JUNEX22 Tabletop Exercise

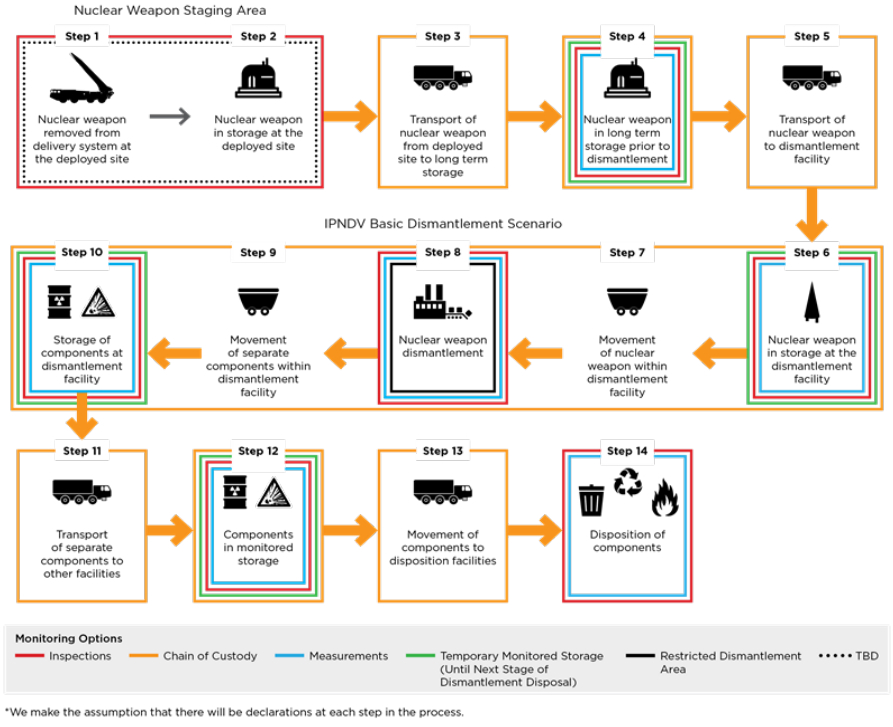
Initial Transport and Long-Term Storage Inspections of Nuclear Warhead Transport and Long-Term Storage

Summary Report

September 2022

From June 27–29, 2022, the International Partnership for Nuclear Disarmament Verification (IPNDV) conducted an in-person tabletop exercise (JUNEX22) to test and assess inspection processes, procedures, techniques, and technologies (PPTT) drawn from the Phase II Working Group 5 report *Verification of Each of the 14 Steps of Nuclear Weapon Dismantlement*.[1] The exercise focused on the PPTT related to the transport and long-term storage of nuclear warheads in a realistic scenario. Specific exercise objectives were centered on:

- Confirming the periodic transport of nuclear warheads from a deployment site to a long-term storage site, and the receipt and placement of those warheads in long-term storage (Step 3, "Transport of nuclear weapon from deployed site to long term storage" of the model "The 14 Steps: IPNDV's Nuclear Weapons Dismantlement Lifecycle");"
- Confirming the declared number of nuclear warheads designated for dismantlement under a notional Nuclear Weapons Reduction Treaty (NWRT) and in long-term storage at a central Weapon Storage Area (WSA) (Step 4, "Nuclear weapon in long term storage prior to dismantlement," of the IPNDV's 14-step model).



[1] https://www.ipndv.org/reports-analysis/working-group-5-verification-of-each-of-the-14-steps-of-nuclear-weapon-dismantlement/.

In addition, the exercise explored methodologies of a "sampling strategy" for determining which specific nuclear warhead storage bunkers to inspect at the Long-Term Storage Site.

There were more than 50 participants from more than 15 Partner countries who were divided into inspector and host teams, supported by a group of technical advisors and observers.

