NUCLEAR SECRETS NEED NOT BE A BARRIER TO VERIFICATION

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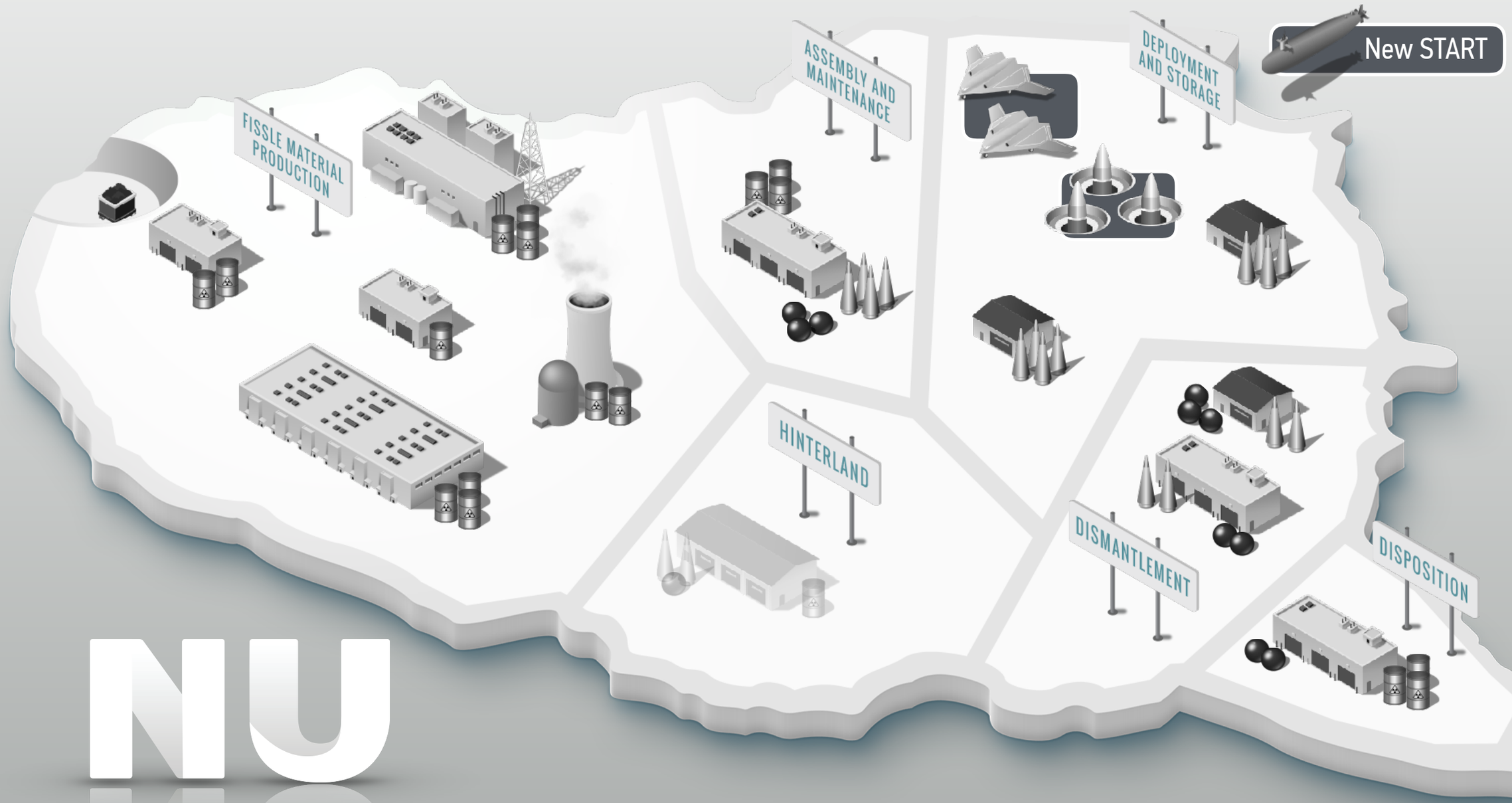
Princeton University

