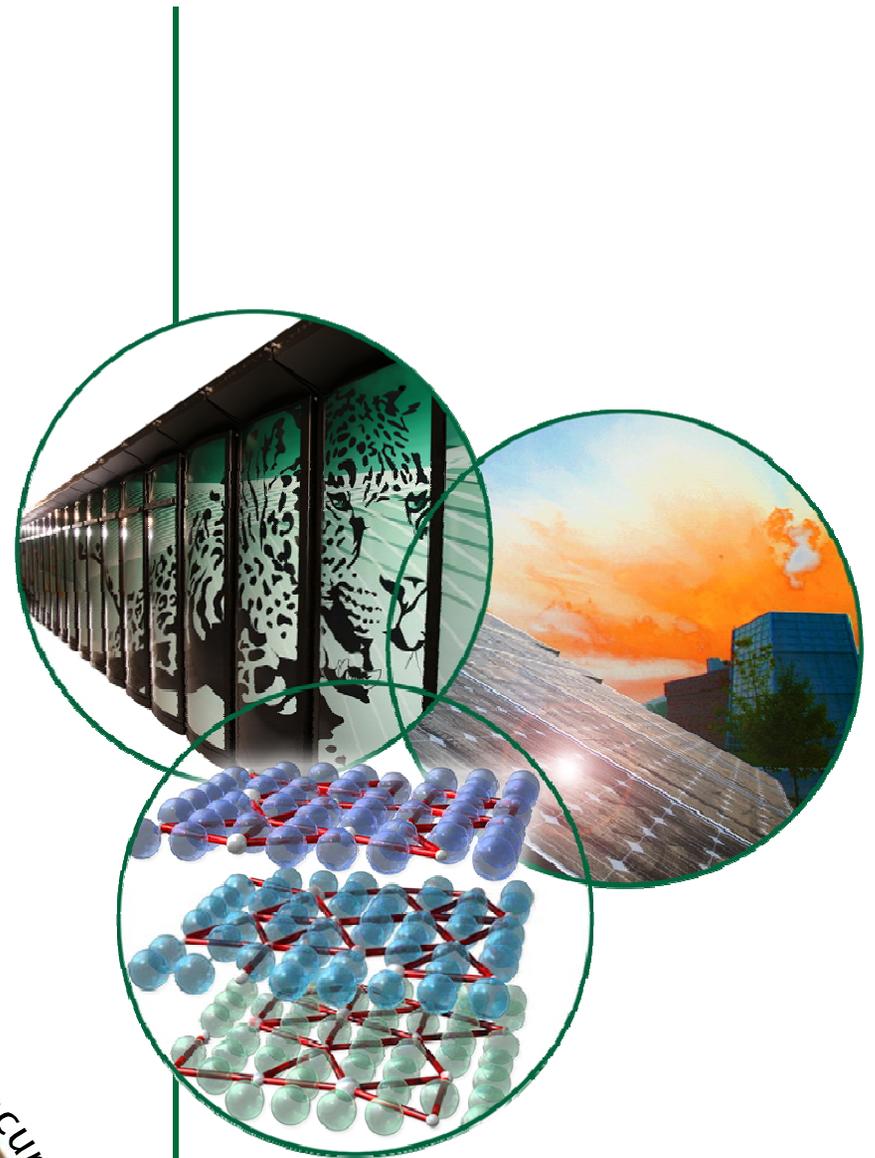


Defining the Need— ORNL Perspective

Nuclear Security: The Intersection of Policy, Science, and Technology

Alan S. Icenhour, Ph.D.
Director
Global Nuclear Security Technology Division

July 20, 2010



Background—Nuclear Fuel Cycle Development in Oak Ridge

- Oak Ridge facilities constructed as part of the Manhattan Project
- Research work to develop processes needed to produce the fissile material for both uranium and plutonium weapons
- The Oak Ridge complex housed fully two-thirds of the crash \$2 billion (>\$25 billion in today's dollars) Manhattan Project
- The work was performed in secrecy at 3 sites given "code names": "K-25" Site, the "X-10" Site, and the "Y-12" Site



