Report on the INMM Workshop on Preparing for Nuclear Arms Reductions to Address Technical Transparency and Verification Challenges

Mona Dreicer
Lawrence Livermore National Laboratory

Ferenc Dalnoki-Veress, Patricia Lewis
James Martin Center for Nonproliferation Studies
Monterey Institute of International Studies

ABSTRACT

In May 2011, a workshop was held to develop broader awareness of the technical and operational challenges that could be used to enhance effective transparency and/or verification in the medium to long-term. Building confidence in a broader multi-lateral engagement scenario adds even greater challenges than the traditional bi-lateral approaches. The multi-disciplinary group that attended included decision-makers needing to understand present and possible future technical capabilities, and the technical community needing clearer definition of possible requirements and operational constraints. In addition to traditional presentations, the group conducted an exercise to stimulate new perspectives on verification requirements for a scenario based on nuclear arms reductions at very low numbers of nuclear weapons. This presentation will summarize the outcome of the workshop and anticipated follow-on efforts.

INTRODUCTION

In Prague on April 5, 2009, President Barak Obama “... state[d] clearly and with conviction America's commitment to seek the peace and security of a world without nuclear weapons. I'm not naive. This goal will not be reached quickly — perhaps not in my lifetime. It will take patience and persistence.” As governments grapple with the defense and foreign policy decisions that must be taken to work towards the long-term goal of nuclear arms reductions, professional societies, such as the Institute of Nuclear Materials Management (INMM), have initiated forums to bring together technology developers, defense/foreign policy experts and students to develop and explore ways to achieve this challenging objective.

In close cooperation with the James Martin Center for Nonproliferation Studies (CNS) at the Monterey Institute of International Studies (MIIS), the Lawrence Livermore National Laboratory, and the INMM's Nonproliferation and Arms Control Technical Division a workshop was organized to:

- To consider government perspectives and results of a recent National Academy of Sciences (NAS)/United States Institute of Peace Symposium (USIP),
- Focus on technical challenges related to achieving greater transparency and verification of compliance with future commitments, and
- Conduct an exercise to challenge participants to think about what would be required to move towards a word with “zero” nuclear weapons.
OVERVIEW OF PRESENTATIONS

During the first session of the workshop, United States and United Kingdom representatives spoke about their government’s views on exploring options for future nuclear weapons stockpile reductions. They stressed the important capability that technology provides to monitor and verify commitments related to nuclear testing, accountability of warhead numbers/locations, possible future weapons dismantlement programs, and the production disposition of fissile materials for use in nuclear weapons. Existing and evolving technologies can help governments move towards these desired policy objectives so a robust dialogue between the technical and policy communities is essential. It was also recognized that engagement must extend beyond U.S.-Russia to other nuclear weapons states (P-5), defacto weapons states, non-nuclear weapons states, and NATO.

A nuclear security symposium, in January 2011, organized by the National Academy of Science Committee on International Security and Arms Control (CISAC) and USIP, asked experts from U.S. and Russia to draw lessons from the past and consider what could be accomplished today and in the future. By focusing on science diplomacy in support of nuclear security, they emphasized how science can bridge distrust and work to build meaningful confidence measures between countries. Past efforts, such as the U.S.-Russia Joint Verification Experiments (JVE) explored how sensitive national security information could be protected while finding ways to monitor the other side’s nuclear tests under the Threshold Test Ban Treaty. In this way, bi-lateral technical cooperation in support of verification was used to build trust.

The following presentations expanded on the importance of scientific and technical cooperation by describing past verification technology cooperation for the Intermediate Range Nuclear Forces (INF) Treaty and the Comprehensive Nuclear Test Ban Treaty (CTBT). Participants noted additional cooperative programs, not necessarily aimed at a specific treaty, which kept technical experts working together on a broad range of national security topics. The U.S. – Russia Warhead Safety and Security Exchange (WSSX), U.S-U.K. cooperation, and U.S.-China cooperation on materials protection, control and accounting were cited as examples. The most successful technical efforts focused on problems to develop common approaches, exercising sound scientific principles, and as much as possible, shielding the work from political pressures.

More details were presented on technical work that aided in the development of the CTBT global Radionuclide Monitoring Network (part of the International Monitoring System) and the CTBT On-Site Inspection regime. Experts illustrated how scientists working in a creative environment could cooperate and effectively communicate the results of their work to the policy community for implementation.

Two speakers addressed practical aspects of implementing verification regimes by drawing on U.S. and Russian experiences to implement Strategic Arms Reductions Treaty (START) on-site inspections and a more recent U.K.- Norway initiative to explore verification of nuclear warhead dismantlement between a nuclear weapons state (NWS)
and a non-nuclear weapons state (NNWS). In both cases, a clear understanding of the treaty/policy requirements was needed for successful implementation of the inspections. The tension between protecting the inspected party’s sensitive information while allowing sufficient access to provide the inspecting party with confidence that their objective has been achieved was clearly illustrated, and ways to overcome this tension were explored.

