FROM ABSENCE MEASUREMENTS TO VERIFIED DISMANTLEMENT OF NUCLEAR WEAPONS

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Toward Nuclear Disarmament

Building up Transparency and Verification

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Foreword
Ambassador Rüdiger Bohn

Executive Summary

1. Baseline Declarations
Mona Dreicer

1.a Appendix: Secure Declarations
Sébastien Philippe

2. Monitoring Regimes for All-Warhead Agreements
Alexander Glaser

3. Fissile Material Stocks and Production
Sharon Squassoni and Malte Göttche

4. Nuclear Monitoring and Verification Without Onsite Access
Alexander Glaser and Irmgard Niemeyer

5. Weapons Production and Research
Moritz Kütt

6. Conclusion: Building up Transparency and Verification
Malte Göttche and Alexander Glaser

Authors

www.auswaertiges-amt.de/en/newsroom/brochures#content_7
BACKGROUND
..., the negotiations should include weapons delivery systems, including the exotic new missile systems Putin is rolling out, as well as the warheads themselves—that is, the actual bombs. New START limited delivery vehicles like missiles and bombers, as well as launch systems. But it didn’t directly limit nuclear warheads, in part because the issue was too sensitive given the top-secret nature of the weapons.

Last year, President Donald Trump got Putin to agree in principle to a total freeze on warheads. This was a positive step toward a New START replacement. Figuring out how to constrain warheads and verify those constraints is a big deal for both sides.
Naval Submarine Base King’s Bay, GA
GPS: +30.78598, -81.53776

Reserve nuclear warheads and missiles are stored underground and in bunkers
These buildings are not inspected as part of New START
Source: xpdf.com/kingsbay
MONITORING REGIMES FOR ALL-WARHEAD AGREEMENTS
POSSIBLE MONITORING REGIMES
FOR ALL-WARHEAD AGREEMENTS

A. ABSENCE REGIME
• Conduct routine & challenge inspections to confirm correctness of declarations
• Accept all items as treaty accountable that the host declared as such
• Only inspect other items present at site to confirm that they are indeed not accountable

B. LIMITED-ACCESS REGIME (for lack of a better name)
• Conduct routine & challenge inspections to confirm correctness of declarations
• Use serial numbers or unique identifiers to account for declared items
• Authenticity of the items themselves is not confirmed

C. CONFIRMATION REGIME
• Warhead confirmation measurements confirm authenticity of declared nuclear weapons prior to dismantlement (using an attribute or template-matching approach), perhaps also during “life cycle” of (randomly selected) weapons

Source: Author (top and middle), U.S. DOE (bottom)
THE ABSENCE REGIME

Confirming numerical limits without access and identification
NEW START

ALLOWS FOR MEASUREMENTS ON ITEMS DECLARED AS NON-NUCLEAR OBJECTS

Section VI. Methods and Procedures for Use of Radiation Detection Equipment

1. During Type One inspections, the inspected Party shall have the right to use radiation detection equipment in order to:

   (a) Demonstrate to inspectors that an object located on the front section of a deployed ICBM or deployed SLBM and declared by a member of the in-country escort to be a non-nuclear object, is, in fact, non-nuclear; and

   (b) Demonstrate to inspectors that an object located on a designated heavy bomber and declared by a member of the in-country escort to be a non-nuclear object, is, in fact, non-nuclear.

For these purposes, the inspected Party shall have the right to use radiation detection equipment provided by the inspected Party, if agreed by the Parties within the framework of the BCC, or radiation detection equipment provided by the inspecting Party.
EXPANDING ABSENCE MEASUREMENTS
TO INCLUDE OBJECTS AT ANY INSPECTED SITE

BASIC CONCEPT OF AN ABSENCE REGIME

- During an onsite inspection, the host gets “credit” for the number of items declared for that site and identifies these items as such
- Declared items will be accepted as “treaty accountable” and never be accessed or inspected
- Inspector has to be able to confirm that other items are not treaty accountable

BENEFITS & CHALLENGES

Well established (as part of New START)

Very low risk of exposing sensitive information

Concept could help address security concerns of some states and encourage them to join arms-control efforts at an early date

Source: quad-nvp.info (top) www.vandenberg.spaceforce.mil/News/Photos/igphoto/2000614747 (bottom)
Modified U.S. Eberline ESP-2 Detector

Source: Randy Montoya, share-ng.sandia.gov/news/resources/news_releases/treaty_equipment, February 2018
E. Lepowsky, J. Jeon, and A. Glaser, “The Absent-Minded Inspector: Confirming the Absence of Nuclear Warheads Via Passive Gamma-ray Measurements,” this conference; see www.youtube.com/watch?v=JUNA6D4kGe4 for a demonstration
THE LIMITED-ACCESS REGIME

Confirming numerical limits with positive identification
FROM ABSENCE CONFIRMATION TO POSITIVE IDENTIFICATION

BASIC CONCEPT OF A LIMITED-ACCESS REGIME

• Same as absence regime, but treaty-accountable items would be tagged
• Identity of treaty-accountable items — but NOT their nature — could be confirmed during inspections by confirming the integrity and the ID of the tag
• Over time, inspectors would gain confidence in the nature of the items

BENEFITS & CHALLENGES

Need to facilitate & manage some inspector access
Could begin with serial numbers or other identifiers used by the host
Regime could be strengthened by (gradually) phasing in unique identifiers; opportunities for joint R&D on concepts and technologies

Source: Paul Shambroom (paulshambroom.com/nuke, top) and pryormarking.com (bottom)
THE CONFIRMATION REGIME

Warhead confirmation and verified dismantlement
UK-Norway Information Barrier
Attribute measurement
Passive gamma (HPGe detector)

TRIS (Sandia)
Template measurement
Passive gamma (NaI detector)

Excalibur (PPPL/Princeton)
Template measurement
Active neutron interrogation (ZKP)

AVNG (VNIIEF/LANL, Trilateral)
Attribute measurement
Passive neutron and gamma detection
CONFIRMATION REGIME

BASIC CONCEPT OF A CONFIRMATION REGIME

Combined with strong chain of custody provisions, conduct measurements to confirm the authenticity of declared nuclear weapons prior to dismantlement (using an attribute or template-matching approach) and perhaps also during the “life cycle” of randomly selected weapons.

CHALLENGES OF A CONFIRMATION REGIME

Even though major research and development efforts have been underway for the past thirty years, no inspection system has so far been successfully demonstrated in a true inspection setting, i.e., with measurements on actual nuclear weapons and the participation of international inspectors, while meeting the requirements for certification and authentication.

Source: ukni.info (top)
A PATH FORWARD
FOR NUCLEAR DISARMAMENT VERIFICATION

RE-IMAGINING NUCLEAR DISARMAMENT VERIFICATION
Explore verification approaches that minimize the need of access to sites and treaty accountable items or avoid measurements on those.
Consider approaches that offer “on-ramps,” i.e., that start off simple and can accommodate “upgrades” later on.

FROM ABSENCE TO CONFIRMATION REGIMES, STEP-BY-STEP
Several types of approaches are available to verify all-warhead agreements; they range from “simple” (absence) regimes to more rigorous but also more intrusive confirmation regimes.
The different regimes can build on each other and be phased in “gradually.”

Source: IAEA, flickr.com/photos/iaea_imagebank/albums/72157659464420989 (top) and quad-nvp.info (bottom)