Oak Ridge National Laboratory Evolved from the Manhattan Project



ORNL in 1943
The Clinton Pile was the world's first
continuously operated nuclear reactor

Today, ORNL is DOE's Largest Science and Energy Laboratory

- \$1.5B budget
- 4,500 employees
- 4,000 research guests annually
- \$500 million invested in modernization

- Nation's largest concentration of open source materials research
- World's most intense pulsed neutron source and a world-class research reactor

- World's most powerful open scientific computing facility
- Nation's most diverse energy portfolio
- Managing the billion-dollar U.S. ITER project



ORNL April 2000



Stimson_1008

5 Managed by UT-Battelle
for the Department of Energy

 **OAK
RIDGE**
National Laboratory

We Have Made Significant Investments to Modernize ORNL



Stimson_1008

6 Managed by UT-Battelle
for the Department of Energy



Transforming the Laboratory with 21st Century Research Facilities

East Campus



Chestnut Ridge Campus



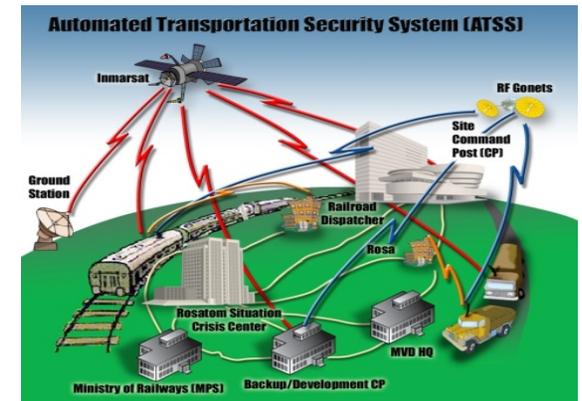
Science and Technology Park



West Campus

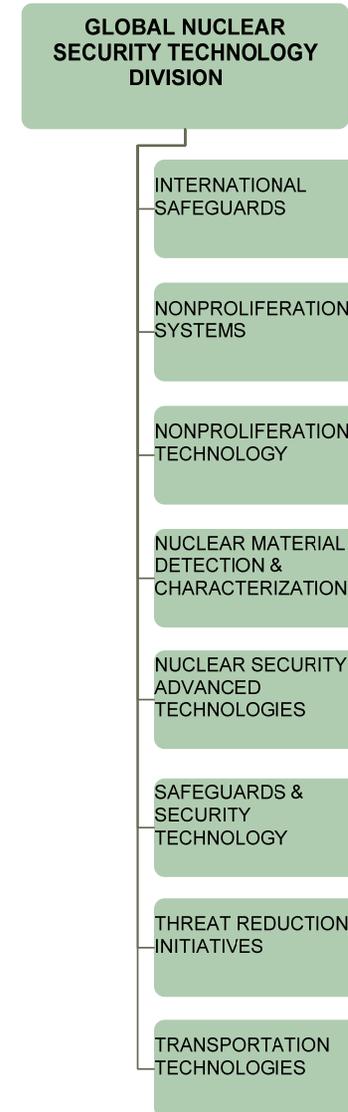
Global Nuclear Security Technology Division

- **Mission:** Research, development, and deployment of science and technology for nuclear nonproliferation, safeguards, threat reduction, transportation security, and related areas
- **Leadership Areas:**
 - Nuclear Radiation Detection
 - Safeguards Systems Development, Testing, and Deployment
 - Comprehensive, Integrated, Safeguards, and Security Program Development
 - Export Control Implementation
 - Comprehensive Vulnerability Assessment
 - Safeguards and Security Information and Knowledge Management
 - Nonproliferation Systems, Policy, Education, and Logistics and Controls
 - Global Threat Reduction
 - Transportation Security and Technology
 - Material Protection Systems
 - International Safeguards and Collaboration
- **Sponsors:**
 - DOE/NNSA
 - DOD, DHS, NRC, and other government agencies