The workshop participants were reminded that hosting an inspection is a disruptive event and must be efficiently run with fully functioning equipment. The health and safety of the inspectors must also be considered. It was stressed that in many cases, the simplest equipment might be the best option but if specialized equipment is needed, jointly developed systems provide the highest confidence that access to sensitive information has been controlled and the measurement results are accurate. The START I inspectors benefited from 10 years of on-the-ground experience and this experience will be carried forward to the New START inspection regime. The U.K.-Norway Initiative illustrated how the dialogue between sides is crucial in understanding the complexities of bi-lateral work between a NWS and NNWS. The U.K-Norway Initiative went one step beyond NWS-NNWS engagement and looked at the advantages and disadvantages of engaging the public via a trusted observer (in this case a non-governmental organization). They reported that this was useful in establishing a constructive dialogue.

The final session, set out to outline the possible steps to be taken as the world moves from the current nuclear weapons stockpiles levels held by the P-5 to lower levels taking into account existing and potential Indian, Pakistani, Israeli, DPRK and Iranian weapons. The session highlighted the premise that, as the number of weapons decrease, the cost and intrusiveness of each successive treaty will increase and new authorities and technological approaches will be required. The challenges inherent in accepting an increased level of intrusiveness and the need to verify declarations will have to be taken into account. Additionally, national defense linkages to conventional weapons cannot be ignored as the number of weapons gets lower and lower.

Technical presentations addressed the anticipated difficulties in protecting sensitive information collected during nuclear warhead measurements and consideration for designing information barriers to protect such information. Significant challenges would be encountered if a treaty required chain of custody and accounting of warheads throughout the lifecycle of nuclear operations.

**EXERCISE**

The workshop participants were divided into two groups and asked to explore the political and technical requirements needed for States to move towards significant arms reductions. Using a technique called “backcasting,” participants were asked to imagine a world without nuclear weapons and describe what would be needed to achieve levels of one thousand, one hundred, ten, and ultimately zero weapons in the world. The objective was never to convince the participants that a world without nuclear weapons would be achievable in the near future but to encourage thinking about the provisions that
would needed to verify such a world. Although many participants could not accept the reality of “zero” nuclear weapons, a lively discussion ensured. Graphical representation of the discussion was used to help the groups’ focus and highlighted some of the diplomatic and technical actions that would likely be needed.

**Key Issues Discussed**

The intent of the exercise was to stimulate discussion and not arrive at consensus conclusions, especially given the small amount of time and diversity of expertise in each group. For the purpose of this paper, a few of the key issues are highlighted. In each case, the topic could be explored to a much greater depth.

**Importance of Political Commitment**

Most participants agreed that a strong political commitment will be necessary and that complete disarmament will only be possible if states are convinced that nuclear weapons serve no purpose. Some members suggested that it is wishful thinking to believe that nuclear weapons will be eliminated and equated this with a change in human behavior stating that "humans will always kill humans, it is in our nature". In considering potential government positions, the group identified two factors that will be pivotal to developing national policies: (1) the deterrent role of conventional forces will influence the perception and need for nuclear weapons, and (2) different States pose different proliferation risks so it will be difficult to formulate a universally-applied global verification regime. This could influence the level of confidence that could be achieved and complicate implementation of an effective global verification regime.

**Beyond the P-5**

Russia-U.S. engagement on arms reductions will be the initial priority, however the importance of P-5 engagement will increase. It was recognized that early inclusion of NNWS into of the disarmament verification process would build broad confidence that nuclear weapons were actually being dismantled. U.K. and Norway have taken an initial step in this direction (as presented earlier). There will be a significant challenge to overcome the tension between the increased need for detailed information sharing while preventing design information from being revealed to NNWS. It was suggested that the international community might have to be satisfied with a "black-box" approach where a warhead is demonstrated to contain fissile materials upon entering a dismantlement cell and shown a "box of parts" at the end of the dismantlement.

**Moving from 1000 to 100 (some concepts/ideas)**

Both groups believed that a time period of greater instability would be encountered when moving from 1000 to 100 nuclear weapons and that it would be imperative to accelerate quickly through this period. A large backlog of weapons designated for dismantlement, but not yet dismantled, would increase instability. Significant dismantlement will likely require dedicated dismantlement facilities in many countries and require firm longer-term political commitment to maintain the activity through this period of instability. In an unstable environment, it is unlikely that states would agree to further reduce their nuclear weapons stockpiles. Some members pointed out that the U.S. and Russia have not
surrendered any strategic capabilities by reaching the current state of the numbers of nuclear weapons. This will change near the period of instability and this will make it difficult, even dangerous to manage.

