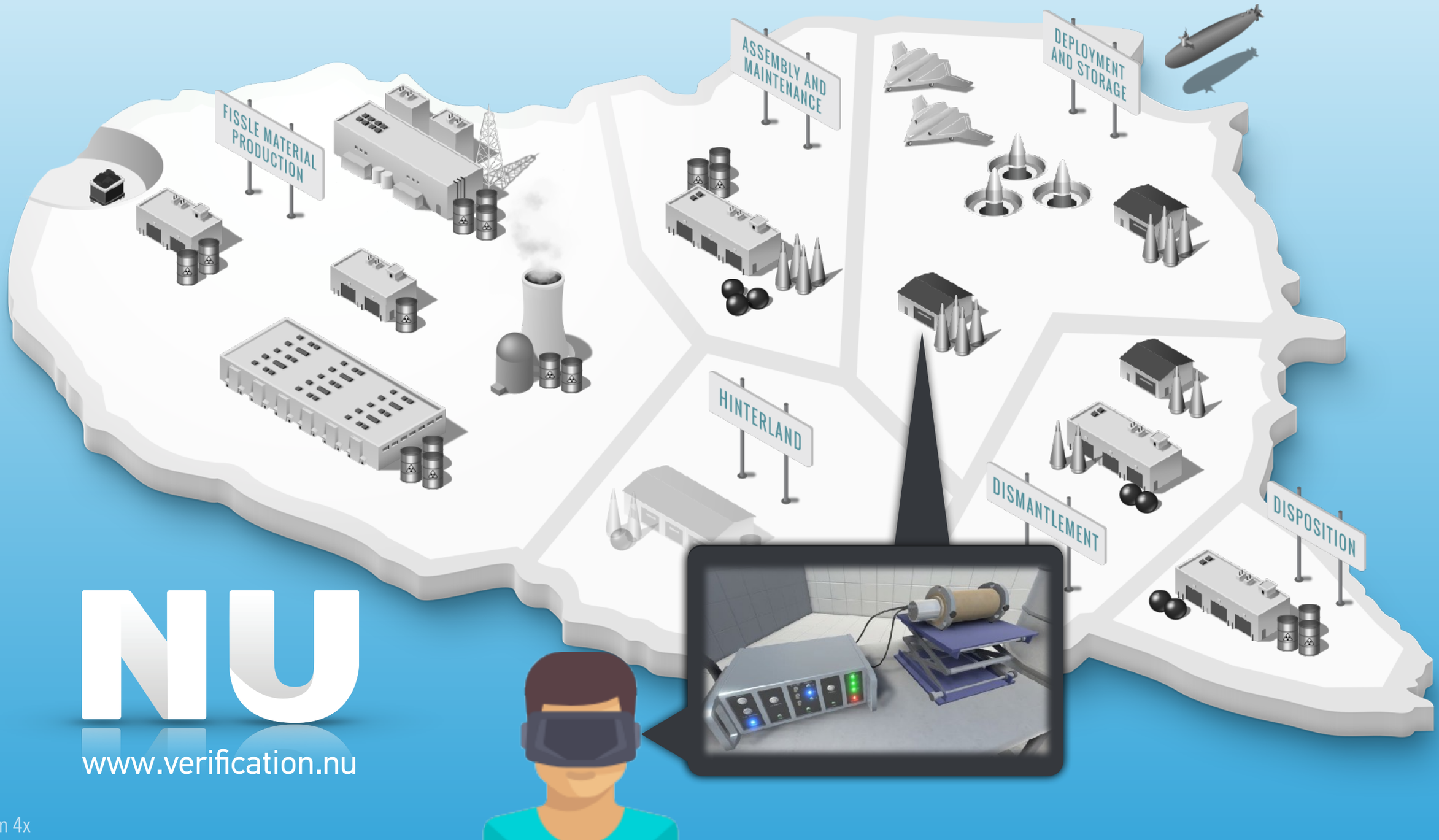
MAPPING NUCLEAR VERIFICATION

Tamara Patton and Alex Glaser

INMM Annual Meeting | July 2017

Revision 3



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Revision 4x

OVERVIEW

1. Tools and Utilities
2. Tour of Nu
3. Map Applications

(4. Virtual Reality Exercise)

NU MAPPING UTILITIES

CONSTRUCTING COMPREHENSIVE VERIFICATION APPROACHES

1. TECHNOLOGY ORIENTATION AND LOCALIZATION

View the broader context of a verification technology and possible overlap with existing treaties