GNSTD—Building Strong Teams Based on a Diverse Range of Skills

- **About 200 staff members**
 - **156 full-time**
 - **Balance are post-docs, post-masters, subcontractors, student interns**
 - **Joint faculty appointments**
 - **University of Tennessee (UT) Governor's Chair for Nuclear Security**
 - **UT, Texas A&M, North Carolina State**
- **Wide range of educational backgrounds**
 - **Engineering disciplines**
 - **Science disciplines**
 - **International relations and policy**
 - **Project management**



ORNL's Nuclear Security Support Activities

Shaping the Future Of Nuclear Security...

Nuclear Lockdown: 1st Line of Defense



Bolstering Border Security 2nd Line of Defense



Enhancing International Export Control



Global Threat Reduction- Convert, Remove, Protect



Nuclear Security R&D



International Safeguards & Security

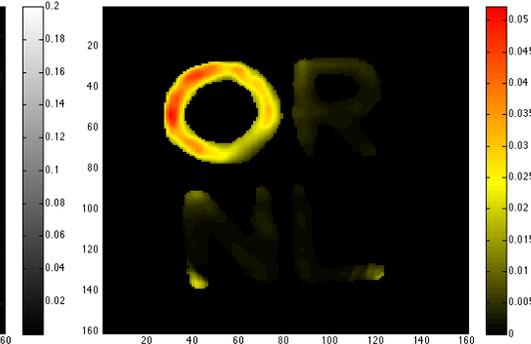
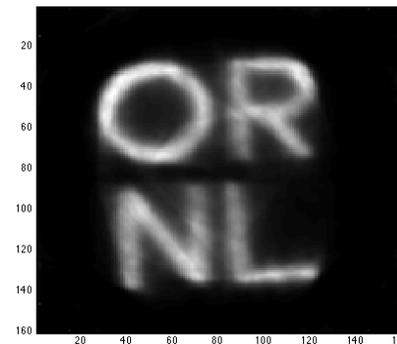
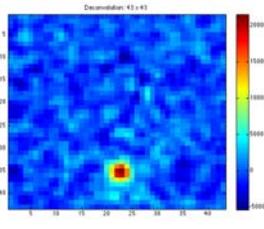
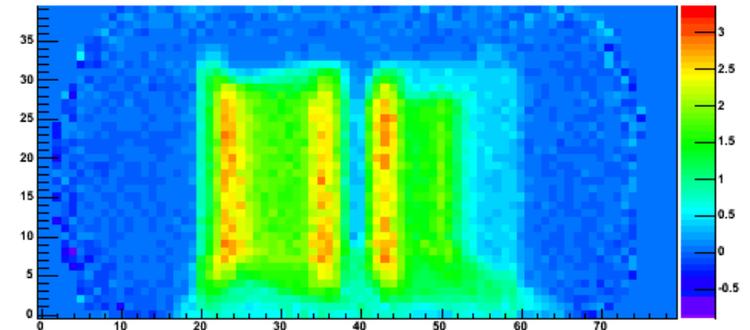
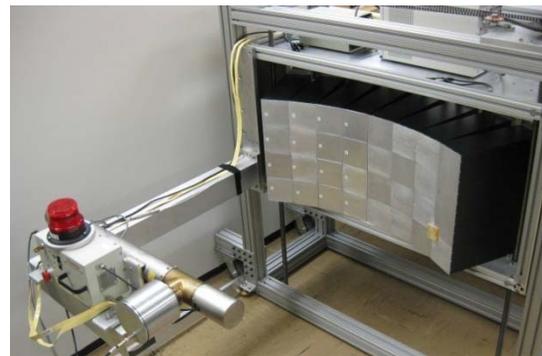
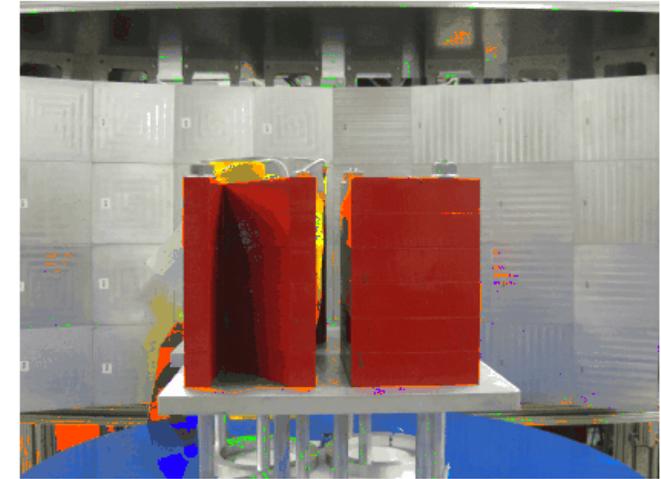


