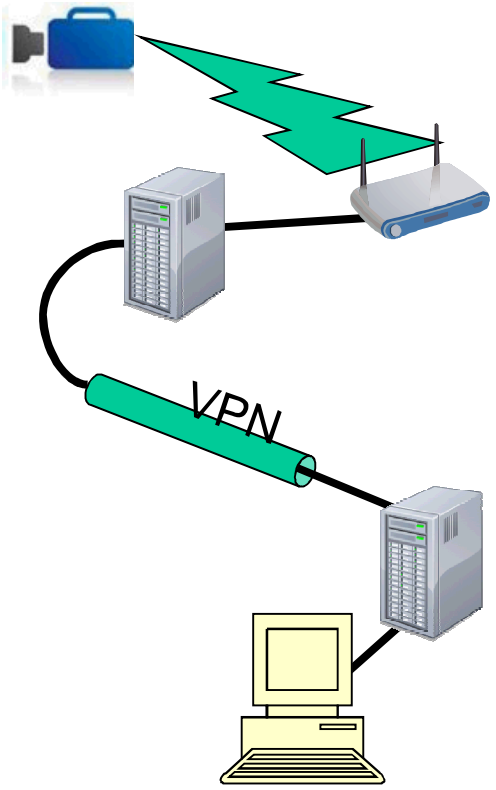
Euratom Action Sheets: Investigate Approaches for Equipment and Information Security

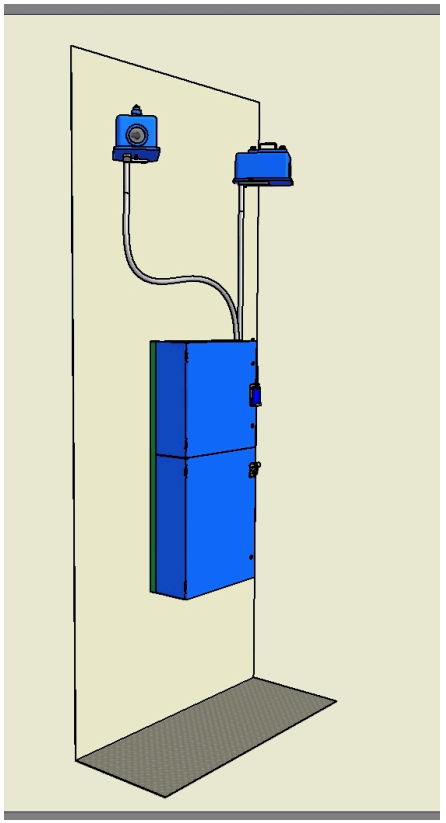
- **Secure Wireless Communication**
  - Short-distance wireless links
    - Within a facility
  - Virtual Private Network (VPN)
    - Secure Internet connection to remote sites
  - Authenticated and encrypted



- **Enhanced Data Authentication**
  - Secure Sensor Platform (SSP)
  - Versatile, standardized interface
    - Authenticated safeguards data

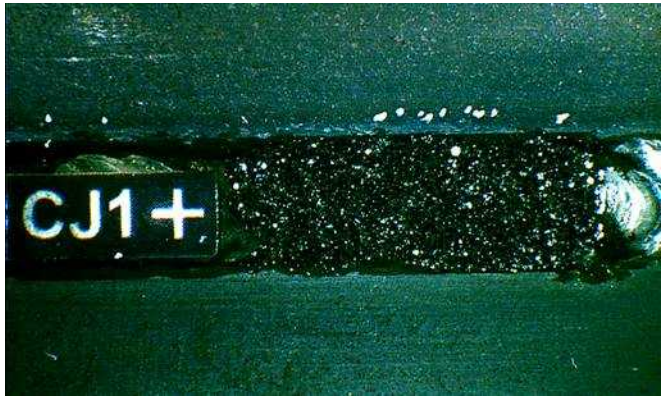
SNL and ABACC – Developing the Secure Video Surveillance System (SVSS)

- **DOE-ABACC Action Sheet**
  - Argentine-Brazilian Agency for Accounting and Control
- **Support for Unannounced Inspections**
  - Two-hour prior notice for unannounced inspection
  - Fast picture-taking interval
  - Video surveillance acquired after the inspection announcement
  - Strong authentication of images
  - Commercial, off-the-shelf components
  - Joint and/ or independent review by ABACC and IAEA inspectors
  - Surveillance technology presently in use by ABACC can no longer be maintained due to lack of replacement parts



Reflective Particle Tag (RPT) Being Developed to Seal the Welds on Nuclear Material Containers

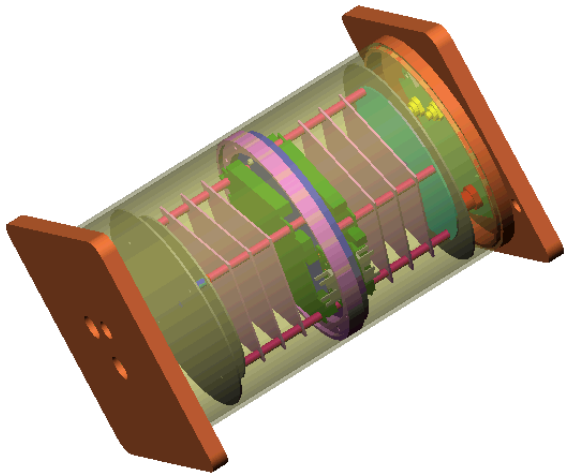
- IAEA application to ensure container integrity
- The speckle patterns of hematite particles embedded in epoxy are unique and impossible to duplicate
- Tag is easy to apply and field-readable
- System relies on controlled geometry for illumination and image acquisition
- Excellent reproducibility unless tampered



Reflective Particle Tag applied to a weld

Information Barrier Technology – One-Way Information Flow

- Traditional monitoring methods could reveal data that the host considers sensitive – such as the flow and enrichment of uranium in some areas of a plant
- Trusted Processor technology is a one-way information barrier system applicable to transparency and safeguards
- Supports reporting of safeguards conclusions without revealing sensitive operational data



Summary

- **Sandia National Laboratories Specializes in Technical Areas of International Safeguards**
  - Equipment and information security
  - Remote and unattended monitoring
  - Vulnerability assessments
  - Containment and surveillance techniques
  - On-site inspection and managed access
  - Geological repository safeguards

- **International Safeguards Cooperation Involves**
  - Bilateral agreements and engagement with international partners
  - Direct support of the IAEA through the US member state support program