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# Future Verification Challenges for Nuclear Arms Reductions

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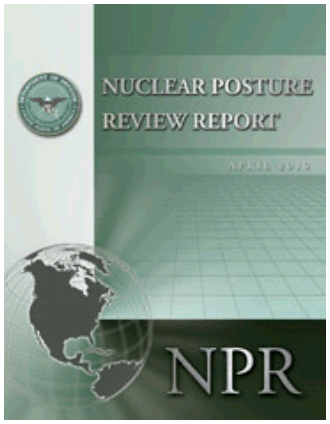
# National Policy Foundation

"…negotiate a new Strategic Arms Reduction Treaty with the Russians this year. … And this will set the stage for further cuts, and we will seek to include all nuclear weapons states in this endeavor."

**President Obama, Remarks in Prague**
**April 2009**



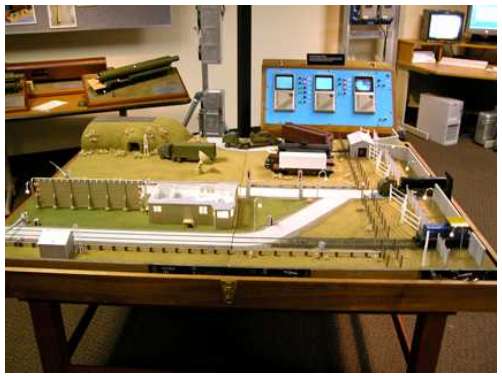

"Non-strategic nuclear weapons, together with the non-deployed weapons of both sides, should be included in any future reduction arrangements between the United States and Russia."

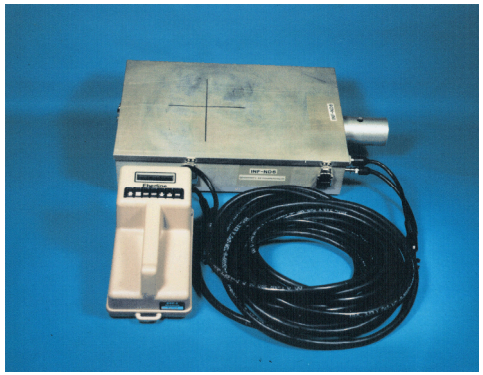
**Nuclear Posture Review**
**April 6, 2010**

"… the United States will seek to initiate, …, negotiations with the Russian Federation on an agreement to address the disparity between the non-strategic (tactical) nuclear weapons stockpiles of the Russian Federation and of the United States and to secure and reduce tactical nuclear weapons in a verifiable manner; …"

**Senate Resolution of Ratification, New START Treaty**
**December 2010**

# Precedents in INF, START, and New START

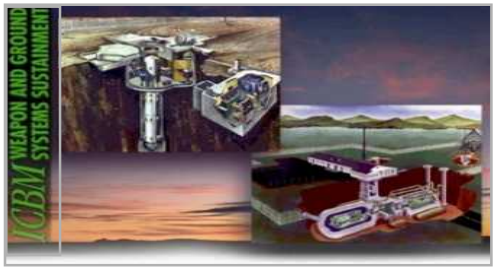


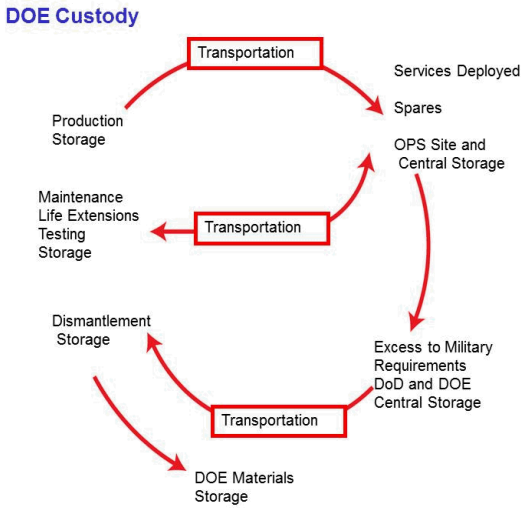


- INF Treaty – eliminated nuclear and conventional ground-launched ballistic and cruise missiles with ranges 500-5500 km
  - First use of on-site inspections in nuclear arms reductions
  - Portal-perimeter monitoring at missile production facilities
  - Radiation detection equipment used to distinguish SS-20/SS-25s
  - Monitored destruction of delivery vehicles
- START Treaty – Limitations on deployed strategic weapons
  - On-site inspections to count launchers
  - Warhead counting handled through attribution
  - Radiation detection equipment used to confirm non-nuclear items
  - Notifications of movements
- New START Treaty – further reductions of deployed strategic weapons
  - On-site inspections to count launchers and deployed warheads
  - Radiation detection equipment used to confirm non-nuclear items
  - Notification of movements

*Emphasis on delivery vehicles and deployed strategic systems reduces intrusiveness; limits on non-deployed warheads introduce new challenges*