Verification Technologies



ORNL Radiation Detection R&D Addresses Nuclear Security Challenges

- Advanced Portable Neutron Imaging System (APNIS) now operational in two modes
 - Radiography and tomography, including induced fission density imaging
 - A fast-neutron coded aperture imager (to our knowledge, the world's first)



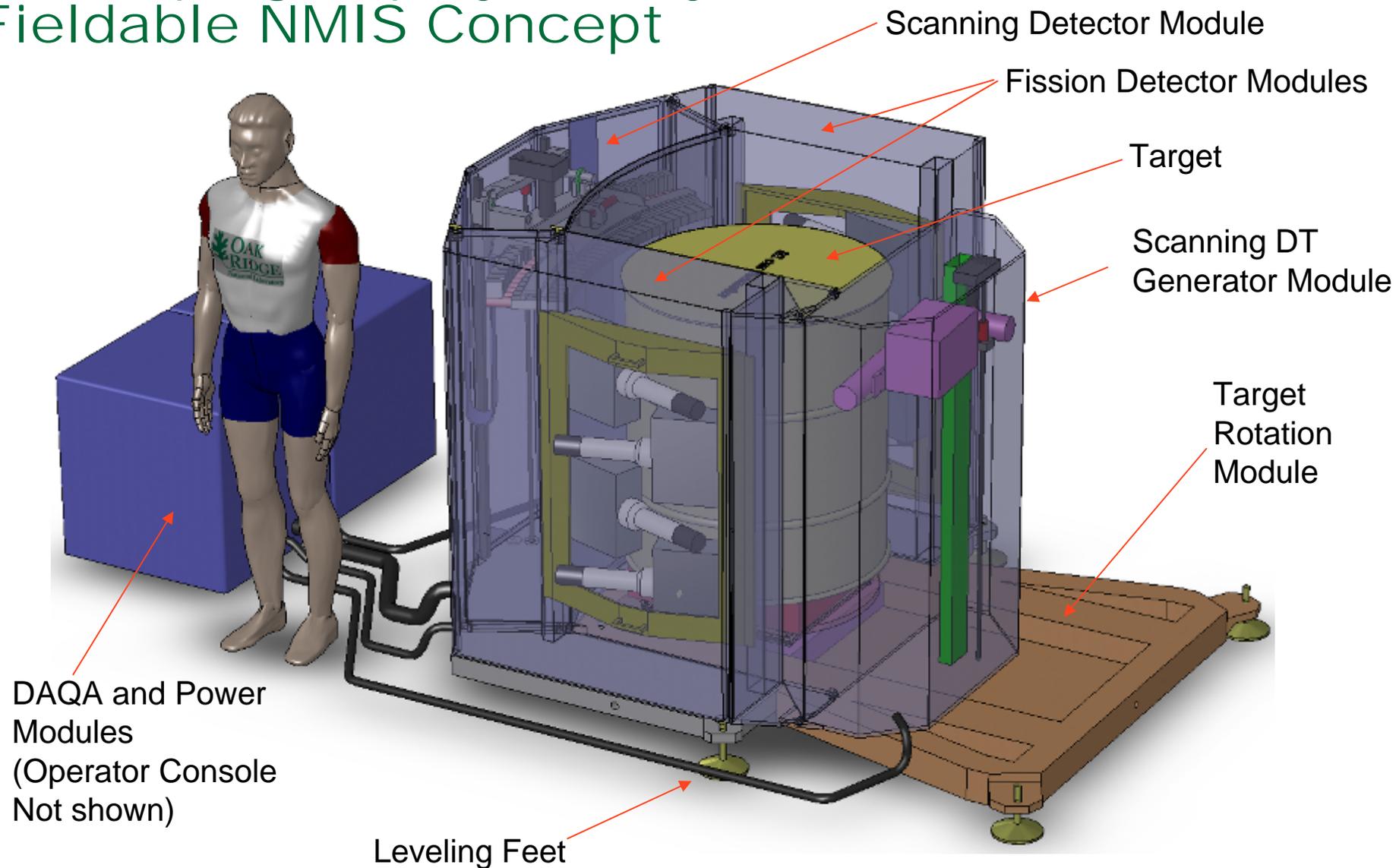
Photograph

Transmission

Fission



Developing Deployable Systems— Fieldable NMIS Concept



FNMIS With Target Rotation Module

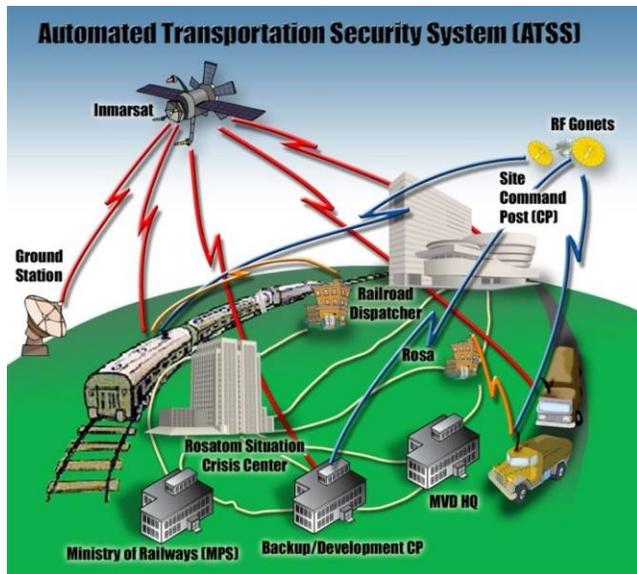
ORNL Portal Monitoring Laboratory

- Radiation portal monitor (RPM) evaluation
 - Testing (indoor and outdoor)
 - Resolution of field issues
- Data analysis of daily files from RPM
- Storage repository for all RPM data



Transportation Technologies—Safety and Security Applications for Radioactive and Nuclear Materials

- Development and deployment of secure transportation systems and equipment in Russia
- Transportation security expertise for shipment of radioactive sources, domestically and internationally
- Development of new Type B packages for nuclear and radioactive materials (certification tests)
- Coordinating plans for shipments of radioactive materials



Radioactive material package testing has been conducted at ORNL for nearly 50 years in support of DOE and other sponsors

Transportation Security



Drawing on our Broad Fuel Cycle Experience, ORNL Assists in “Closing the Loop”

High Risk



HEU fuel and enrichment technology components removed as Libya renounced intentions to develop nuclear weapons program (**RRRFR program**)

Tajura Research Center, Tripoli, Libya

Material shipped to RIAR, Dimitrovgrad, Russia for secure storage (**MPC&A program**)