2. IDENTIFYING AND CLOSING GAPS

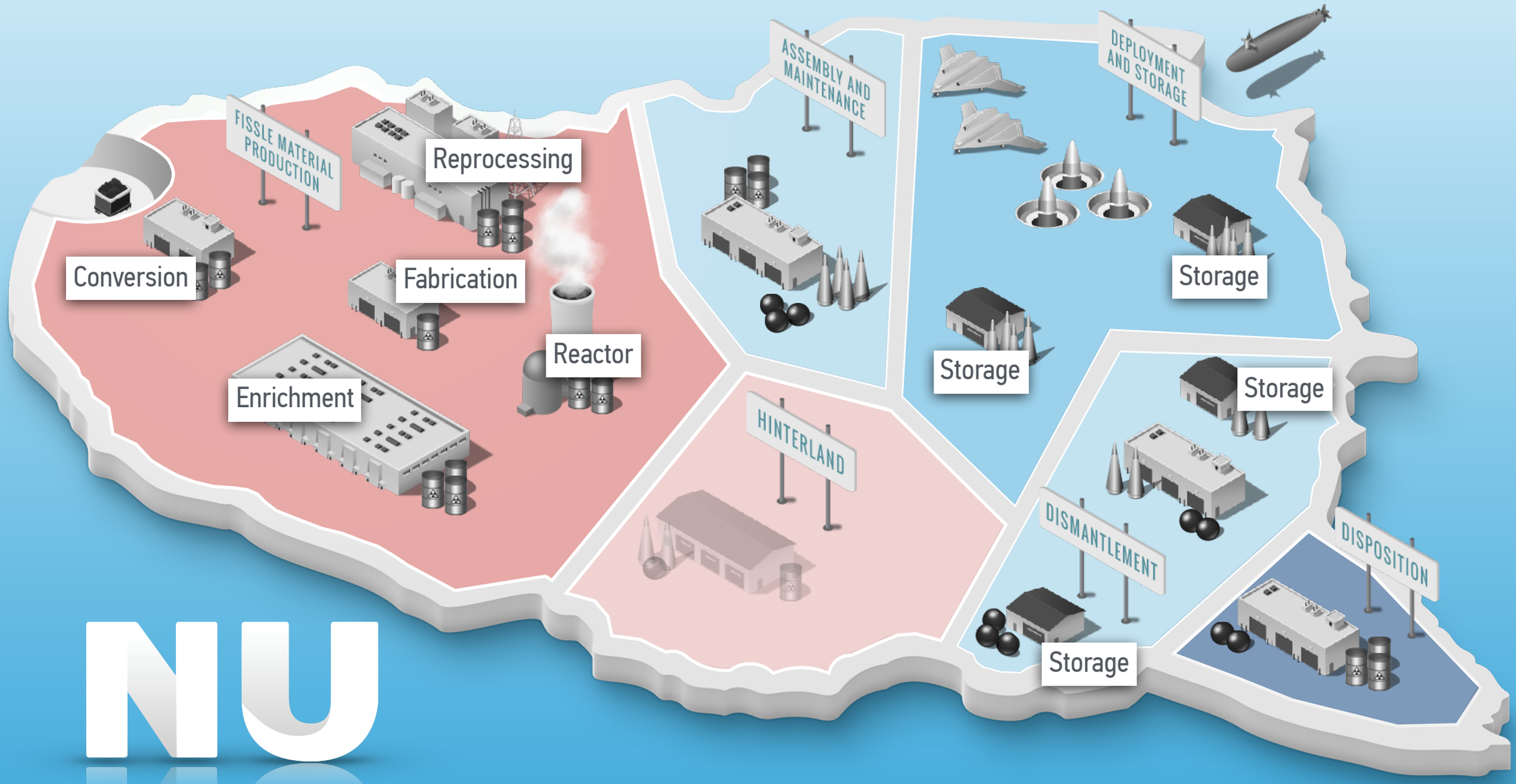
View the map in terms of verified and unverified transfer pathways

for example, between facilities within a given sector, between sectors, or to the "hinterland"

3. CONTEXT FOR VIRTUAL REALITY INSPECTIONS

Within a given Nu strategy, utilize VR for more detailed facility level inspection design & simulation

