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Sandia National Laboratories

International Nuclear Safeguards Human Capital Development at Sandia National Laboratories

ANS Advances in Nuclear Nonproliferation Technology and Policy

Santa Fe, N.M.

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Risa N. Haddal

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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To Be Addressed

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- Summary of SNL HCD efforts 2008-2016
  - University Engagement
  - Safeguards Internships
  - Training and Professional Development
  - Human Resource and Technology Development
  - International Engagement

University Engagement

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- Universities engaged
  - Fordham University
  - Georgia Institute of Technology
  - Metropolitan State College
  - Missouri University of Science and Technology
  - New Mexico Institute of Mining and Technology
  - Stanford University
  - Texas A & M
  - University of California, Berkeley
  - University of Maryland, Baltimore County
  - University of Missouri
  - University of New Mexico (UNM)
  - University of South Alabama
  - University of Tennessee

THE UNIVERSITY of NEW MEXICO

FORDHAM UNIVERSITY
THE JESUIT UNIVERSITY OF NEW YORK

TEXAS A&M UNIVERSITY

USA UNIVERSITY OF SOUTH ALABAMA

Berkeley
UNIVERSITY OF CALIFORNIA

University Engagement Continued

- Other university outreach/engagement efforts
  - SNL provides the NPT and safeguards lecture for the UNM *WMD Nonproliferation Science and Polic*y Course (Offered each Spring, funded internally.)
  - SNL collaboration with LANL on UNM *Nuclear Safeguards and Nonproliferation* course
    - Focus: Methods and technology associated with nuclear material safeguards and application on nuclear material detection, tracking, and accounting.
    - 2013-2016: 25 undergraduate and 13 graduate students have completed.
- Success stories/best-practices
  - In-classroom lectures spark interest in safeguards.
  - Linking context of safeguards challenges with current events (Iran, DPRK, etc.) fuels interest in the field.
  - Face-to-face discussions with students; support for internships.

Safeguards Internships 2008-2016

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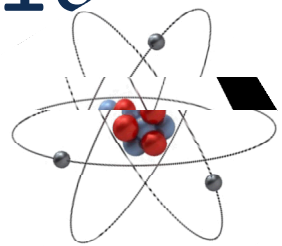

- Number of NGSI internships supported:
  - 17 internships (graduate and undergraduate)

- Recent statistics/metrics on interns since 2014:
  - Fordham University, University of New Mexico (UNM), University of South Alabama
  - Majors: Nuclear Engineering, Political Science, Computer Science
  - Number of interns attending INMM (pre-2011): 2
  - Number of interns returning for a second internship: 2 (+1)
  - Percentage of interns on NA-24 vs. NA-22 safeguards projects:
    - Majority NA-24

- Success stories/best-practices
  - Two Sandia interns participated in the PNNL Summer Safeguards Course.
    - Foundational safeguards knowledge
    - Professional networking
  - FY16 Fordham University undergraduate intern (policy)
    - UAV for safeguards project (NA-241)
    - Passionate about subject matter
    - Self-starter, independent
    - Bringing on year-round to support NGSI and PNS topics

Training

Since 2011, SNL has enrolled early- to mid-career staff in training to strengthen safeguards expertise and technical capabilities.

- Course name, length, and focus:
  - *INL Pre-Inspector training course* (INL, June 2011 and May 2015)
  - *LANL Fundamentals of Nondestructive Assay* (LANL, April 2013)
  - *ESARDA Safeguards and Nonproliferation course* (2012)
  - *Safeguards Training Course* (SNL, January 2010)

Professional Development

- Recent efforts to reach and engage mid-career and young professionals via training and seminars

FY16:

- 1 early/mid career staff
  - *Nuclear Facilities Experience (NFE) in Japan – May 2016*
- 4 early- and mid-career staff
  - *Nonproliferation Seminar (*DC) – July 2016
  - *Reactors in Commercial Nuclear Industry* (ANL) – September 2016
  - *Cybersecurity for Safeguards Course* (PNNL) – September 2016
- 2 interns
  - *Intro to Nonproliferation and Safeguards* course (PNNL) – June 2016

FY15:

- 1 mid-career staff
  - *IAEA Pre-Inspector Training Course (INL) – May 2015*

FY14-16:

- *NGSI Summer Safeguards Lecture Series*

Professional Development

- Involvement with the Next Generation Safeguards Professional Network (NGSPN)
  - FY15: 1 SNL staff member at INL event
  - FY14: SNL co-hosted with LANL
- *Success stories/best-practices*
  - NGSPN collaboration with LANL (2014):
    - Positive, educational experience
    - Fostered collaborative relationship between labs

NGSPN March 2014
Albuquerque, NM

Human Resource Development

Hiring

- 2010-2016: 4 full-time early- to mid-career staff to support NA-24 sponsored projects.
- Customers: INSEP, C&A, SG Tech and HCD subprograms

Knowledge retention activities

- Informal mentoring/knowledge transfer through daily project work
- Management support for for ad-hoc mentoring and career conversations
- Prior to retirement, portfolio responsibilities transferred to early- to mid-career staff as early as possible
- Retiring personnel and support staff organize electronic and physical files based on portfolio topic; assign to new POCs
- Retirees participate in professional networks (INMM, ANS, IEEE), but there is no formal mentoring program and post-retirement contracts are limited

