

A person in silhouette is operating a yellow robotic device, possibly a camera or sensor, mounted on a tripod. The device is positioned next to several large white cylindrical containers. One container is labeled 'H1514 MODEL' and has a handle with the text 'COVER LIFT ONLY'. The background is a concrete wall with some pipes and a blue structure on the right.

MONITORING & VERIFICATION WITH LIMITED INSPECTOR ACCESS

Alexander Glaser and Irmgard Niemeyer

Virtual event organized by the Permanent Representation of the Federal Republic of Germany to the Conference on Disarmament in Geneva, June 24, 2021

“KEEP IT SIMPLE”



How can the two presidents make the best of their one shot at setting the nuclear table?

I have some advice for them: Keep it simple.

Rose Gottemoeller, June 2021

Lead U.S. negotiator of New START (2009)

Photo credit: NATO

www.politico.com/news/magazine/2021/06/14/biden-putin-summit-nuclear-treaty-start-494313

TECHNOLOGIES & APPROACHES

(Chapter 4 in the Report, with Irmgard Niemeyer)

INSPECTION APPROACHES

WITHOUT (OR WITH LIMITED) ACCESS



1. SATELLITE IMAGERY

Satellites have historically played an important role in arms-control verification, and their potential is likely to grow further in coming years

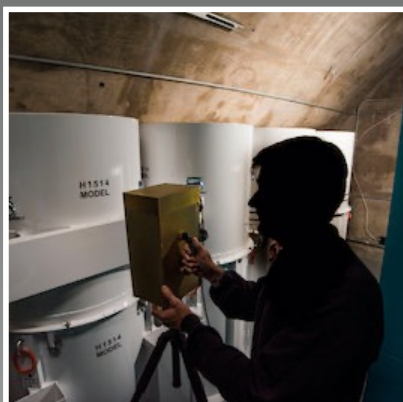
Not only relevant for detecting undeclared sites, but also for monitoring declared ones



2. PERIMETER MONITORING & REMOTE (VIRTUAL) INSPECTIONS

For facilities where access is initially considered too intrusive, perimeter control or sensors at the site boundary could provide reassurance of compliance

Virtual inspections: Could inspectors even conduct some activities remotely?



3. MINIMALLY INTRUSIVE INSPECTION APPROACHES ... WHERE NECESSARY

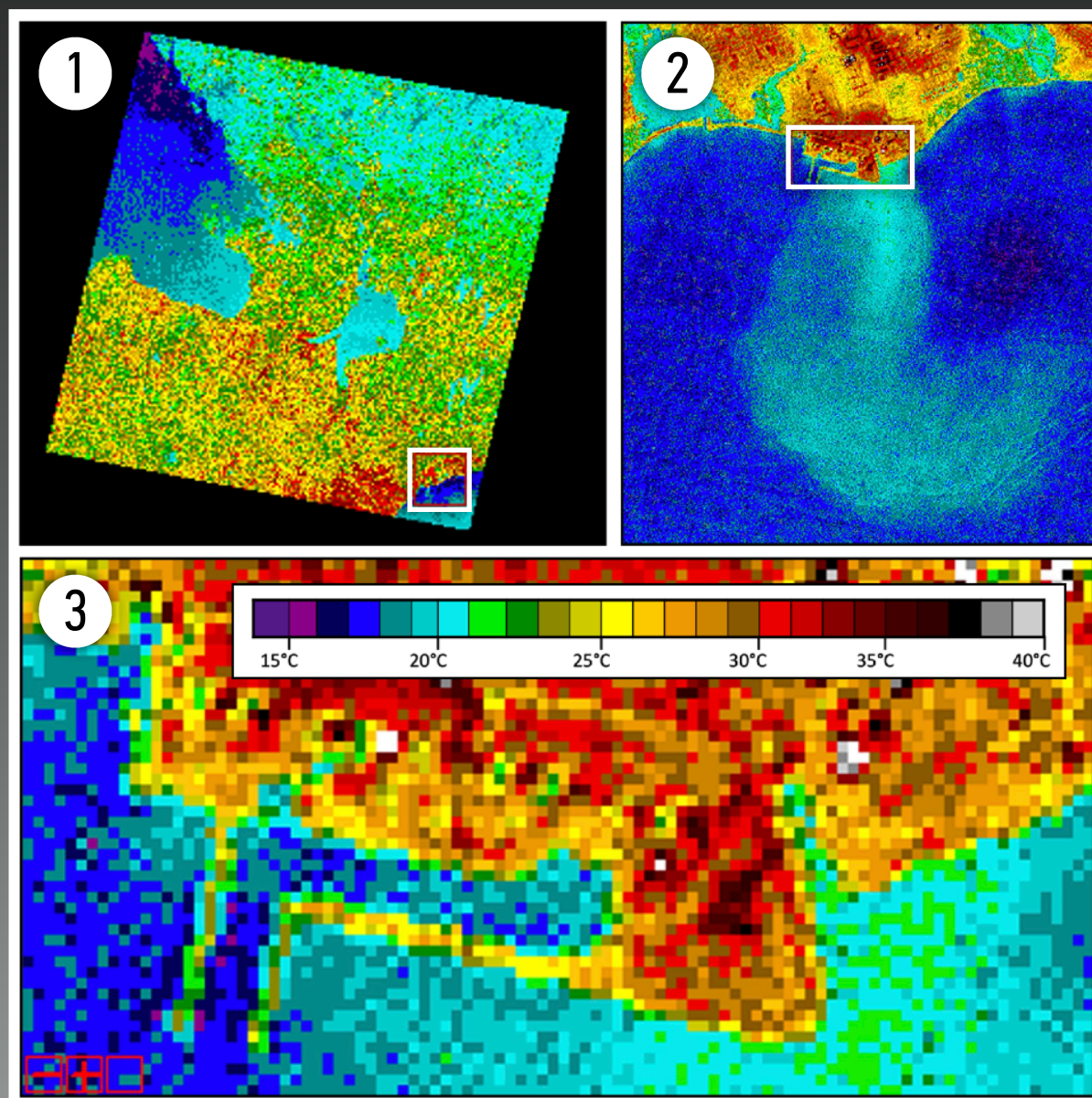
When onsite inspections are clearly preferable or indispensable, approaches that avoid certain types of measurements (putting at risk sensitive information) could help facilitate early adoption of new verification provisions