Low Risk



ORNL directs a team of material monitors who ensure that material received is correct and material is blended down (**MCC program**)

International Safeguards

Strengthening the application of international safeguards systems through technical assessments, methods development, operational testing, training, destructive and nondestructive analysis, and online support

ORNL Roles:

- **Technical support to international partners** to improve implementation of International Safeguards
- **Training assistance to IAEA** for future and current Safeguards Inspectors
- **Ad hoc support** for high-priority inspections by the IAEA
- **Equipment development and deployment**
- **Tech support** for international negotiations
- **Safeguards Lab** – National User Facility



Drum inspections and measurements in South Africa



Collaboration with Brazilian regulatory commission

ORNL Safeguards Laboratory

- DOE Designated National User Facility devoted to research and international collaboration
- SL is accessible (employees, non-employees, U.S. citizens and foreign guests)
- Special nuclear materials are available and can be used for training, testing, and research
- Internationally-recognized capability for conducting hands-on testing, evaluation, validation, and training for integrated safeguards methods, procedures, and instrumentation



International Export Control

Regulating the use and supply of sophisticated, but dangerous, technologies that could contribute to the spread of nuclear, chemical, and biological weapons, as well as missile delivery systems

ORNL Roles:

- Evaluation and assessment of export licenses of potentially dual-use goods
- Technical support of international export control training
- Assistance in development of comprehensive regulations
- Technical assistance in interdiction efforts relating to nuclear smuggling
- Support for international negotiations



Identifying export-controlled material and equipment



Strengthening export control procedures worldwide



Nonproliferation Engagement, Training, and Outreach

- International engagement
- Technical assessments
- Methods development
- On-site support
- Training and specialized workshops
- Recent Conferences and workshops
 - American Nuclear Society
 - Institute of Nuclear Materials Management
 - European Safeguards
 - Containment and Surveillance workshop



Workforce Challenges—ORNL is Facing the Same Demographic Challenges as the Rest of the Community

- Large population of retirement-eligible or soon-to-be retirement-eligible employees
- Post Cold War drawdown of personnel, facilities, and capabilities—the career pipeline disappeared!

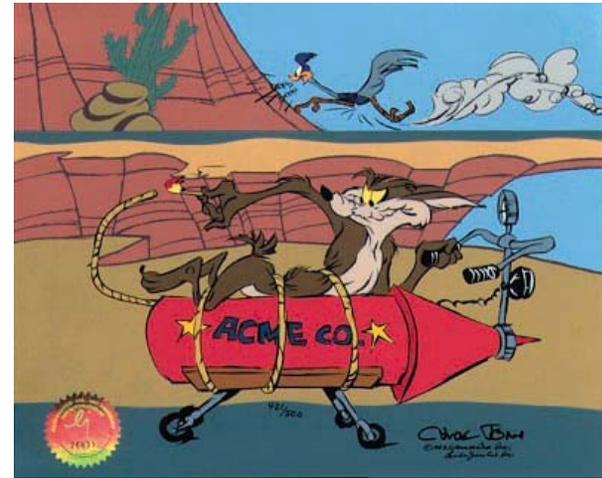
We are aggressively recruiting and hiring to address this approaching bow wave of personnel needs

- In a lot of cases, the personnel who will be retiring over the next few years serve as the corporate memory for specialized expertise dating back to the Manhattan Project

In some cases, there is currently no way of replacing this intimate, hands-on expertise that has been developed over many years. We need to capture and transfer knowledge

ORNL Hiring Challenges

- Organizations are jointly drawing on a dwindling labor pool of seasoned S&T personnel with hands-on experience in the nuclear fuel cycle—we are chasing the same people and we need to develop more
- A “nuclear renaissance” will create an additional drain on available S&T resources
- The supply of experienced personnel in some technical specialties (such as uranium enrichment) is very limited