MAPPING NUCLEAR VERIFICATION



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WEBSITE TOUR

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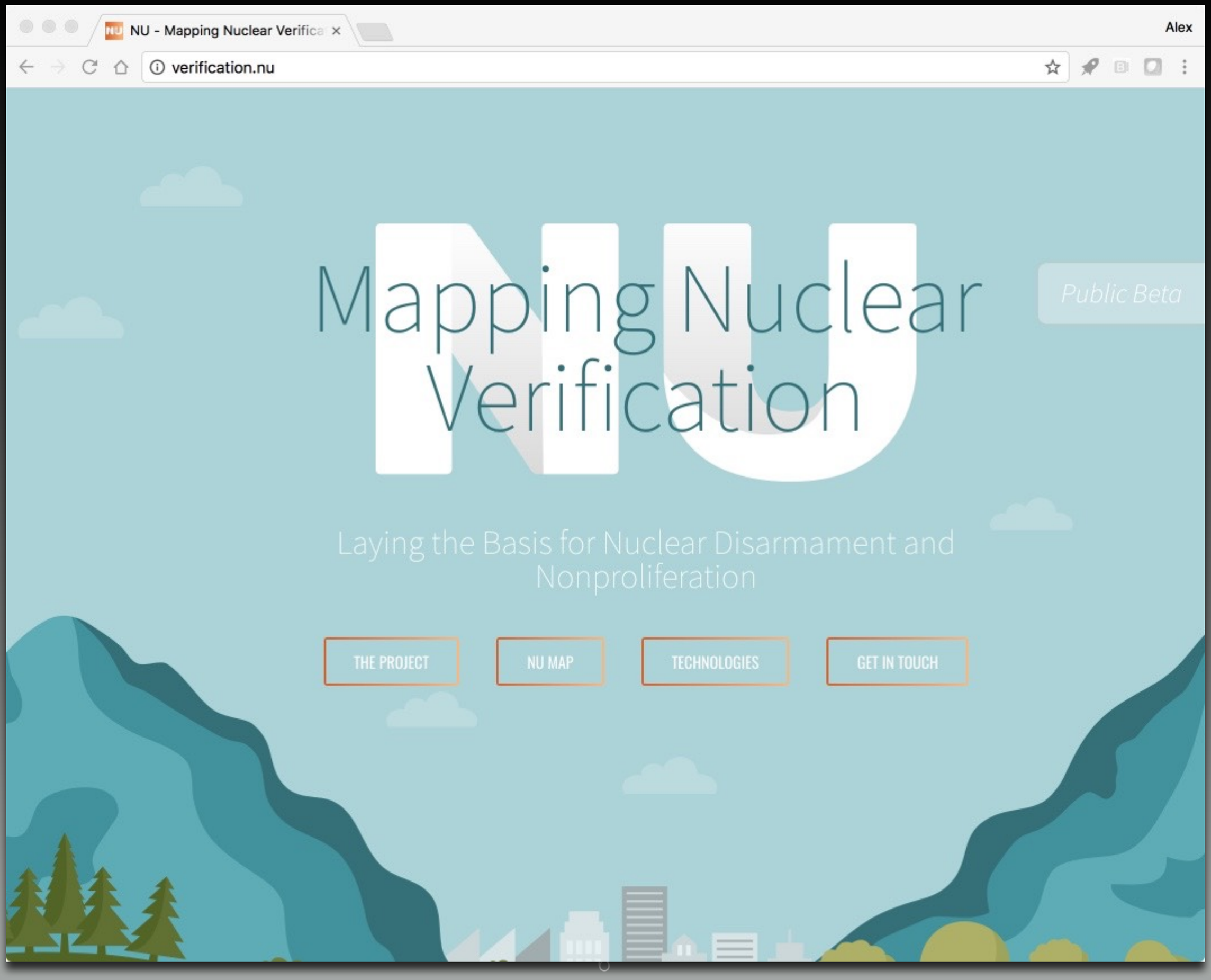
NU - Mapping Nuclear Verifica
Alex
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Mapping Nuclear Verification
Public Beta
Laying the Basis for Nuclear Disarmament and Nonproliferation
THE PROJECT
NU MAP
TECHNOLOGIES
GET IN TOUCH