Source: DigitalGlobe (top), U.S. DOE (middle), Randy Montoya via Sandia National Laboratories (bottom)

or complements
ALTERNATIVES TO ONSITE INSPECTIONS
FOR SENSITIVE NUCLEAR FACILITIES

(Some examples)

USING SATELLITE IMAGERY TO CONFIRM THE OPERATIONAL STATUS OF DECLARED FACILITIES



Surface temperatures at a nuclear power plant (Landsat-7)



Water-vapor plume from cooling towers (Source: Planet Labs)

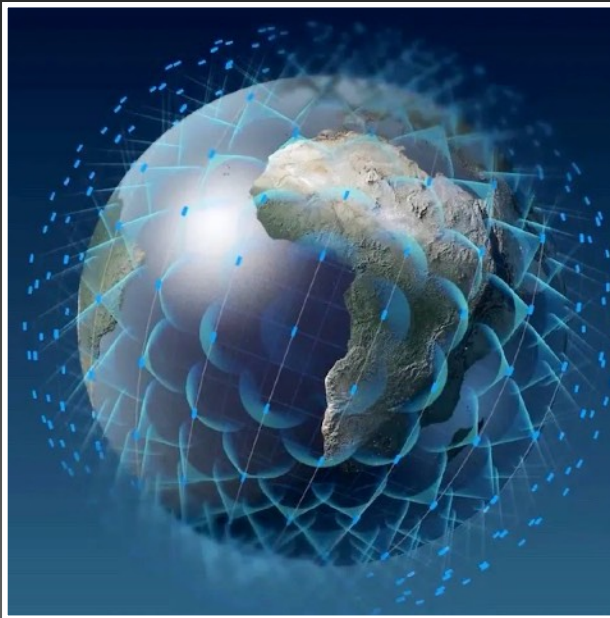
USING SATELLITE IMAGERY TO VERIFY DECLARATIONS OF MOBILE MISSILE LAUNCHERS



“Display in the open” of road-mobile launchers; concept used under START (Article XII) but not under New START
(June 22, 2005 @ LAT +55.381 LON +82.920)

USING SATELLITE IMAGERY

OPPORTUNITIES AND CHALLENGES FOR NUCLEAR VERIFICATION



OPPORTUNITIES

New satellite constellations may offer quasi real-time imagery, often with multiple revisits of the same site per day