The overall JUNEX preparations and tabletop exercise comprised the following elements:

1. Preparatory activities, including:
    - An initial meeting of JUNEX22 inspection and host teams, technical advisors, and observers to develop a set of agreed PPTT to be tested in the exercise, based on the options set out in the Working Group 5 report;
    - Briefings and a conceptual discussion among JUNEX22 participants of issues in developing and implementing a sampling strategy for use in the Long-Term Storage Site inspection that reflects the inspection time available on site, inspection priorities, allocation and trade-offs between the use of the agreed PPTT, information from baseline and other earlier inspections, and other relevant information; and
    - Meetings by the respective inspection team and host team, with support from technical advisors, to explore issues likely to arise in carrying out the different inspections.
2. An initial Pre-Exercise Move on Wednesday June 15, 2022, in which inspection and host teams met separately to develop specific plans for the inspection.
3. Four exercise "moves" conducted June 27–29:
    - Move 1: Testing PPTT for Verification of Transport (Step 3);
    - Move 2: Level of Confidence Assessment in Verification of Transport;
    - Move 3: Testing PPTT for Confirming Nuclear Warheads in Long-Term Storage; and
    - Move 4: Level of Confidence Assessment in Verification of Long-Term Storage.
4. JUNEX22 also made use of a graphic display "game board" to allow the two teams to visualize the sites being inspected and their ongoing inspection activities at those sites. Unlike past IPNDV exercises, JUNEX22 also sought to bring the "time factor" explicitly into the exercise. It did so with the use of a "game clock" that allowed participants to make a rough estimate of how much time various inspection activities required and keep track of cumulative elapsed time over a posited 72-hour inspection time limit.

5. Building on breakout discussions by the inspection and host teams, a discussion by all participants on Wednesday, June 29 on lessons learned from JUNEX22 for developing and testing concepts/technologies for verification of nuclear disarmament.

This report provides a detailed summary of JUNEX22. It begins with an overview of the exercise. It then sets out some observations on implementing the agreed PPTT in JUNEX22 as well as on broader implications for thinking about nuclear disarmament verification; possible areas for future work; and some preliminary implications for future exercises. In so doing, it draws on the discussion among participants and makes every effort to be faithful to that discussion.

Overview of JUNEX22

In Move 1 of JUNEX22, the inspection team (the Multi-State Verification Body, or MSVB) carried out a regularly scheduled inspection to confirm the transport of four containerized nuclear warheads from an operational Intercontinental Ballistic Missile (ICBM) base ("Westend Mobile-ICBM base") to the WSA in the inspected State's (Ipindovia) Long-Term Storage Site at its central nuclear weapons assembly/disassembly facility (LADDU). The MSVB chose to inspect after notification of receipt of the warheads at the Long-Term Storage Site rather than prior to shipment from the Westend Mobile ICBM Base. For their inspection, the MSVB inspectors drew on the set of agreed PPTT to achieve the following objectives: (1) confirm chain of custody on accountable items that are transported between sites and (2) ensure timely detection of any failure of chain of custody related to such movements and, if necessary, reconfirm that affected items are as declared. This inspection was the first of its type. Move 2 entailed a discussion without any role playing among all participants of the level of confidence in the results of the Move 1 inspection activities.

In Move 3, the MSVB carried out a regularly scheduled inspection of Ipindovia's WSA at the Long-Term Storage Site at LADDU. The MSVB did so after receiving notification from Ipindovia that it had declared 25 nuclear warheads as subject to dismantlement under the NWRT and moved them into the WSA at the Long-Term Storage Site at LADDU. Those warheads had previously been in storage elsewhere at LADDU and had not been subject to any verification under the NWRT. In carrying out this inspection, the MSVB drew on the set of agreed PPTT to achieve the following objectives: (1) establish and routinely check inventories of accountable items in storage and (2) maintain chain of custody for accountable items, including by using containment and surveillance techniques and by checking the physical integrity of facilities, buildings, and storage containers. This inspection was the first of its type at LADDU. Move 4 of JUNEX22 was a discussion without any role playing among all participants of the level of confidence in the results of the Move 3 inspection activities.

In carrying out both inspections, the inspection team was provided detailed information on Ipindovia's prior implementation of the NWRT, including past inspection history; site diagrams of the inspectable areas at LADDU (including the WSA, Maintenance Facility, and Dismantlement Facility); and other planning assumptions regarding the duration of the inspection, inspection equipment, safety and security constraints, and Ipindovia maintenance procedures for containerized nuclear warheads subject to possible inspection. Members of the host team provided the inspection team with a pre-inspection briefing before each inspection, which included information on locations of containerized nuclear warheads subject to the NWRT inside the WSA.