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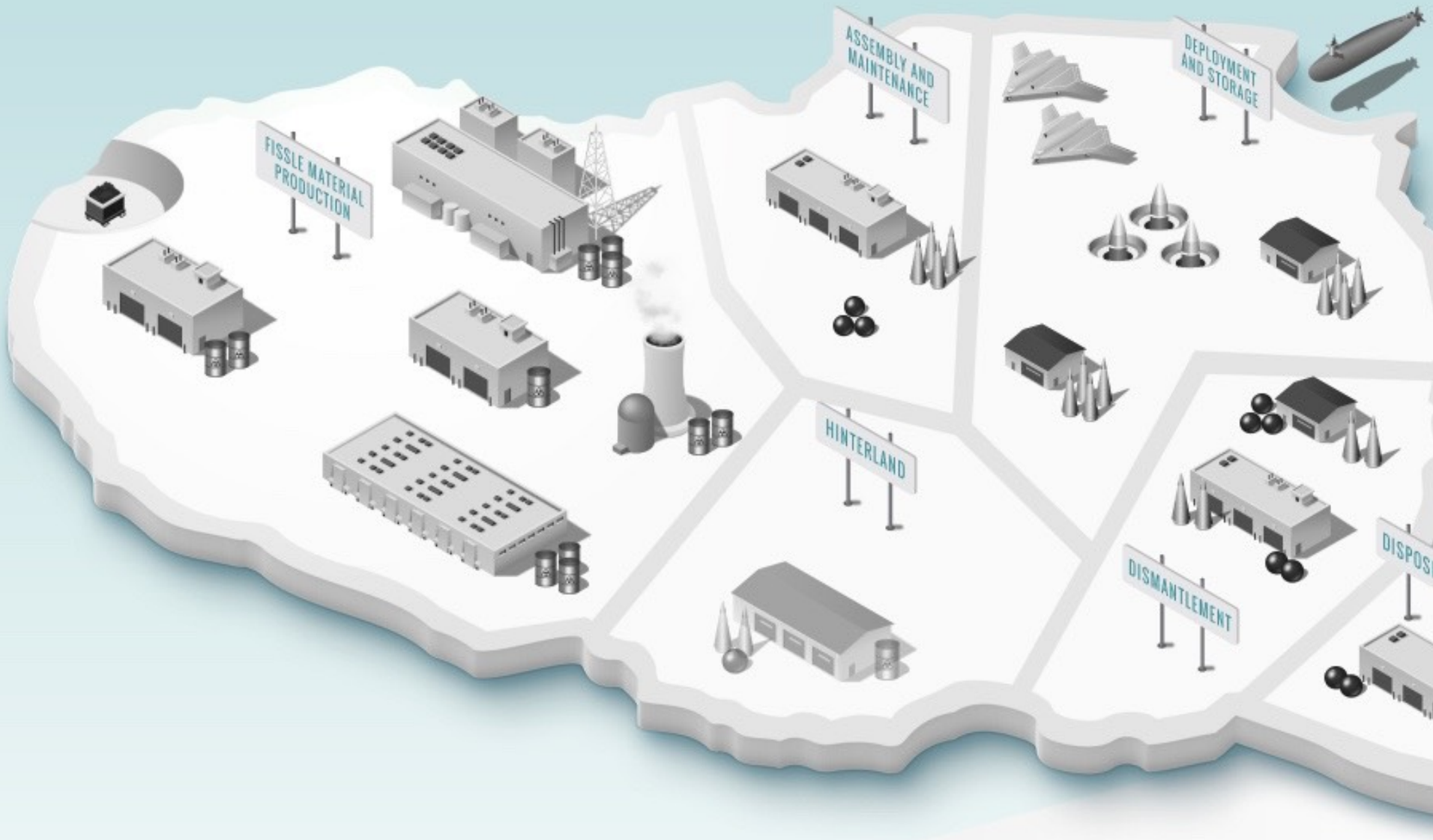
verification.nu/#map

Discover the Nuclear Verification Landscape



Explore Nuclear Verification Technologies

Verification technology development is an area rich in innovation and centers on answering questions such as: How can we determine whether a country is telling the truth about the total size of its nuclear arsenal? How can we determine whether a nuclear weapon presented to us is real, without learning any classified information about it? And, how can we ensure that a country is not secretly assembling new weapons under a treaty? We have made strides toward answers, but more work is needed.

VIEW ALL TECHNOLOGIES

Explore Nuclear Verification Te ×

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verification.nu/verification-tools-technologies/

Identification

EDDY CURRENT METHODS

Verification methods involving eddy currents have the potential to support the goal of achieving just enough information to uniquely identify items without providing unnecessary information.

MODAL TESTING

Modal vibration signatures might be used to uniquely identify warheads and containers.