United Nations, Palais des Nations, Geneva, May 15, 2018

Painting by Helen Schrayer, Acrylic on Canvas, 2017
Revision 3

VERIFYING DEEPER REDUCTIONS

IN THE NUCLEAR ARSENALS



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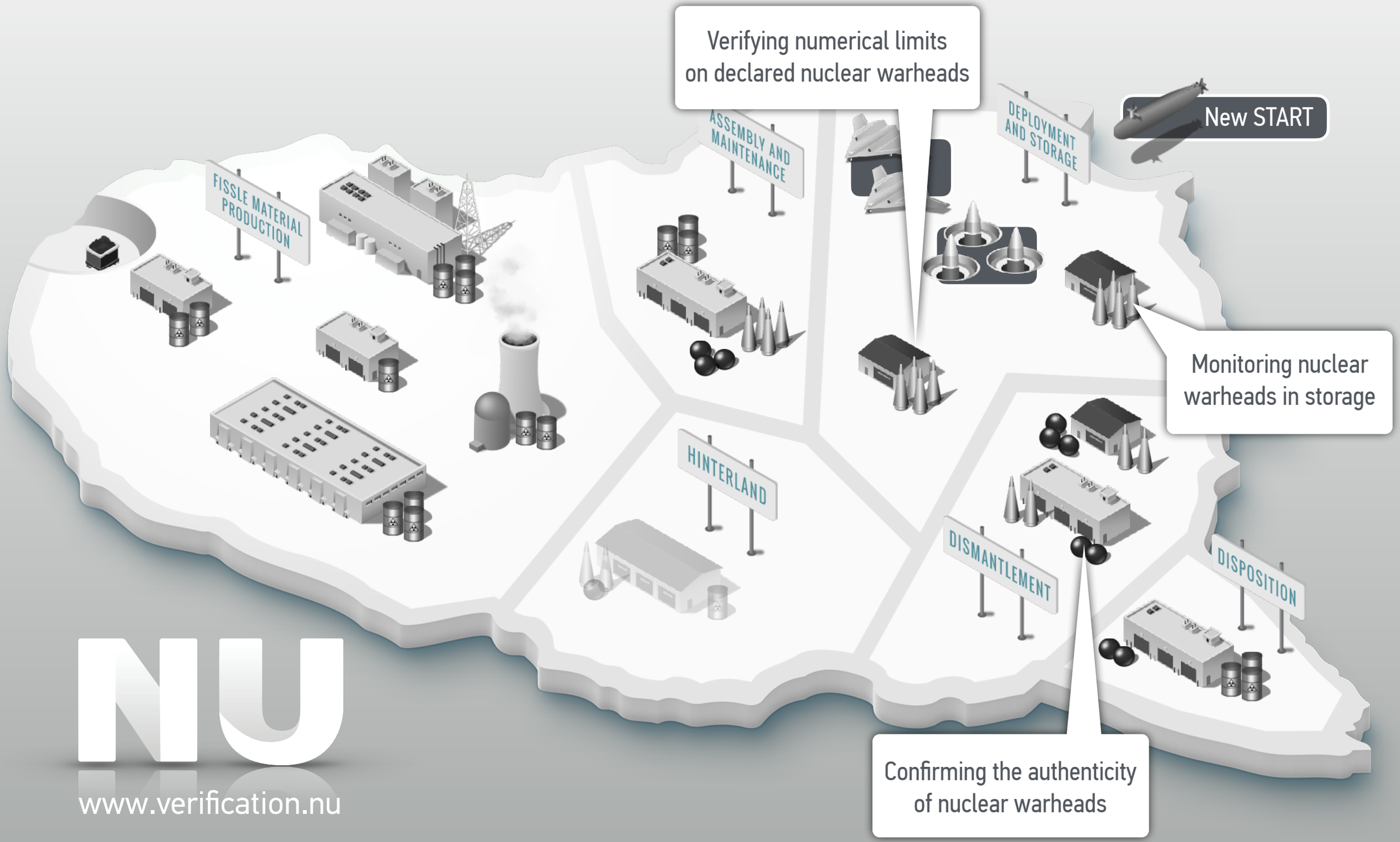
VERIFYING DEEPER REDUCTIONS



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DEALING WITH SECRETS

(Warheads and other classified nuclear components)