For its part, the host team had to develop and implement a plan and strategy to host each of these inspections in a manner that met its own objectives for the inspection, while facilitating the inspection team's activities to verify the NWRT. Specific host team objectives during the inspection were to (1) facilitate the inspection team's conduct of required inspection activities; (2) restrict inspectors' access to that which is specified in the NWRT; (3) not allow inspectors to view non-containerized nuclear warheads; (4) not allow inspectors to view the interior of nuclear warhead containers; (5) not allow inspectors access to facilities unrelated to the specific inspections; (6) protect proliferation-sensitive and other sensitive information; (7) ensure safety and security of all personnel and activities on site; (8) protect information regarding the physical security of nuclear warheads and their storage sites; and (9) protect information about operations at LADDU not related to the inspection and limit impacts on any ongoing operations at either site not related to the inspection. To achieve these objectives, the host team employed a set of managed access concepts developed in earlier phases of the IPNDV.

Observations on Implementing the Agreed PPTT

1. Validation of the Basic IPNDV Inspection Concepts and Approaches

The JUNEX22 exercise validated the inspection concepts and approaches identified in the Working Group 5 report for verification of the Transport and Long-Term Storage steps of IPNDV's 14-Step model of the nuclear dismantlement process. The agreed PPTT provided the right set of tools for carrying out these inspections and building confidence in Ipindovia's implementation of its disarmament obligations under the NWRT. As such, JUNEX22 complemented the results of the June 2021 exercise, which validated PPTT for Step 1 ("Nuclear weapon removed from its delivery system at the deployment site") and Step 2 ("Nuclear weapon in storage at the deployment site").

2. Refined Understanding of Specific Agreed PPTT and Their Implementation

The exercise allowed the participants to dive deeper into the implementation of specific inspection concepts. For example, the Move 3 discussion of verification of nuclear warheads in

long-term storage generated new detail on how radiation and laser detection containment and surveillance (C&S) technologies could be used during an inspection to help ensure short-term integrity of a weapon storage site subject to an ongoing inspection. That discussion also delved into the specifics of how to confirm the accuracy of previously supplied site diagrams. Similarly, the discussion of the use of radiation measurement equipment during both the Transport and Long-Term Storage site inspections highlighted the importance of the time differentials involved in the set-up and use of different types of radiation measurement equipment and the secure storage of such equipment at the end of an inspection day. More generally, JUNEX22 proved valuable in helping to address specific questions of how to use given technology options, something that had been flagged as an issue for more work in the June 2021 exercise.

3. Reaffirmed Importance of the Concept of "Two Layers" of Verification Security

The importance of providing "two layers" of verification security and avoiding a single point of verification failure was raised during the French-German NuDiVe-2019 exercise[2] and confirmed during the June 2021 Westend Base exercise.[3] The discussions in JUNEX22 both reaffirmed the importance of the "two layers" concept for the design of a nuclear disarmament verification regime and tested that concept's application in practice. Seeking two layers of verification and avoiding a single point of failure was a guiding principle used by the inspection team in its choices of how to apply the agreed PPTT. For example, the inspection team combined reliance on application of tags and seals and use of C&S during confirmation of the warheads in long-term storage at the WSA. Participants also emphasized that the inspectors should seek to verify more attributes of a nuclear warhead or its site as soon as possible.

4. Identified Implementation Issues for Additional Analysis

Participants flagged several issues that warrant additional, more detailed analysis. In particular, they agreed PPTT for both the Transport and Long-Term Storage Site inspections provided for the use of radiation measurement technologies to make templates of selected nuclear warheads to help confirm chain of custody of those warheads, their non-diversion, and their eventual verified dismantlement. JUNEX22 highlighted how the choice of specific radiation measurement technologies could impact the inspection process. For example, assuming an extended period of time required to set-up, cool-down, and prepare one type of gamma detection technology, it would have been difficult for inspectors to conduct all the measurements they deemed necessary. Or, to take another example, the importance of data storage and data security for any radiation measurement templates stood out in the discussion as an area for additional analysis. The exercise also highlighted the importance of considering how to combine different

[2] https://www.ipndv.org/news/ipndv-experts-gather-in-julich-germany-for-nuclear-disarmament-verification-nudive-exercise/

[3] https://www.ipndv.org/news/inpdv-conducts-virtual-nuclear-disarmament-verification-exercise/

technologies in an inspection, such as using radiation detection and laser detection systems as part of an approach to C&S at the exits of the WSA. During the discussion, participants considered a proposal to develop an electronic "passport" for each containerized nuclear warhead, thereby facilitating its tracking throughout what would be a multi-step, multi-year dismantlement process.