Advances in data sciences offer automated analysis of imagery

Potential cost-savings, perhaps also relevant for IAEA safeguards



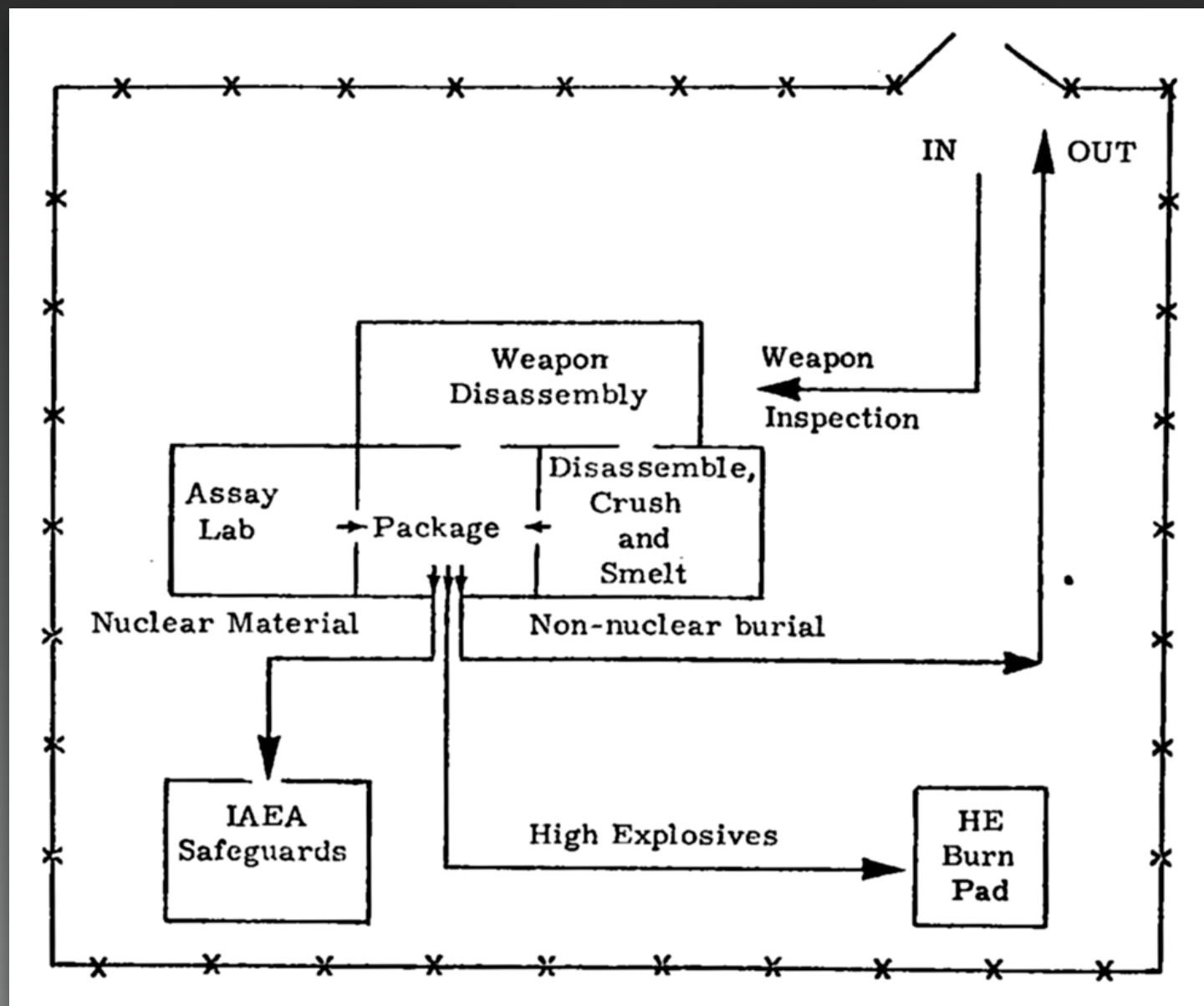
CHALLENGES

Few countries and organizations have robust satellite imaging capabilities; it raises the issue of equitable access and (possibly) of data authenticity

Increasing need to work with machine-learning techniques; joint research, development, and training could help ensure that satellite imagery can unfold its true potential as a verification technology

Source: Airbus Industries (top) and ESA (bottom)

USING PERIMETER MONITORING TO AVOID ACCESS TO SENSITIVE NUCLEAR SITES



*Field Test FT-34: Demonstrated Destruction of Nuclear Weapons
U.S. Arms Control and Disarmament Agency, January 1969*

A Perimeter Safeguards System for Enrichment Plants

(A joint Arms Control & Disarmament Agency and
U. S. Atomic Energy Commission Project Plan)

November 22, 1972

*Herbert Kouts, A Perimeter Safeguards System
for Enrichment Plants, November 1972*

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: xpda.com/kingsbay

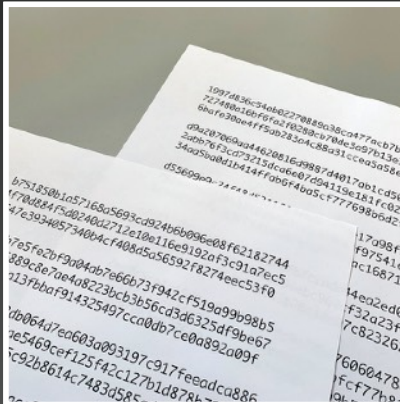


MONITORING REGIMES FOR ALL-WARHEAD AGREEMENTS

(Chapter 2 in the Report)

POSSIBLE MONITORING REGIMES

FOR ALL-WARHEAD AGREEMENTS



1. 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



2. 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



3. 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)



Source: Randy Montoya, share-ng.sandia.gov/news/resources/news_releases/treaty_equipment, February 2018

FROM ABSENCE CONFIRMATION TO POSITIVE IDENTIFICATION



ADVANTAGES & SHORTCOMINGS OF AN ABSENCE REGIME

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



TOWARD IDENTIFICATION OF TREATY-ACCOUNTABLE ITEMS

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)

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 (top, [flickr.com/photos/iaea_imagebank/albums/72157659464420989](https://www.flickr.com/photos/iaea_imagebank/albums/72157659464420989) and quad-nvp.info (bottom)