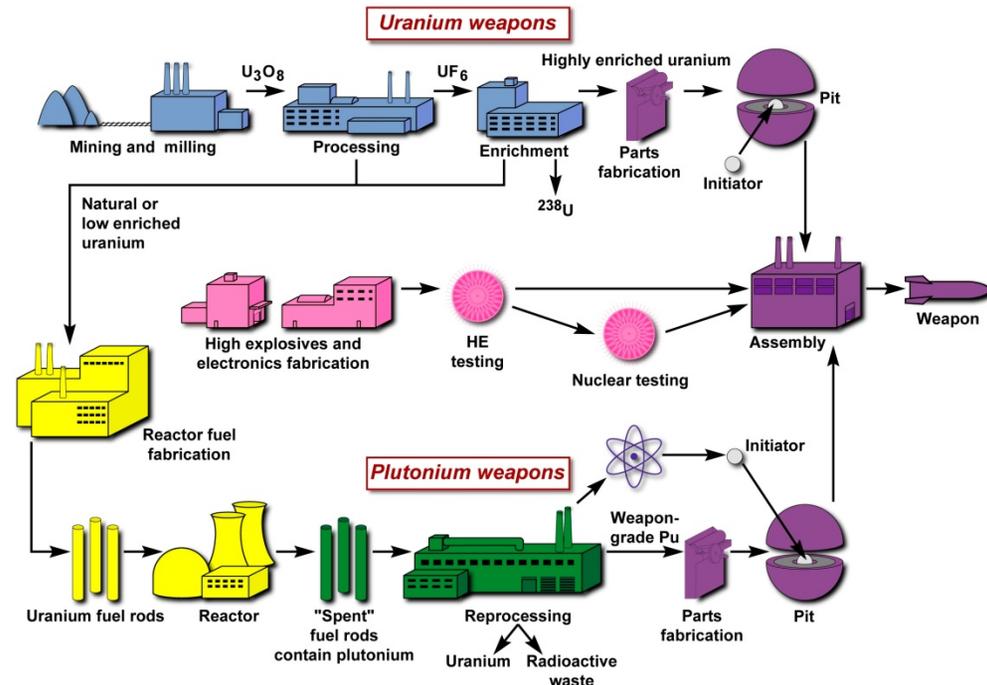


The Multidisciplinary Nature of the Nonproliferation and International Safeguards Mission Space Requires Diverse Skill Sets



Education:

- Chemical Engineering
- Chemistry
- Electrical Engineering
- Mechanical Engineering
- Nuclear Engineering
- Physics
- Political Science . . .



Experience:

- Nuclear Fuel Cycle
- Nonproliferation
- International Safeguards
- Security
- Program/Project Mgmt
- System Engineering
- Policy . . .

Collectively, the workforce needs knowledge of both policy and technology

ORNL is Taking a Number of Steps to Address Staffing Challenges

- **Understand and communicate our needs**
 - Traditional business planning: capabilities, programs, staffing, equipment, facilities
 - Succession planning
 - Functional analysis
- **Establish a clear pipeline from education to employment**
 - Hands-on experience at real facilities
 - Continuing professional development opportunities
 - Next Generation Safeguards Professional Network
- **Strong University partnership and presence**
 - Joint appointments
 - Internships and post-doc/masters programs
 - ORNL/UT Graduate program—strong integration of adjunct faculty, distinguished graduate fellowships
 - Seminars/short courses/recruiting booths/visits
 - Foster development of joint education programs; support development of curricula and programs that provide multidisciplinary experiences



Summary

- As a multi-purpose, multi-program lab, ORNL has a broad spectrum of capabilities that provide timely nonproliferation support to DOE that is vital to US National Security interests
- Multi-disciplinary approaches are required to address nuclear security challenges—we operate at the intersection of policy, science, and technology
- University-Laboratory partnerships are an important element of developing the next generation workforce



Questions ?