5. Impact of the "Time Factor"

Use of the game clock indicated there would have been sufficient time to fully implement the inspection team's plans in the Transport inspection. By contrast, in the Long-Term Storage inspection, the inspection team had to modify its inspection plan because of time considerations. Overall, JUNEX22 underscored for participants that both implementing specific PPTT and the overall inspection process will take more time than initially anticipated. Quite differently, the JUNEX22 discussion suggested that given the posited period of up to 20 years for full implementation of the NWRT, certain inspection activities, especially measurements for templates, could be carried out over time as long as chain of custody is sustained on the containerized warheads.

6. Impact of Numbers

In JUNEX22, the Long-Term Storage inspection intentionally began with notification by Ipindovia that it had declared 25 containerized nuclear warheads as now subject to the NWRT and that it had moved them into storage at the WSA along with four other warheads previously transported to the WSA from the Westend Mobile ICBM Base. Even with only 29 warheads in storage at the time of the inspection, the inspection team lacked sufficient time within the 72-hour time limit to carry out its proposed radiation measurements on nine nuclear warheads, as put forward in its initial inspection plan. Instead, it was only possible to do radiation measurements on six warheads to compare against a template of the single type of nuclear warhead that the scenario stated Ipindovia possessed. Moreover, given Ipindovia's obligation to dismantle 500 nuclear warheads, the number of containerized warheads in storage at the WSA and subject to inspection could grow considerably. Larger numbers of warheads to inspect would place even greater importance on using a sampling strategy to choose which items to inspect and on chain of custody as a means of verification. Such limits on the number of containerized nuclear warheads that could be subject to inspection at any time also would increase uncertainty and reduce verification confidence.

7. Impact of Inspection Contingencies

Inspection contingencies explored in JUNEX22 included damaged tags and seals, malfunction of inspection equipment, and various weather-related incidents. The occurrence of such contingencies should be anticipated and planned for. That said, quality control of inspection equipment up front could at least lessen the likelihood of failures in the field. Particularly for

equipment-related contingencies, the availability of duplicate, authenticated equipment to replace defective equipment would also lessen their impact.

The ensuing discussion as well as the use of the "game clock" made clear, however, that the occurrence of such contingencies could significantly disrupt an ongoing inspection, push out the inspection timeline, and make it difficult to carry out all planned activities in the time available. In addition, such contingencies increase the uncertainties remaining even after an inspection. Thus, it was seen as essential to build into any inspection planning process a capability to recover from these types of contingencies. Recovery is likely to involve actions by both the host and inspectors during the ongoing inspection. This could include extending the work day in the case of a temporary breakdown of inspection equipment to allow scheduled measurements to be completed as well as follow-up actions by inspectors on revisiting a site. For example, in the case of a damaged but still functional seal on a warhead container, the inspectors could re-check that seal and possibly select that container for radiation measurement of its contents.

8. Deepened Understanding of Safety and Security Requirements

The JUNEX22 discussion provided insights into how safety and security requirements could complicate and constrain implementation of specific PPTT. In so doing, JUNEX22 underscored for participants the many and sometimes unexpected ways that proposed inspection activities could bump up against safety and security considerations. For example, possible use of C&S technology in close proximity to one of the warhead bunkers in the WSA was ruled out because of the lack of any electrical power at such a bunker for safety reasons; battery-operated equipment also was ruled out because of safety concerns, as a battery malfunction could cause the equipment to catch fire. CCTV cameras to monitor the bunkers or entrance-exit from the WSA were ruled out for security reasons, including the risk to sensitive information about personnel and site activities. Additionally, an inspector request for logs of all vehicular movement in and out of the WSA during the inspection was ruled out because of security considerations, though providing inspectors with a log of any movement during an inspection in and out of specific bunkers subject to inspection was suggested as an alternative. Under some conditions, safety concerns could simply shut down all inspection activities for that day, such as during thunderstorms or a short-circuit of equipment that raised concerns of fire. Not least, it was stressed that the host escorts are bound by safety and security regulations.