# Enterprise-Level Challenges for Accountability of Non-Deployed Warheads




- A warhead accountability regime could potentially encompass much more of the NWE
  - ICBM, SSBN, Strategic bomber bases
  - Bases for non-strategic systems, dual-capable delivery vehicles
  - Storage depots
  - Support facilities
  - DOE Facilities

- The warhead lifecycle is a dynamic, ongoing process

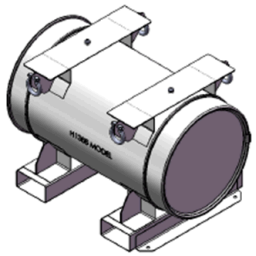
# Potential New Verification Needs

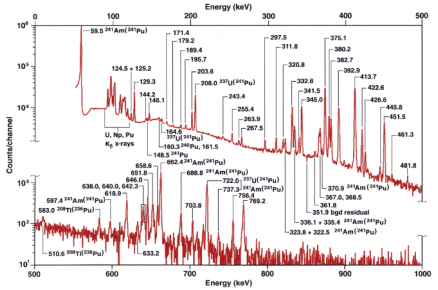
- Confirm that an item declared to be a nuclear warhead is as declared
- Inspect, authenticate and account for declared warheads of various types
- Confirm the declared number and status of non-deployed warheads
- Maintain chain of custody for warheads during transportation, storage, and retirement
- Confirm dismantlement / destruction of retired warheads

# A Model for Thinking about Warhead Monitoring


- Initialization – The set of procedures relating to entry of a declared TAI into a treaty accountability regime
- Chain of Custody – The process of monitoring the status of a monitored item as it moves between locations or resides at a location.
- Warhead Confirmation – The process by which a monitoring party gains appropriate confidence that a declared item is a nuclear warhead as declared
- Dismantlement – The stage in the disassembly process where the fissile material has been separated from the high explosive

