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Sandia Safeguards Overview

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International Safeguards and Technical Systems

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Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Department Goals

Sandia National Laboratories

- Research, develop, and deploy tools, processes and procedures to ensure information integrity and confidence
- We address information assurance concerns across data lifecycle and with a system's view
  - Sensor
  - Delivery infrastructure
  - Processing
  - Knowledge generation
  - Human interface
    - Operations/Practices/Procedures
- We apply diverse capabilities to programmatic missions
  - International Safeguards
  - Transparency Agreement
  - Security

International Safeguards

- Activities, actions and agreements that provide assurance to the global community that countries are using nuclear technologies for *peaceful purposes*
- 6832 contains all SNL programmatic responsibility and technical direction

Early developments directly addressed IAEA needs

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- Integrated Monitoring System (IMS-I) (1980)
  - Designed to detect movement of shipping casks containing LWR fuel
  - Main intelligence of system contained in Data Collection Module (DCM)
    - Collected rad detector and crane location detector information
    - Information displayed through Inspector Display Module (IDM)
- IMS-II (1985)
  - System capable of monitoring unattended areas
  - Contained DCM, IDM, UPS, and passive IR and Mini-Surveillance Television and Recording (MINISTAR) system

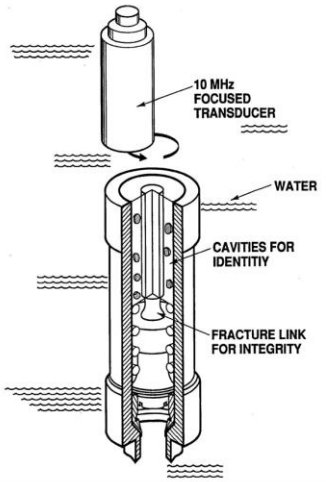
Additional Development work

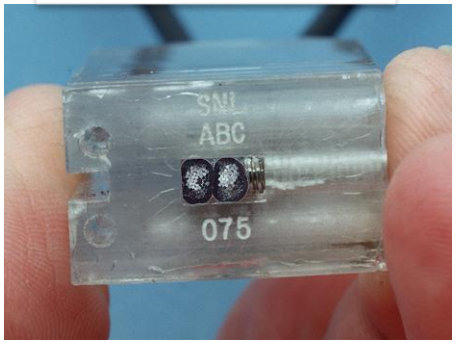
Sandia National Laboratories

- Film scanner developed (1981) to ease film review process
- Modular Integrated Video System (MIVS) (1991)
  - Replacement for Agency's twin Minolta film camera system
  - POTAS funded
  - Aquila Technologies Group selected by POTAS after SNL development as commercial supplier
- MIVS Image Processing System (MIPS)
  - Eased burden of review

Development beyond video systems

- Seal Pattern Reader (SPAR) (late 1970s)
  - Capable of reading several types of ultrasonic seals
    - Fuel Assembly Identification Device (FAID) (Sandia)
    - Random Coil Seal (ARC) (Atomic Energy of Canada, Ltd)
    - Multielement Bottle Seal (MEB) (Sellafield, UK)
    - VAK-III (JRC)
- Cobra Seal (1980s)
  - Passive fiber optic loop seal
  - After SNL development Aquila Technologies Group selected as commercial supplier