9. Coordination within the Inspection Team

In both the Transport and the Long-Term Storage inspections, the inspection team chose to split into sub-teams to carry out the inspection tasks. As the exercise continued, where to draw the line between the activities of these sub-teams emerged as an issue. After the fact, the team's leadership would have modified its initial approach to better reflect the balance of efforts needed

for given inspection activities. In turn, JUNEX22 again flagged the importance of thinking about how to coordinate between sub-teams as they implement their overall inspection plan.

10. Shared Interest of Inspectors and Hosts in an Effective Inspection

The JUNEX22 discussion, as with the earlier Westend Base exercise, underlined the shared interest of the inspectors and hosts in an effective inspection. Within the constraints of safety and security, the hosts sought to find ways to address inspector requests, including being prepared to revisit the inspection schedule following delays due to unexpected weather events.

Broader Lessons for Thinking about Nuclear Disarmament Verification

1. The Chain of Custody Bedrock

Repeatedly during JUNEX22, participants from the inspection team emphasized the importance of robust chain of custody measures using tools from visual observation; unique identifiers (UIDs), tags, and seals; and extending to C&S. Establishing and maintaining chain of custody was seen as the bedrock of nuclear disarmament verification. Other PPTT can complement chain of custody measures and also offer ways to recover from breakdowns of chain of custody.

2. Rethinking Assumptions within the 14-Step Model

The 14-step model depicts each of its steps as a discrete verification activity. The Partnership's work in prior phases also identifies specific inspection PPTT options for verification of each of those steps. Continued exercises by the Partner countries, however, have demonstrated the need to approach verification as a system that considers all steps in the process and identifies key points where verification activities are most effective.

For example, during JUNEX22, the scenario required the inspection team to choose whether to carry out the transport inspection either prior to shipment from Westend Mobile ICBM Base or after receipt at the WSA—but not to do both. Participants in the exercise did not question that requirement as weakening verification. Indeed, the discussion during JUNEX22 considered the possibility that if effective chain of custody had been established over the containerized warheads at the base on their removal in Step 1 from delivery vehicles through observation as well as application of UIDs, tags, and seals, and then sustained in Step 2 during on-base storage through periodic checks of UIDs, tags, and seals, there might be no need to inspect those containers prior to shipment to long-term storage, or to do so only for some shipments. At the same time, the discussion suggested considerable reluctance to choose among steps in terms of their relative importance.

The JUNEX22 scenario also posited that the Transport inspection was a discrete inspection, carried out at some time prior to the Long-Term Storage inspection. However, the JUNEX22

discussion also raised the question of whether it would have been more effective to have combined the Transport and Long-Term Storage inspections into one overall inspection, rather than consider them as separate activities, so long as the inspectors chose to conduct their Transport inspection to confirm receipt of the nuclear warheads at the Long-Term Storage Site. More broadly, participants raised the importance of additional thinking about how to combine inspection activities at different steps to enhance overall verification effectiveness and confidence.

3. Phasing and Priorities in the Design of an Overall Inspection Strategy

JUNEX22 highlighted choices in the design of an overall inspection strategy. For each specific inspection, inspectors will need to decide whether and on what specific treaty-accountable items to carry out agreed inspection activities. For example, as part of the Long-Term Storage Site inspection, the inspection team had to choose a limited number of nuclear warheads from which to make a radiation measurement for a warhead template. Given the time required, it would not have been possible to make templates for all 29 nuclear warheads subject to the NWRT; neither would it have been cost-effective to do so. Closely related, JUNEX22 also highlighted the importance of thinking about the overall phasing and ordering of discrete inspection activities to be carried out during a single inspection. Such phasing and ordering of activities becomes especially important as time becomes a constraining element. In turn, assuming that inspection activities are conducted by multiple inspection sub-teams, as was done in JUNEX22, the sub-teams' activities must be carefully planned to ensure coordination and that each team's work compliments the other. Most broadly, the Long-Term Storage site inspection underscored that inspectors will not be able to do everything. Setting priorities will be an essential element of future nuclear disarmament verification and should be incorporated into the design of verification measures.