# Technical Challenges for Accountability of Non-Deployed Warheads

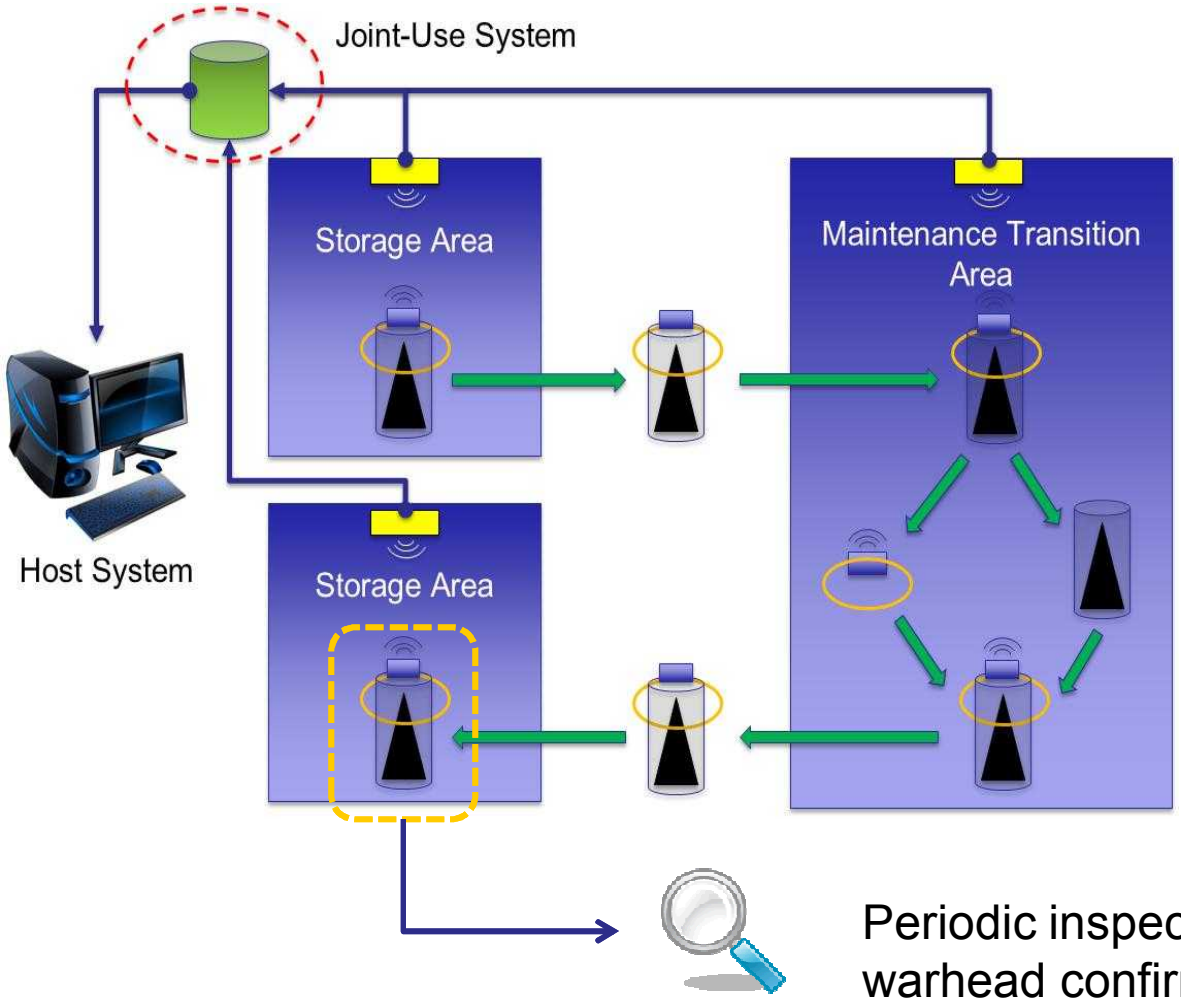





Spectrum of unclassified source

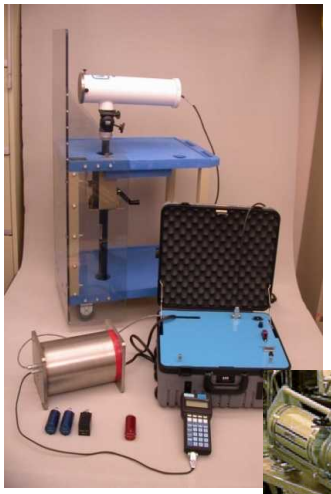
- Non-deployed warheads are stored in a variety of containers and configurations
  - Containers
  - Bolsters (single and double-stack)
  - Rotary launchers
  - Pylons
- Lower limits may require more stringent verification
  - Confirmation that a declared item is a warhead
  - Monitored dismantlement
- Technology introduces risks and complexity
  - Authentication
  - Certification
  - Protecting sensitive information, e.g., design information
- In situ measurements challenging
  - Other nearby sources
  - Configurations/geometry may change

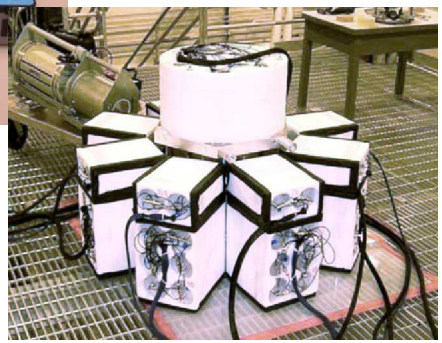
# Notional Monitoring Approach

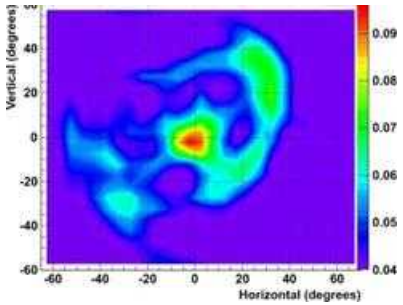



Periodic inspections including warhead confirmation

# Technical Challenges of Warhead Authentication

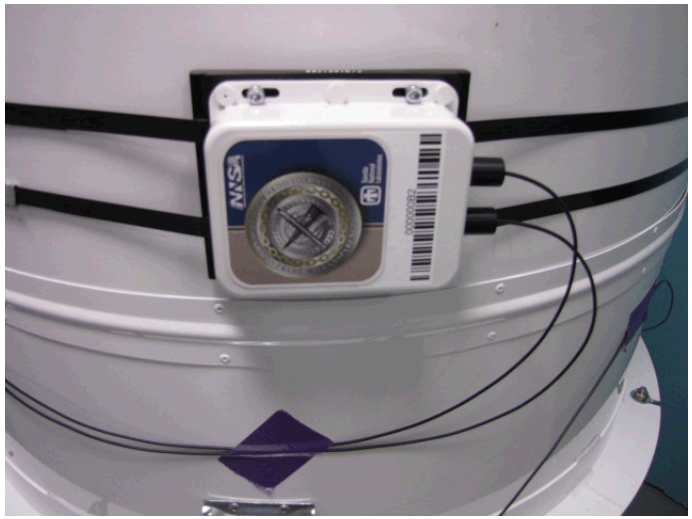







- How to be confident that a declared item is a warhead?
  - Attributes: presence of SNM, SNM mass, isotopic composition, geometry
  - Templates – comparison to a warhead with a known provenance
- Challenges
  - Which set of measurements is sufficient
  - Measurement times
  - Measurement geometries
  - Background and presence of other sources
  - Changes to fissile material over time
  - Information Barriers

# Experiments at a Test Bed Help Evaluate Technologies



Item monitor mounted to a mock storage container

Typical evaluation experiment configuration

Container being transferred from truck (background) to the tunnel


Image from monitoring system

# A Systems Approach to Developing Verification Technology Options