ACCOUNTING

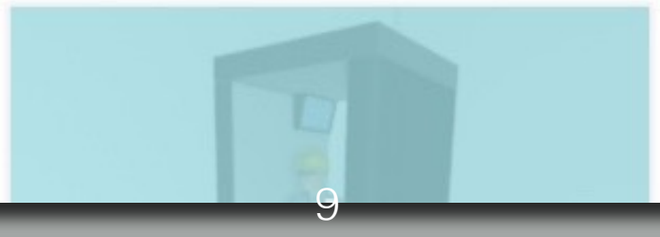
CONFIRMATION

CONTINUITY-OF-KNOWLEDGE

IDENTIFICATION

REMOTE AND PERIMETER MONITORING

Remote and Perimeter Monitoring



Magtag - Verication.NU

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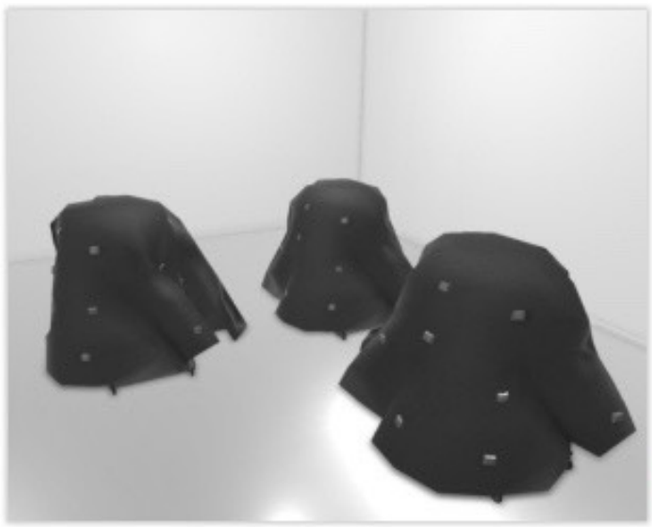
Magtag

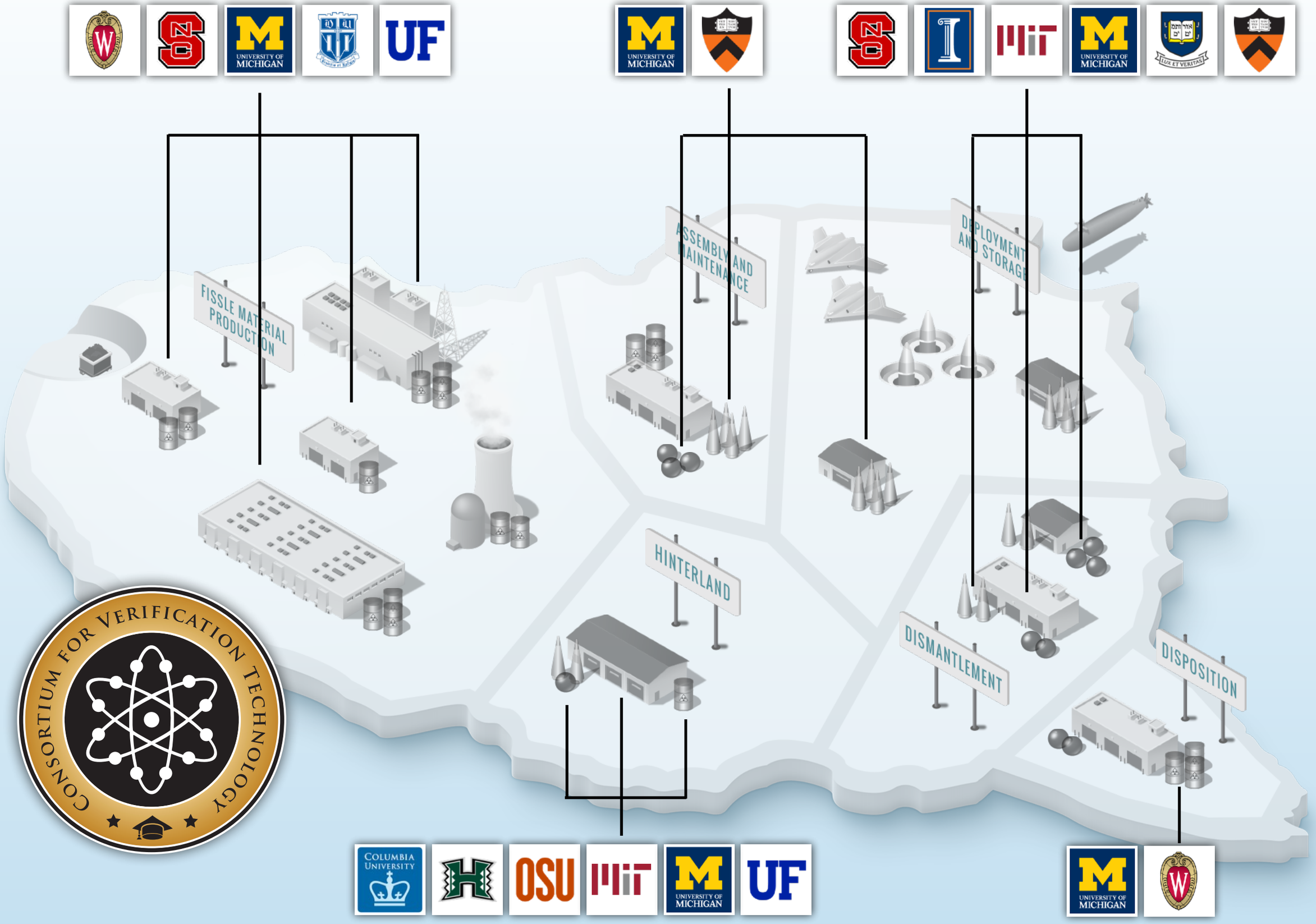


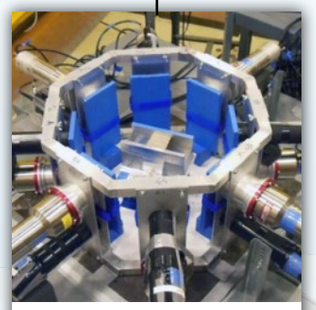
MAGTAG blankets containing randomly oriented magnets are used to cover storage containers. A highly sensitive magnetometer detects any changes in the magnetic field due to illicit movements.