Throughout the process of dismantlement, continued monitoring of States and non-State actors to prevent and detect the acquisition and development of nuclear weapons would be needed. Suggestion were made for; (1) an expansion of the "Open Skies Treaty" where mutual aerial observation was agreed to among 34 nations as well as a sensor network to monitor and detect facilities; (2) the need for a new Conventional Forces Treaty, based on the CFE (Conventional Forces Treaty in Europe) to prevent a non-nuclear arms race by placing ceilings on non-nuclear weapons; (3) societal verification with cell phones equipped with sensors and sophisticated patter recognition software to track financial transactions dealing with the transfer and acquisition of materials for a nuclear program; and (4) a verification regime for the PAROS (Preventing an Arms Race in Outer Space) treaty containing remote sensing and on-site inspection components to verify no warheads on ballistic missiles (expected not to be difficult with radiation detectors near the launch site).

The group discussed the need to have an international body monitor the disarmament process to maintain legitimacy for the international community. One possibility could be the development of an intergovernmental panel on verification and disarmament (note that something similar has been proposed by Frank von Hippel in terms of an inter-governmental panel for fissile materials as discussed in P. Lewis, www.icnnd.org/Documents/Lewis_FMCT.doc, p. 15) to monitor and facilitate disarmament. Membership would be expected to include NWS and defacto NWS and NNWS to maintain legitimacy.

Dealing with Materials
The groups recognized the problem of fissile material disposition after warheads dismantlement. Controlling fissile materials is important since nuclear material could be a direct route to reconstitution of weapons. Possible solutions discussed were: (1) declare the materials as civilian stocks, place them under IAEA safeguards; (2) establish an international fuel bank of dismantled warheads (based on the “Megatons to Megawatts” program), where a handful of states (P-5) would provide fuel for all States, thereby requiring no further uranium enrichment in NNWS (The reduced need to produce and sell enriched uranium would greatly affect the enrichment industry.); or (3) negotiate a HEU agreement (as with a Fissile Material Cut-off Treaty) to outlaw its use in the civilian sector and to tag naval reactor fuel with isotopes to prevent its further use in nuclear weapons.

At Low Numbers
At low numbers of nuclear weapons it will become increasingly important to verify that no nuclear weapon state has a strategic advantage because of their arsenal. Therefore, greater openness, such as revealing the yield and type of weapons to assure all nuclear weapon states of the intention to disarm will be needed. It will be critical to prevent design related information from becoming available to other states in accordance with the
NPT. For example, specific details on weapon miniaturization will need to be protected from becoming available to less advanced nuclear weapon states. Some members stressed that as the number of nuclear weapons draws down among states committed to disarmament, there will be an increased need for transparency among the weapon states, to the point that it may even be possible to forego the need for information barriers. To be able to increase transparency, suggestions were made for "graded classification schemes" based on the proliferation potential of the knowledge to be shared.

As the number of nuclear weapons dwindle to tens of weapons for each NWS, the requirements for transparency will become even more stringent, type of delivery system, and speed in dismantlement will become even more important. Some members suggested that all nuclear weapons will need to be monitored, seen at all times. This need must be balanced against national security vulnerabilities resulting from disclosing the locations of the weapons. Again, the tensions between transparency and revealing too much information will have to be carefully managed.

When the point of zero nuclear weapons is reached, the challenge will be to maintain a chain of custody of all fissile materials and the universal safeguards of proliferation sensitive facilities. This will require a strong financial commitment by the international community since this would need to be maintained in the long term. In principle, a lot of the social, political technological challenges will already be solved in order to get to this point. However, dealing with dual-use and latent capabilities together with the need to control any release of sensitive national security or weapons significant information will greatly complicate the process. Some members of the group observed that once nuclear weapons will become devalued in society they will still pose an inter-generational danger, and it will be important not to become complacent and maintain chain-of-custody in perpetuity.

CONCLUSIONS

An INMM workshop to address technical transparency and verification challenges in preparing for nuclear arms reductions brought together about 70 international multi-disciplinary experts from government, international organizations, non-governmental organizations, national laboratories, industry, and academia. The mix of policy and technology experts, together with students resulted in lively discussions and the group was motivated to explore various options, and identify obstacles and technology challenges. Student participation allowed engagement between those embarking on their careers with those who have had decades of experience working on nuclear weapons issues. The presentation materials will be available on the INMM website and ideas for follow-on workshops and studies are being explored.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344 (LLNL-PRES-505356)