HOW NOT TO GIVE AWAY A SECRET

CONTINUE IMPROVING TECHNOLOGIES AND APPROACHES

Work on information barriers with a particular focus on certification and authentication;
in particular, identify joint hardware and software development platforms

REINVENT THE PROBLEM: NEVER ACQUIRE SENSITIVE INFORMATION TO BEGIN WITH

Explore radically different verification technologies and approaches;
for example, develop alternatives to onsite inspections at certain sensitive facilities

REVEAL THE SECRET

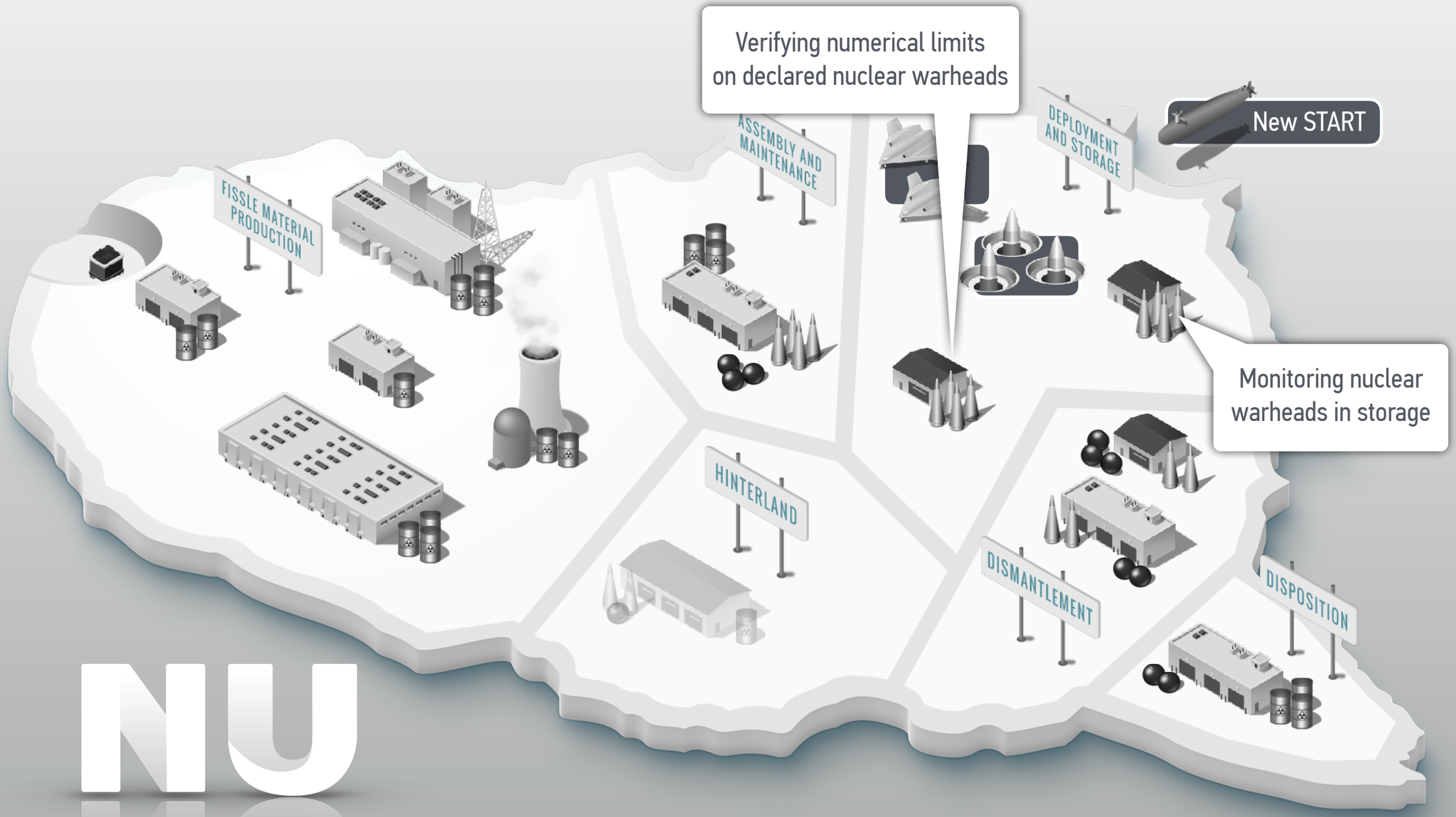
Requirement to protect sensitive information is typically the main reason for complexity of verification approaches; for example, mass of fissile material in a nuclear weapon