OVERVIEW

In the late 1990s, Los Alamos National Laboratory developed and demonstrated a number of systems that provided continuous, live sensor data to inspectors outside the facility in order to eliminate the need for information barriers and encryption.

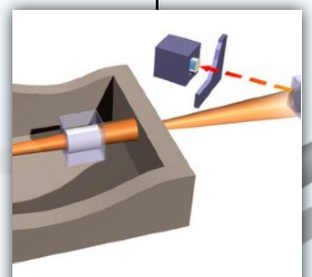
The Magazine Transparency System (MTS) is one of these systems. It is designed to monitor treaty-limited items during either short-term long-term storage and detects unauthorized movement of weapon containers from the facility. Only passive tags and


FISSLE MATERIAL PRODUCTION
ASSEMBLY AND MAINTENANCE
DEPLOYMENT AND STORAGE
HINTERLAND
DISMANTLEMENT
DISPOSITION
CONSORTIUM FOR VERIFICATION TECHNOLOGY

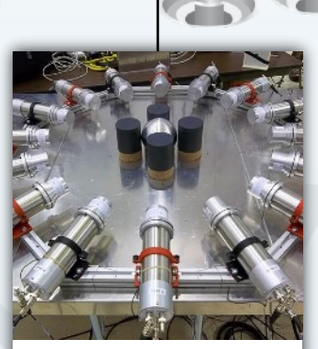


Fast neutron multiplicity counter

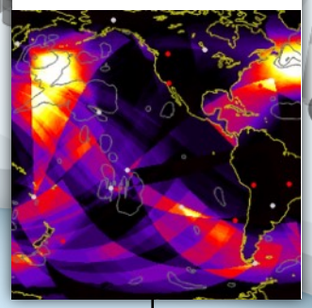
Buddy Tag (joint with Sandia)



Nuclear resonance fluorescence



Neutron Coincidence Anisotropy Setup



Next-generation Infrasound Sensors

HINTERLAND

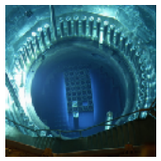
DISMANTLEMENT

DISPOSITION

CONSORTIUM FOR VERIFICATION TECHNOLOGY

MAPPING NUCLEAR VERIFICATION CHALLENGES

Ensuring the peaceful application of fissile material production



Verifying numerical limits on declared nuclear warheads

FISSLE MATERIAL PRODUCTION

ASSEMBLY AND MAINTENANCE

DEPLOYMENT AND STORAGE

New START

NPT

FMCT

HINTERLAND

DISMANTLEMENT

DISPOSITION

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Establishing confidence in the absence of undeclared stocks or production

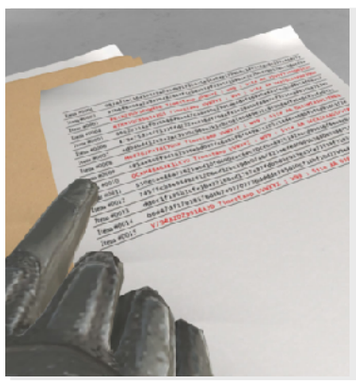
Confirming the authenticity of nuclear warheads

VERIFYING NUMERICAL LIMITS ON DECLARED NUCLEAR WARHEADS

Buddy Tags

CONFIRMING NUCLEAR WARHEADS

EXAMPLE | WARHEAD LIMIT AGREEMENT



1. HASHED DECLARATIONS

Privacy-preserving declarations based on cryptographic hash functions, which would only reveal certain information for a particular site (if an inspection is called for that site)

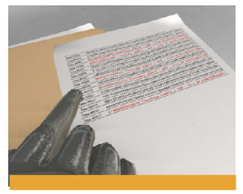
2. PORTAL MONITOR

Portal-perimeter system to detect the passage of nuclear materials, for example, using standard neutron detectors