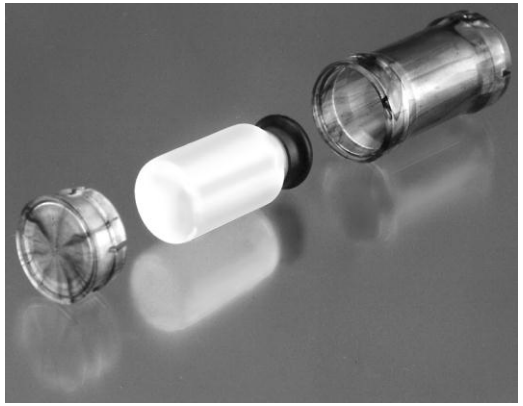




Picture courtesy SNL

Sample Vial Secure Container

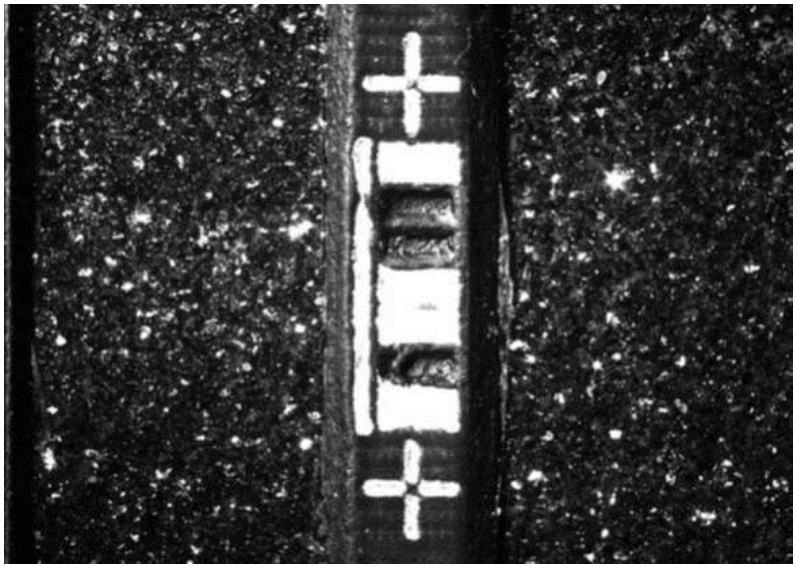
- Sample Vial Secure Container (SVSC) (1990s)
  - Vial for transporting of liquid samples
    - Provide confidence in sample integrity after loss of custody
    - Constructed from polysulfone (rad hard)
    - Single use
    - Visual inspection
  - Unique features
    - Metal plate with an engraved serial number
    - Swirl pattern in casing
  - Small size (3”x1”)



Picture courtesy SNL

Reflective Particle Tags (RPT)

- Hematite particles embedded in adhesive matrix
- Speckle pattern in unique and extremely difficult to duplicate
- Application is relatively simple and field verifiable



Picture courtesy SNL

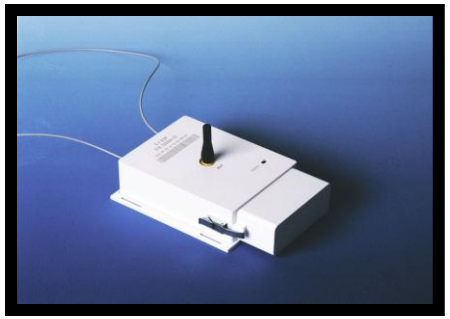
Digital Systems

Sandia National Laboratories

- Authenticated Item Monitoring System (AIMS) (1989)
  - RF seal and receiver system in tamper enclosure
  - Integrated data authentication into system
- Data authentication expertise
  - evolved from development and testing of unattended seismic stations late 1970's and early 1980's
- Associated R&D formed basis for cryptographic data authentication approaches still used today

Electronic Seals

- T-1 Radio Frequency Seal
  - Active fiber optic loop seal
    - Two-way RF communication
    - Tamper indicating enclosure and loop integrity
  - IAEA accepted for specific facility (KAMS)



- T-1A
  - Enhanced T1 capabilities
  - Smaller battery, plastic case, internal antenna, plastic fiber optic

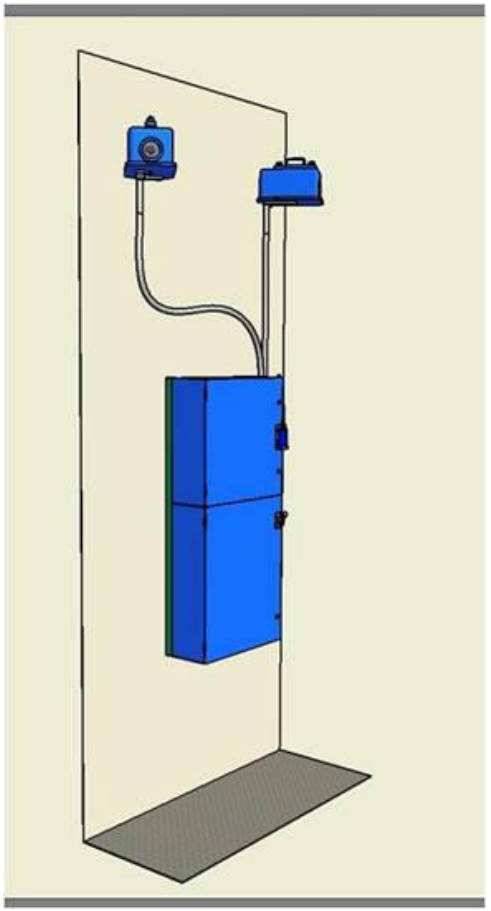
- Remotely Monitored Sealing Array (RMSA)
  - SSP architectural framework
    - Security, power, communications
  - Enhanced RF range
  - NIST approved cryptography