Source: Author (top and bottom), altave.com.br (middle)

REINVENTING THE PROBLEM

PART 1: WATCHING THE WARHEAD

VERIFYING DEEPER REDUCTIONS



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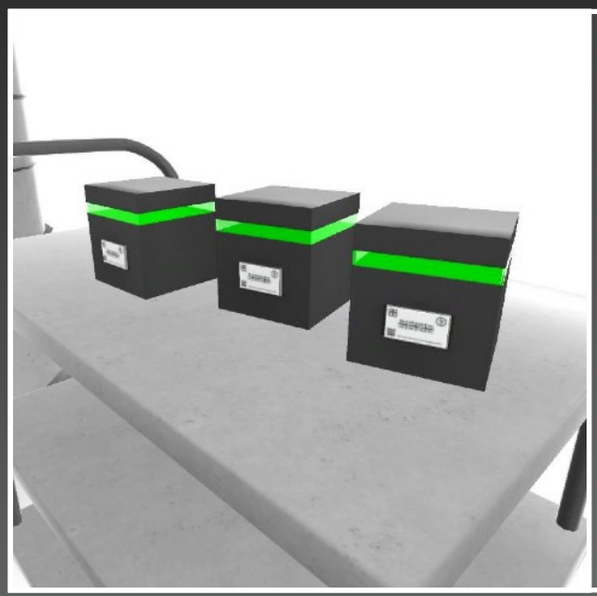
NON-INTRUSIVE APPROACHES

FOR VERIFYING NUMERICAL LIMITS AND MONITORING ITEMS IN STORAGE



VERIFYING NUMERICAL LIMITS

- Innovative tagging approaches that separate tags and items, so that no direct inspector access to sensitive items is needed (“Buddy Tag”)
- Tagging could be avoided entirely by using privacy-preserving declarations, which enable selective release of information (and early commitment)

MONITORING WARHEADS IN LONG-TERM STORAGE

- Remote-monitoring systems, inspections from a distance that don’t require trusted sensors and perhaps don’t even reveal location of storage area
- Perimeter-control approaches could offer an alternative and avoid onsite measurements and related inspection activities altogether

Credit: Nuclearfutures Laboratory (top) and Sandia National Laboratories (bottom)

UNCONVENTIONAL APPROACHES

(SIMPLE, NON-INTRUSIVE, AND QUICKLY IMPLEMENTABLE)

Entrance to Storage Magazine at Pantex, Zone 4
Uses 40-ton concrete blocks to prevent unauthorized access
Credit: U.S. DOE