EXAMPLE | WARHEAD LIMIT AGREEMENT

Hashed Declarations

Confirming declared number of warheads



FISSLE MATERIAL PRODUCTION

ASSEMBLY AND MAINTENANCE

DEPLOYMENT AND STORAGE

New START

HINTERLAND

DISMANTLEMENT

DISPOSITION

Portal System

Facility-level perimeter monitoring

Inspector Escort

Material sent to conversion or disposition facility

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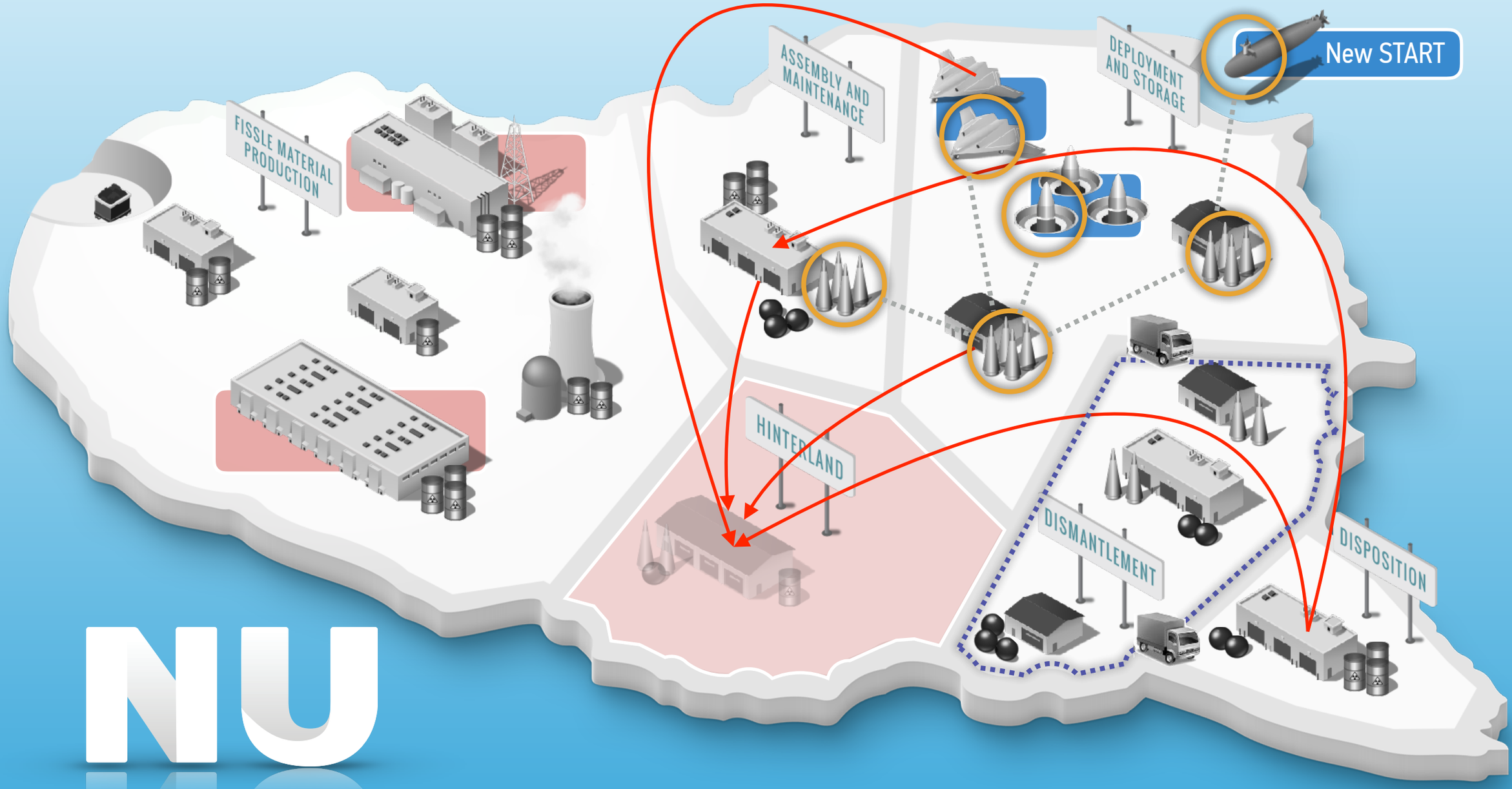
EXAMPLE | WARHEAD LIMIT AGREEMENT



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MAPPING NUCLEAR VERIFICATION