Pictures courtesy SNL

Secure Video Surveillance System (SVSS)

Sandia National Laboratories

- System designed and built for ABACC
  - Addresses one issue of unannounced inspections
    - Two hours could elapse between the notification of inspection arrival of inspectors at facility
  - System performs video surveillance to record facility activities in area of interest during this time
  - SVSS employs commercial, off the shelf components



Additional Support to IAEA

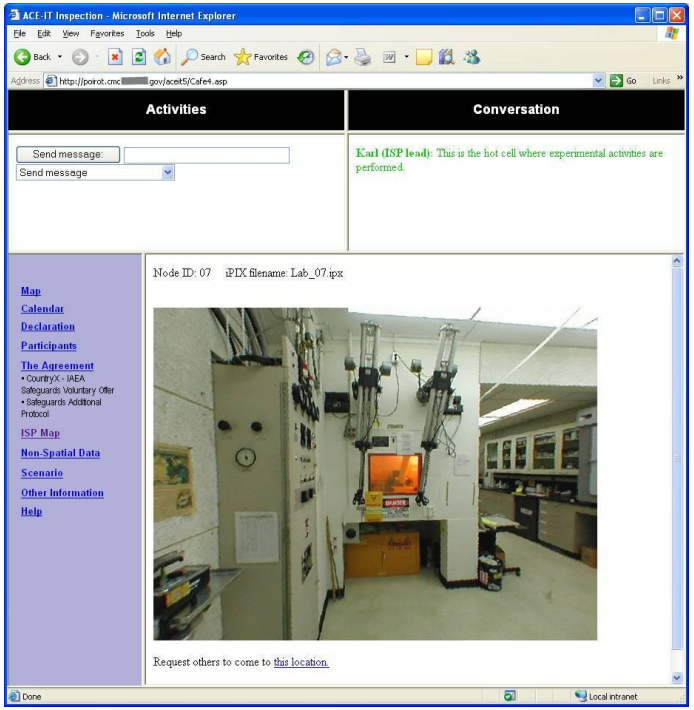
- Developed INVO information management tools for analysis and inspection (1994-2003)
  - INVO intra-net
  - Analysis visualization tool
    - Creating knowledge regarding roles and responsibilities of Iraqi organizations based on diverse information sources
  - Tools to process heterogeneous inspection data

INVO team members

Picture courtesy SNL

Leveraging capabilities

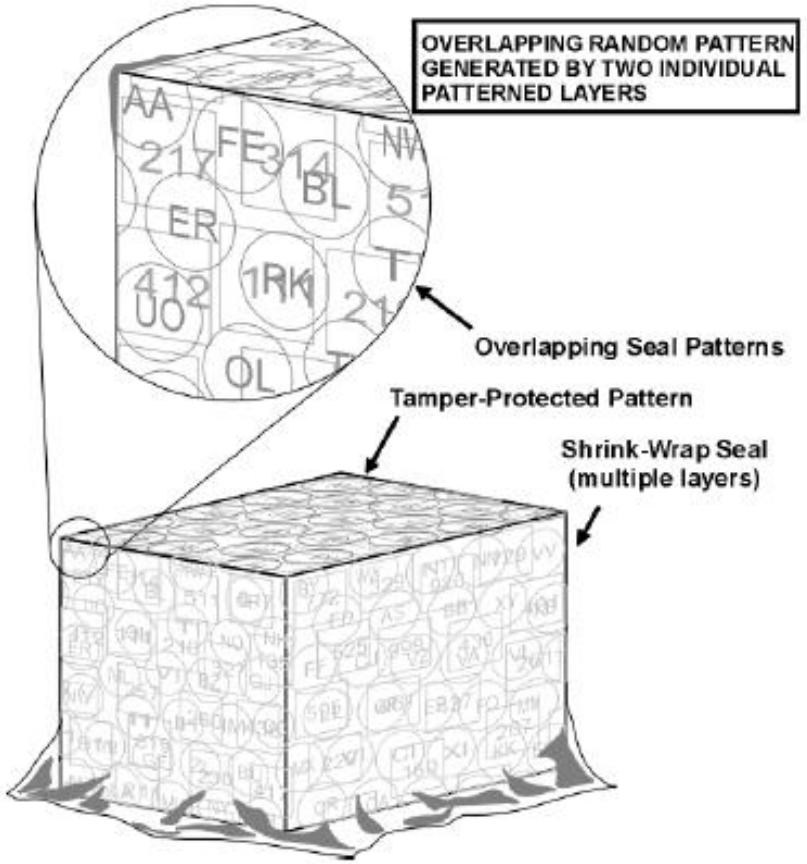
- Augmented Computer Exercise for Inspection Training (ACE-IT) (1995)
  - Trains Inspectors/Hosts for SNRI inspections
    - Developed for CWC challenge inspections
  - Scenario based virtual reality exercise
  - Modified for Additional Protocol, Complimentary Access (2002)
  - Continues to evolve and apply to various communities
    - Training
    - Confidence building measures