Technology Development

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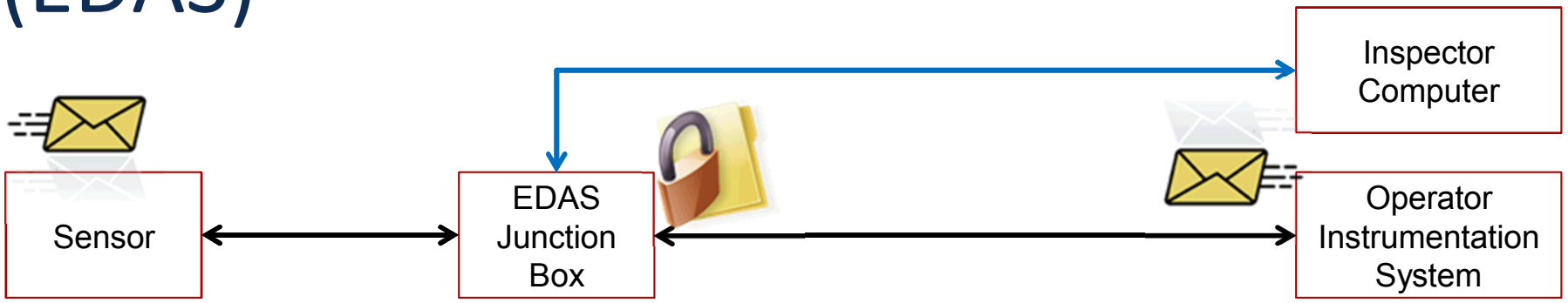
- Draws upon substantial core R&D across a wide scope of fundamental science and engineering disciplines.

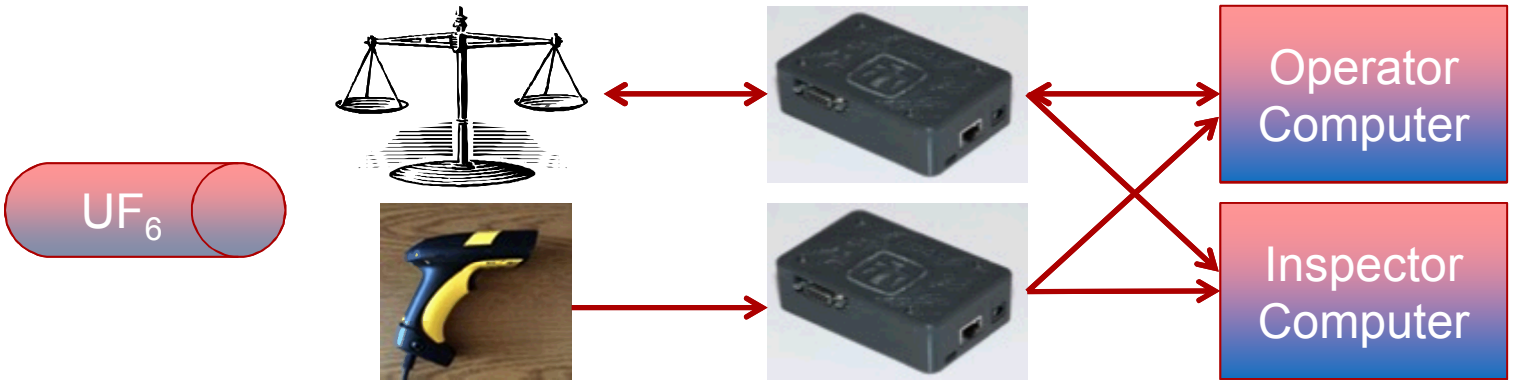
- Examples:
  - Remotely Monitored Sealing Array (RMSA)
    - Low-power/low-bandwidth active seal
    - Stores, forwards and communicates data via RF
    - Uses authentication and Encryption
  - Enhanced Data Authentication System (EDAS)
    - Prototype technology used to duplicate information from a measurement system to a secondary observer.
    - Inserts a secure “branch” in existing instrumentation

Enhanced Data Authentication System (EDAS)



EDAS Field Trial

- Demonstrate secure branching under realistic operating conditions
- Identify any unanticipated issues with EDAS operation and installation
- Derive narrative of facility activity from multiple operator instruments



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Remotely Monitored Sealing Array (RMSA)

- Developed in response to SP-1 (circa 2010)
- Active loop seal for IAEA Safeguards application
  - Seal integrity and status reported via authenticated/encrypted wireless transmission to a central "translator"
  - Seals units are optimized for low power consumption and last 4-5 years on battery without replacement
  - Plastic fiber optic seal cable is easy to install and terminate
  - Incorporates advanced tamper indication and communications capabilities
  - Low life-cycle cost

- IAEA has approved RMSA for routine inspection use
- IAEA now commencing procurement (Canberra) and deployment
- SNL Principal Investigator:
  - Ross Hymel

RMSA pre-production prototype

International Engagement

- Since the 1990s, SNL has engaged in international safeguards technical cooperation with partners worldwide.
- Countries


South Korea


France


Germany


Japan


Argentina


Brazil

- International Organizations


Euratom


IAEA

ABACC

- Primary Customers
  - DOE/NNSA: INSTEP
  - U.S. Department of State: Partnership for Nuclear Security (PNS)

Conclusion

- SNL's HCD efforts have strengthened human capital to help address declining pool of U.S. safeguards expertise through engagement at:
  - Sandia National Laboratories
  - Universities
  - DOE/NNSA complex
  - International partner organizations

- Efforts include university engagement, coursework, training, internships, technology development and international partnerships.

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Questions?