At another level, the JUNEX22 discussions pointed to the importance of thinking about phasing and ordering inspection activities. The scenario posited inspection quotas for different types of inspections. The existence of such quotas impacts planning for inspections conducted (1) at different sites in a single year, (2) at a single site during one year or over multiple years, and (3) at multiple sites over multiple years. JUNEX22 required, for example, that the inspection team choose whether to undertake a Transport inspection prior to warheads being shipped from the deployment site to long-term storage or after the receipt of those warheads at the WSA. As part of the recovery from an unexpected contingency, participants discussed what follow-up inspection activities at the same site during a later inspection might be needed to rebuild confidence in a continuous chain of custody. Given practical constraints of time and resources confronting an inspection entity, it will be important to think about inspection planning as a long-term activity conducted at multiple sites.

At a final level, phasing and ordering may include choices about when inspectors carry out technical measurements. Different views were expressed from doing so at the time when a warhead was initialized into the dismantlement process (e.g., at Step 1 or 2) to just prior to dismantlement (at Step 8).

4. Exploring Verification Confidence

Prior work of the IPNDV has repeatedly emphasized that verification of nuclear disarmament should be viewed as a confidence-building process. Over time, implementation of inspection PPTT at given steps in the 14-step model will create confidence that parties to a nuclear disarmament agreement are meeting their obligations.

For the first time, IPNDV partners explicitly addressed the question of what elements contribute to building verification confidence during discussions at JUNEX22. Those discussions identified a number of broadly defined and partly overlapping ways of thinking about verification confidence. The following sets these out, offers an attempt at elaboration in light of the overall discussion in JUNEX22, and includes examples taken from the JUNEX22 scenario.

- **Quantitative-Qualitative.** Verification confidence will be greater to the extent that it is possible to confirm the attributes of more Treaty Accountable Items (TAIs), including checking UIDs, tags, and seals on all containerized warheads in long-term storage or successfully making the requested number of radiation measurements to develop templates. At the same time, there is a qualitative dimension of verification confidence reflected in the extent of cooperation from the host in facilitating routine inspection activities or in facilitating recovery from unexpected contingencies.

- **Objective-Subjective.** Similar to the preceding pair of elements, the discussion highlighted objective and subjective elements contributing to overall verification confidence. The objective dimension partly points to the extent to which the inspectors are able to successfully carry out their inspection plan and the extent to which doing so met their stated objectives (e.g., use of a “drive-around” the WSA to confirm the accuracy of the site diagram provided the inspectors). At the same time, the objective dimension highlights the extent to which uncertainties remain despite successful implementation of inspection activities. Time was a particularly important factor, in that it is likely to limit the number of inspection activities that can be carried out during an inspection. These limits may be compounded by unexpected events that could preclude or disrupt full implementation of planned inspection activities. Much like the “qualitative” dimension, the subjective dimension focuses on the extent to which the inspectors come away with an overall sense that the inspected party is carrying out its obligations, a sense derived from the information gained, the extent of cooperation, the degree of inspector access to relevant portions of the inspection site, and other intangible factors.

- **Relative Diversion Risk.** The Partners identified that more work should be done to assess the relative diversion risk inherent in different parts of the Ipindovia nuclear disarmament scenario. There could be, for example, a higher risk that Ipindovia would seek to falsely declare the number of containerized nuclear warheads that it had moved into the LADDU WSA as subject to the NWRT than it might seek to divert a warhead being removed from a delivery vehicle. To detect the former diversion pathway, declared UIDs would provide the only provenance; for the latter diversion pathway, a mixture of visual observation, confirming UIDs as well as tagging and sealing, and possibly radiation measurement would establish chain of custody from the start. Thus, verification confidence could increase if diversion risks were low, or with more extensive verification in situations with a high diversion risk.

- **Sampling Strategy and Detection Probability.** Given what one participant referred to as the "inability to do everything," inspectors will need to develop a sampling strategy, in particular for deciding what radiation measurements to make. The JUNEX22 inspection team relied on a simple sampling strategy of random selection; other more sophisticated mathematical strategies exist, taking into account treaty-specific provisions. Based on the sampling strategy, there will be a given probability of detecting an anomalous result; conversely, to achieve a desired detection probability, it could be necessary to try to adapt the sampling strategy. So far, the Partnership has only begun to explore both aspects.