EXERCISES IN VIRTUAL REALITY

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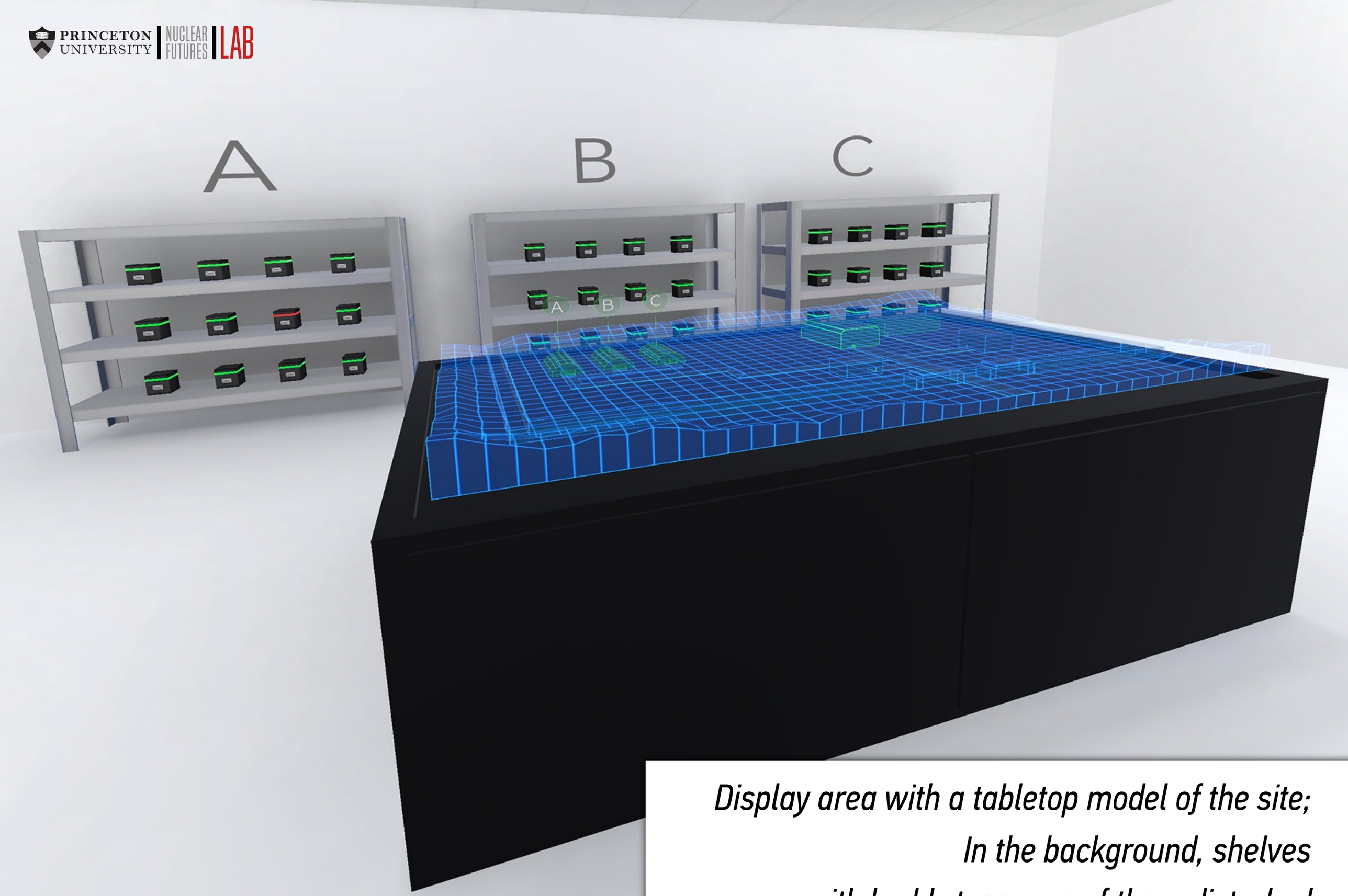

Display area with a tabletop model of the site;
In the background, shelves
with buddy tags, one of them disturbed

Storage bunker with warhead storage containers;
Inspectors can select one or more
containers for inspection with information barrier

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Closeup of detector and information barrier with simulated radiation spectrum and shielding material handled by user

STUDENT INSPECTIONS IN VIRTUAL REALITY

APRIL 2017

Virtual reality inspections of a warhead storage site | April 2017 | WWS 353 Science and Global Security

FUTURE WORK

GROWTH OF NU WEBSITE

Working to expand library of technologies to support collaboration between complementary verification technology development efforts & increase interactivity of mapping tools.

CONSTRUCTION OF VR ENVIRONMENTS

Expanding set of virtual facilities comprising the Nu landscape; developing capabilities to run and evaluate inspection simulations in support of government-to-government and research community collaboration.

INTEGRATION OF NU AND VR

Further integration of Nu and VR to develop verification option sets from both a both a broad, birds-eye view and a detailed facility-level view.

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