Screenshot courtesy SNL

Tamper Indicating Shrink Wrap

- Developed in support of Chemical Weapons Convention
- Intended for securing whole-volume elements



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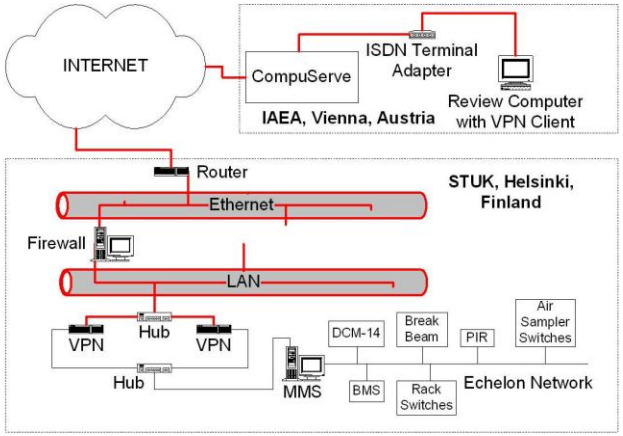
Partnering to support IAEA

- SNL performed first demonstration of secure Internet communications (VPN-based) between STUK, Helsinki, Finland and the IAEA in 1999
  - Use of public infrastructure drastically reduced communication costs and is now commonly used by IAEA
    - Previous remote monitoring communication cost tens of thousands of dollars



    - POTAS funded activity

SNL International Safeguards Areas

Sandia National Laboratories

- Equipment and Information Security
  - Authentication, encryption, tamper indication and system design
- Remote and Unattended Monitoring
  - Secure communications Internet, satellite, or telephone
  - Basis technologies for Remote Inspections
- Vulnerability Assessments
  - Ensure continued operations equipment evaluated in rigorous testing
- Containment and Surveillance (C&S) technologies
  - Technologies ensure “Continuity of Knowledge”
- Onsite Inspection and Managed Access
  - Readiness procedures and host/inspector training
- Geological Repository Safeguards
  - Objectives still being established
  - C&S methods are viewed as essential

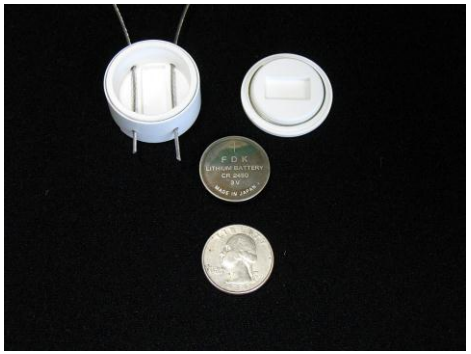
Diverse Program for Safeguards

Sandia National Laboratories

- Research:
  - Intrinsic Tamper Indicating Seal
  - Intrinsic markings
  - Open Source Geographic Information for Safeguards Analysis
  - Advanced cryptography
- Development:
  - DOE/NNSA Next Generation Safeguards Initiative (NGSI)
  - Support International Atomic Energy Agency (IAEA) Department of Safeguards requests
    - The U.S. Program of Technical Assistance to Agency Safeguards (POTAS)
- Technical Engagement:
  - Bilateral Cooperation Agreements between the U.S. Department of Energy (DOE) and various international partners Office of Global Security Engagement and Cooperation
    - Regional Safeguards authorities: Euratom, ABACC
    - States: Japan, Korea, France, Brazil, Argentina, Australia, and many others