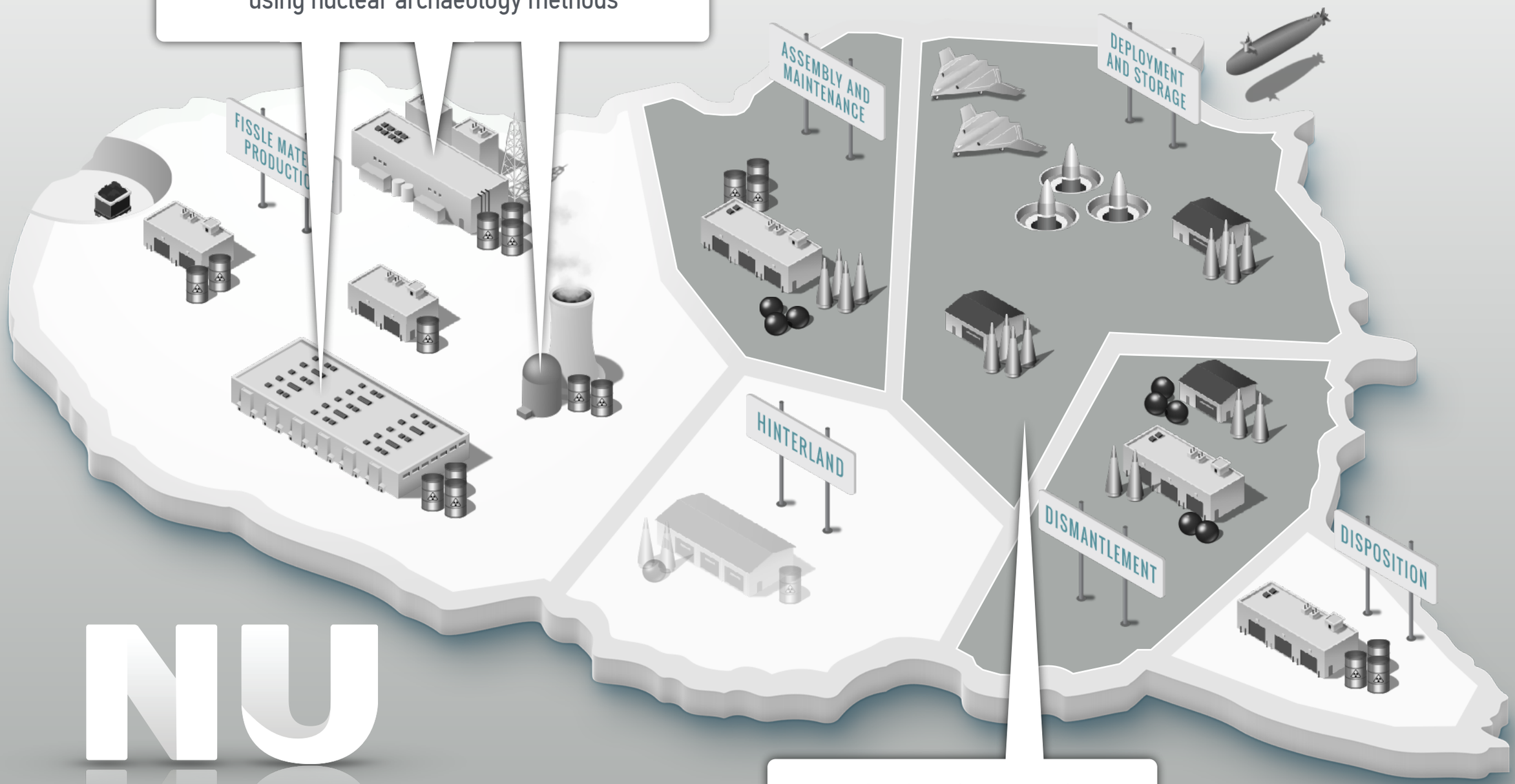
Tethered balloons for 24/7 site surveillance
Widely used for civilian and military applications
Credit: Altave Omni, www.altave.com.br

REINVENTING THE PROBLEM

PART 2: LEAVING THE WARHEAD BEHIND

DEFERRED VERIFICATION

Confirming completeness of baseline declarations using nuclear archaeology methods



Shrinking footprint of off-limit areas (“closed segment”)