- **Repetition over Time.** The discussion also pointed to the contribution of repeated inspections at different sites over time in building verification confidence. An ongoing process of verification will offer an opportunity to confirm the attributes of additional TAI, undertake inspection activities to recover from unexpected contingencies, focus on additional locations within a site or across sites, and hold more sites and activities at risk over time. Equally important, the very process of repeated inspections and visits to the same site will build an understanding of "normal activity" that would help to identify possible anomalous behavior.

- **Capability to Recover.** Verification confidence is linked to an ability to recover from breakdowns of chain of custody as well as unexpected contingencies. The concept of two layers of verification security mentioned earlier seeks to address this aspect.

5. The Call for Thinking Strategically

The JUNEX22 discussion also suggested ways to follow-up on the call to think more strategically that came out of the June 2021 Westend Base exercise. For example, a more detailed assessment of the payoffs and costs of specific inspection activities in specific steps of the 14-step model would contribute to thinking strategically. How to use different types of technologies most

effectively, including low-technology approaches for certain steps, also fits in here. Closely related, the call for thinking strategically suggests stepping back from the overall 14-step model to assess the relative priorities of given steps and their contribution to building verification confidence. More thinking about inspection activities and priorities over time, at multiple sites, also would fit in here.

Areas for Future Work—by Task Groups, Technology Track, Integrated Teams

During the three days of discussions at JUNEX22, ideas emerged for follow-on work by the Inspector Task Group, Host Task Group, Technology Track, and integrated teams with members from all three. Suggestions included:

- Carry forward the ongoing work on inspection CONOPS, now taking into account lessons from JUNEX22;
- Carry forward the work on unexpected contingencies, including identifying possibilities and potential responses;
- Revisit the PPTT identified for each of the 14-steps to consider how to combine discrete PPTT to meet the two layers of verification security test;
- Analyze in greater detail different options for C&S approaches/technologies as well as their potential applicability in different steps;
- Consider the implications for design of inspection strategies and verification confidence of the point in the 14-step model at which warheads are initialized into the verification process, including those warheads without “provenance”;
- Assess the relative costs and benefits of radiation measurements as part of an inspection regime—when is it needed, how repeated measurements can be avoided, and what low technology alternatives could be used;
- For different steps, conduct more detailed analysis of how to combine specific technologies to achieve inspection objectives;
- Analyze issues of data storage and data security;
- Continue to think through approaches to sampling strategy, including more statistical approaches as well as levels of acceptable detection probability;
- Explore possible development of a “passport” for containerized nuclear warheads to be dismantled under a disarmament agreement; and

- Analyze technology measurement options for nuclear warheads based on highly enriched uranium.

Implications for Future Exercises

In the overall wrap-up session, the following preliminary suggestions were made for future exercises:

- After the inspection team and the host team have created their separate plans for the specific inspection scenario, bring the two teams together to discuss those plans and work out any differences regarding what activities would be permitted and how;
- Build on the use of the "game board" by finding a way for it to simultaneously show the activities underway in sub-groups and by linking the game clock to the "game board";
- Continue to use a multi-phase, hybrid exercise process that could combine virtual preparatory activities, planning discussion of inspection plans, and pre-site visits with in-person implementation of inspection plans at a given site;
- Seek to use the next exercise to address a multi-year inspection strategy, perhaps entailing a series of visits to one site or to multiple sites over time;
- Craft an exercise that involves the inspection and host teams planning for an inspection, a pre-inspection planning visit, and then focuses on how to address contingencies that arise in the actual inspection; and
- Explore possible elements of an exercise that would focus most on issues of coordination within inspection and host teams.

About IPNDV the International Partnership for Nuclear Disarmament Verification

The International Partnership for Nuclear Disarmament Verification (IPNDV), through a unique public-private partnership between the U.S. Department of State and the Nuclear Threat Initiative, brings together more than 25 countries with and without nuclear weapons. In this ongoing initiative, the partners are identifying challenges associated with nuclear disarmament verification, and developing potential procedures and technologies to address those challenges. Learn more at www.ipndv.org.