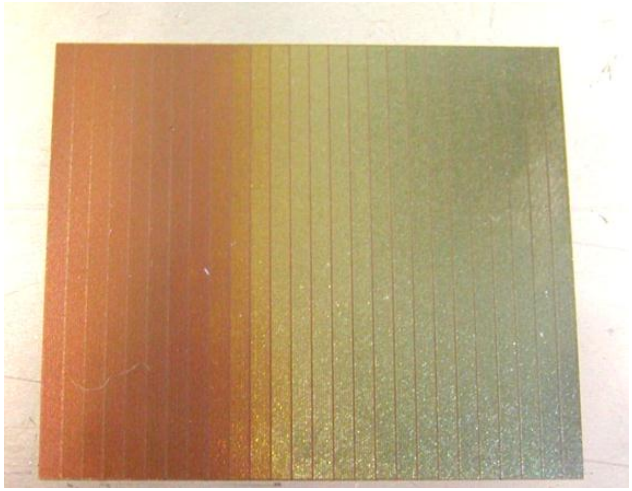
Research Projects

- Intrinsically Tamper Indicating Ceramic Seal (ITICS)
  - Ceramic based seal to replace globally deployed metallic seal



Picture courtesy SNL

- Intrinsic, unique identification markings and patterns

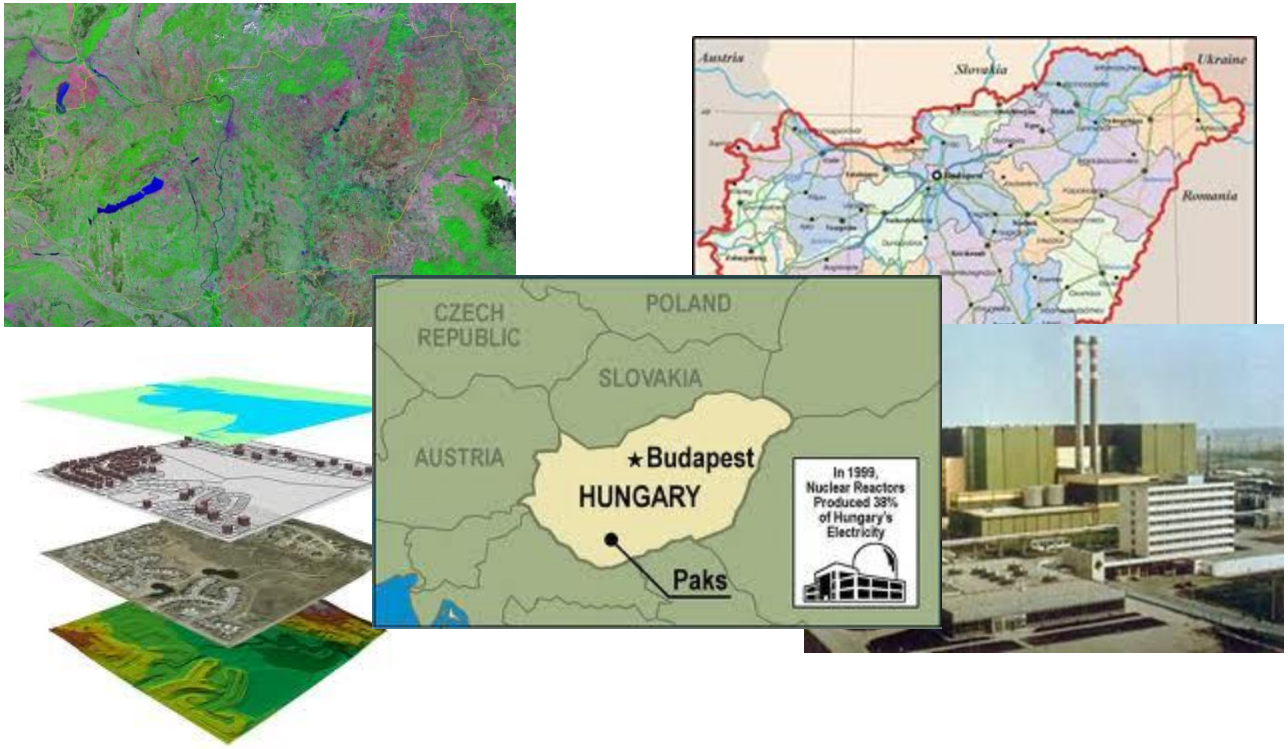


Picture courtesy SNL

Research Projects-Information

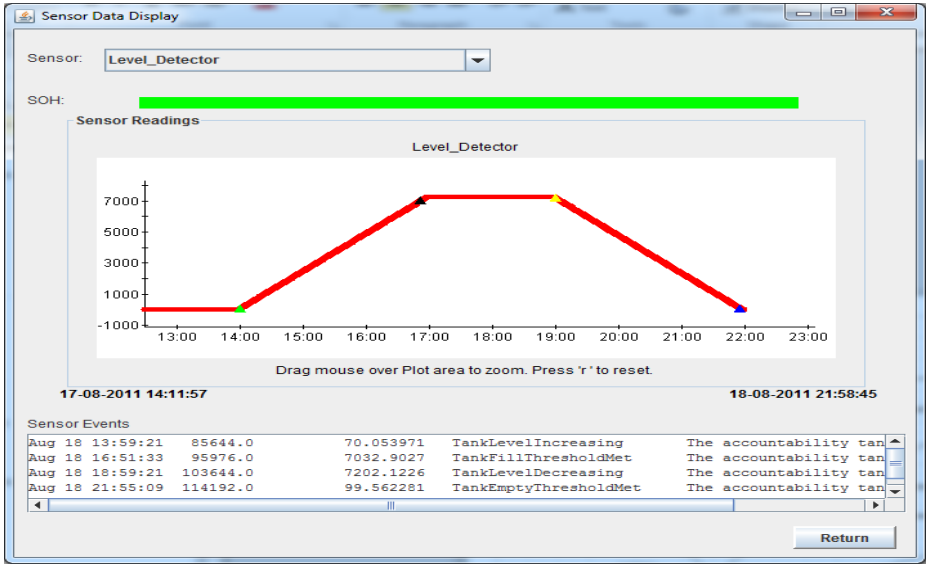
Sandia National Laboratories

- Open Source Geographic Information for Safeguards Analysis
  - Researching means to improve analyst ability to harvest geo-referenced information from open sources for safeguards analysis



Research Projects-Information

- Knowledge Generation (2000)
  - Software to compare operator declarations with plant operations
    - Useful for large, heterogeneous data sets
    - Recently applied to data generated from reprocessing plant model
      - Limited scope but results were encouraging



Transparency Agreements

Sandia National Laboratories

- Highly Enriched Uranium Transparency Implementation Program
  - Transparency element of the US/RF Agreement to dispose of 500 MT of Russia HEU (Megatons-to-Megawatts)
  - SNL activities include
    - Monitoring visits
      - Special Monitoring Visits
        - » 4 sites, typically 1 week duration
      - Transparency Monitoring Office
        - » 2 sites, typically 3 month duration
    - Radioactive Source Management
      - Negotiate and manage purchase, installation, certification and disposal of radioactive sources for Blend Down Monitoring Systems at 3 sites