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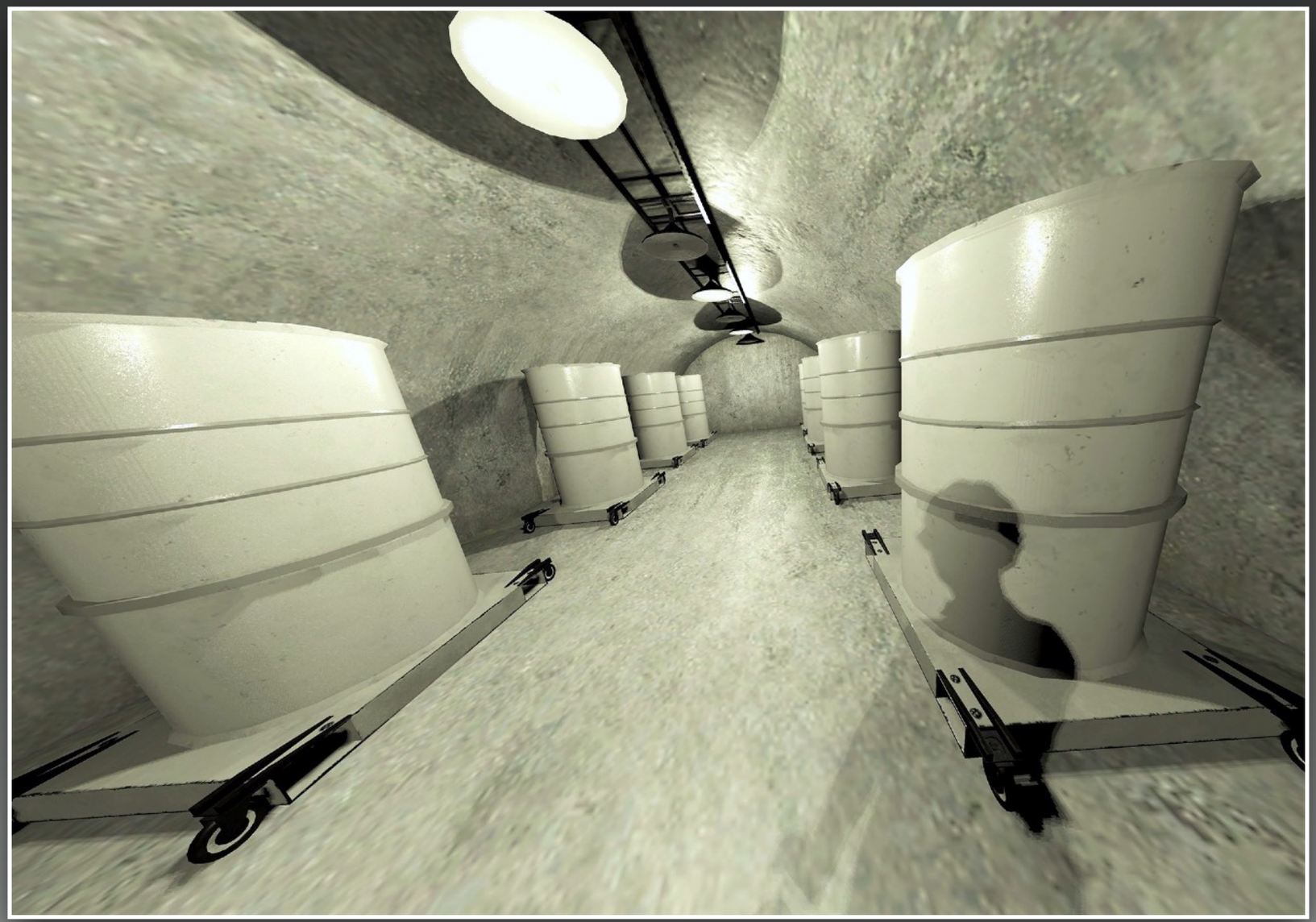
AN INSPECTOR WALKS INTO A BUNKER