    - Seal Program
      - Implement all aspects of seal deployment

A sampling of Sandia POTAS tasks

Sandia National Laboratories

- Remotely Monitored Sealing Array (RMSA)
- Vulnerability Assessment of the Ultrasonic Sealing Bolt (USSB)
- Vulnerability Assessment of the “Sign and Forward System”
- Weld Reflective Particle Tag
- Consulting on Equipment Security
- Consulting on Information Collection and Analysis Systems
- Mobile Monitoring System for Container Transport (MMCT) at Chernobyl
- Universal Nondestructive Assay Platform (UNAP) Workshop

Other activities

- Test and Evaluation capabilities
  - Perform various installation, operation, and evaluation activities
    - Discrete device testing
      - Performance
      - Environmental
    - Radiation Portal testing
  - Outdoor Test Facility (OTF)
    - Evaluate ground sensor systems
  - Perimeter Security systems
    - T&E of detection sensor systems
- Training
  - Physical security training-training SMEs
    - International Training course
    - International country training courses
    - DOE and NRC physical security training course

Pictures courtesy SNL

Summary

Sandia National Laboratories

- Sandia has a long history in the area of International Safeguards
- We continue to build upon this experience base to assist the community
- We view Information assurance as a broad application space
  - From discrete sensors to operations and procedures
  - Information protection requires systems approach
- We access the resources across Sandia to help us accomplish our work