AND FINDS A NUMBER OF SUSPICIOUS-LOOKING ITEMS
BUT THE HOSTS INSISTS THAT THEY ARE NOT TREATY ACCOUNTABLE

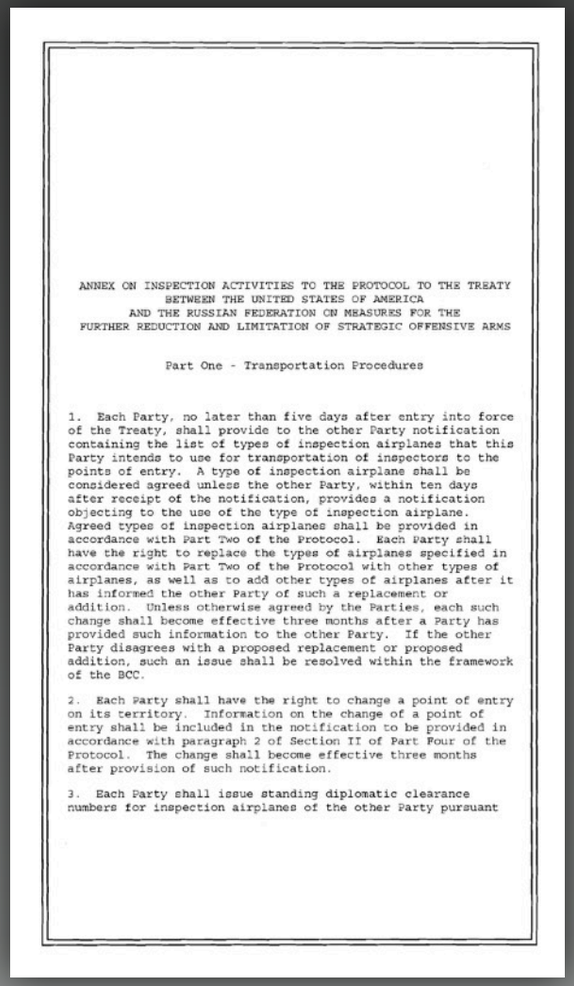


Source: Princeton Nuclear Futures Laboratory, VR Project

CONFIRMING THAT AN OBJECT IS NOT A NUCLEAR WARHEAD

NEW START TREATY

ALLOWS FOR MEASUREMENTS ON ITEMS DECLARED AS NON-NUCLEAR OBJECTS



ANNEX ON INSPECTION ACTIVITIES TO THE PROTOCOL TO THE TREATY BETWEEN THE UNITED STATES OF AMERICA AND THE RUSSIAN FEDERATION ON MEASURES FOR THE FURTHER REDUCTION AND LIMITATION OF STRATEGIC OFFENSIVE ARMS

Part One - Transportation Procedures

1. Each Party, no later than five days after entry into force of the Treaty, shall provide to the other Party notification containing the list of types of inspection airplanes that this Party intends to use for transportation of inspectors to the points of entry. A type of inspection airplane shall be considered agreed unless the other Party, within ten days after receipt of the notification, provides a notification objecting to the use of the type of inspection airplane. Agreed types of inspection airplanes shall be provided in accordance with Part Two of the Protocol. Each Party shall have the right to replace the types of airplanes specified in accordance with Part Two of the Protocol with other types of airplanes, as well as to add other types of airplanes after it has informed the other Party of such a replacement or addition. Unless otherwise agreed by the Parties, each such change shall become effective three months after a Party has provided such information to the other Party. If the other Party disagrees with a proposed replacement or proposed addition, such an issue shall be resolved within the framework of the BCC.

2. Each Party shall have the right to change a point of entry on its territory. Information on the change of a point of entry shall be included in the notification to be provided in accordance with paragraph 2 of Section II of Part Four of the Protocol. The change shall become effective three months after provision of such notification.

3. Each Party shall issue standing diplomatic clearance numbers for inspection airplanes of the other Party pursuant

...

"If the average measurement of the neutron radiation level at the selected point is less than or equal to the comparison number calculated in accordance with subparagraph 14(e)(iv) of this Section, the inspected object is, in fact, a non-nuclear object. This fact shall be recorded in the inspection activity report."

...

Annex on Inspection Activities to the Protocol to the Treaty Between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, www.state.gov/documents/organization/141293.pdf

DEFINING AND INSPECTING

OBJECTS THAT ARE NOT NUCLEAR WEAPONS

POSSIBLE DEFINITION

An object is accepted as a non-treaty-accountable item if (a) it does not exceed an agreed radiation level (combined neutron and gamma) or if (b) the inspector can confirm its nature as a non-treaty-accountable item, for example, through direct visual access.

Once a satisfactory definition of a "non-weapon" can be agreed upon, development and demonstration of measurement equipment could be straightforward (in particular, because far less if any sensitive information would be involved)

Valuable for deferred verification approaches
(but also for confirming numerical limits on nuclear weapons)

Alex Glaser, "Toward a Verifiable Definition of a Nuclear Weapon," *58th Annual INMM Meeting,* Indian Wells, California, July 2017

WHAT COULD BE DONE NOW

(NEXT STEPS FOR NUCLEAR DISARMAMENT VERIFICATION)

RETHINKING NUCLEAR DISARMAMENT VERIFICATION

Inspection protocols and measurement equipment for non-intrusive approaches for confirming numerical limits and for monitoring nuclear warheads in long-term storage could be developed quickly

Focus initially on basic approaches that can accommodate “upgrades” later on

MEANWHILE …

Dismantlements continue to be unverified, and almost 90% of all nuclear weapons do no longer exist today

Weapon states ought to begin now to document dismantlements in ways that international inspectors will find credible at a later time

Source: NNSA (bottom)

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