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'Verifying Warhead Dismantlement: Past, present, future'
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Introduction

Our report, Verifying Warhead Dismantlement: Past, present, future, builds on VERTIC's three-year involvement with the so-called UK-Norway Initiative to investigate some of the issue involved in the verification of nuclear warhead dismantlement.

As the first time a non-nuclear-weapon state has partnered with a nuclear-weapon one in this way, the UK-Norway Initiative has broken important new ground, and set what may yet become a strong precedent for future work.

VERTIC has been involved as an independent observer to the Initiative from the project's earliest beginnings in 2007. Civil society involvement in an initiative of this kind is important for a host of reasons—not least in terms of increased transparency, outreach and after-action promotion.

The Initiative grew out of the work of the 'Seven Nation Initiative' driven by Norway after the 2005 NPT Review Conference.[1] It was not part of the initiative as such, however. It sought to identify the possibilities for non-nuclear-weapon state involvement in future dismantlement processes. The initiative was set up to be apolitical, driven by scientific and technological curiosity, and did not attempt to shape policy agendas. In that regard, the project, which remains ongoing, has been a considerable success.

At present, the UK-Norway Initiative is focusing on smaller-scale, 'targeted' exercises focusing on specific issues to arise from the main inspections; facility security for instance. A third inspection visit is scheduled to take place, in the UK this time, this coming December.

Arguably the Initiative's most important finding, as reported in the joint UK-Norway working paper presented by the two countries to the 2010 NPT Review Conference, was that it is possible for a nuclear and a non-nuclear weapon state to successfully 'collaborate within this field and successfully manage any risks of proliferation while doing so'.[2]

[1] See http://www.7ni.mfa.no/. The initiative involved Australia, Chile, Indonesia, Norway, Romania, South Africa and the United Kingdom.
[2] See UK-Norway Working Paper (NPT/CONF.2010/WP.41) (May 2010), available at http://www.vertic.org/assets/Publications/WP41.pdf

One way in which the UK-Norway Initiative sought to minimize proliferation risks was to have the country participants swap roles. That is, UK personnel played the part of NNWS inspectors while Norwegian players represented personnel from a nuclear-armed host state. An added benefit of this switch was that it allowed each side to approach the challenges involved from a new perspective, enabling them to gain a better understanding of the issues and considerations of the other party.

Ultimately, by framing verification problems in generic terms, it was found that proliferation risks can be kept to a minimum. And that, in turn, allows non-nuclear-weapon states to contribute to the development of technical solutions addressing dismantlement verification needs—which opens the door to a host of new possibilities.

In writing this report, our intention was to place the UK-Norway Initiative in the wider historical context of other exercises and studies, in order to draw out the commonalities and differences between past efforts and the achievements of the UK and Norway—and to point toward the most promising and necessary avenues for future research. The intention was also to dispel the notion that this was a 'cartoon exercise' whose artificiality was such that it could produce no useful findings.

The report itself evolved into a story. Indeed, as we write in the introduction, it almost became a history, albeit limited in scope, of nuclear arms control verification itself, charting strands of thinking from the height of the Cold War to the present day.

We at VERTIC felt that the rich historical experience of past research has never before been accorded the attention it deserves, nor ever consolidated in one place. Aside from a few isolated instances of personal communication with involved participants, all sources used for the report are freely available in the public domain.

The report presents its historical case studies in chronological fashion, beginning in the 1960s, at the height of the Cold War, with a description of a remarkably detailed verification exercise undertaken in the US, an exercise designated Field Test FT-34.

It moves on to look at the so-called Black Sea Experiments in 1989, the US Department of Energy's mid-1990s investigation of verified dismantlement, the Trilateral Initiative conducted between the US, Russia and the IAEA from 1996-2002, the multi-year study of disarmament verification undertaken by the United Kingdom from 2000 onwards, and lastly, the UK-Norway Initiative itself.

This presentation aims to give a brief overview of the main findings from each of these exercises, to highlight the most consequential lessons learned, and to set out where, in our view, future research can best go next.

Field Test FT-34

This exercise, held over four months and four US nuclear facilities in 1967, remains significant to this day not only because it represents the first full-scale dismantlement exercise, but also for the level of attention to detail involved.

During FT-34, scientists and military personnel charted the probabilities of successful attempts at diversion and the amount of classified information revealed at successfully higher levels of inspector access with mathematical precision.

Some of the projects conclusions are intuitive and reappear in later studies; others, however, such as the almost exponential rise in the number of classified items revealed as access levels increase, are more distinctive.

An underlying theme, though, is that inspector access to facilities where dismantlement is taking place requires careful planning, preparation and management.

In terms of results, some of the most important are:

- That the construction of a dedicated dismantlement facility may be necessary;
- That not all information of use to a foreign government can be protected regardless of precautions taken (note that the FT-34 report did not say 'classified information' here but rather 'information of use');
- That a high access level is required if inspectors are to be reasonably certain that a weapon is not a fake.

The Black Sea Experiments

For their part, the 1989 Black Sea Experiments stand out as something of a verification anomaly. For the first time, US scientists were allowed to take close-up, unrestricted measurements of an operational Soviet warhead, located on an active Soviet naval vessel.

The experiments served to push the boundaries of what was deemed the acceptable limits of verification, and represented a significant milestone in building trust between US and Soviet scientists.

In fact, the experiments were so controversial in the US that Washington actively discouraged those US personnel who did take part from doing so, fearing that that the experiments would encourage calls for a reciprocal visit aboard an American warship.

While the Black Sea Experiments had no sequel, and arguably wouldn't take place today, the main reason for their inclusion in our report is the manner in which they show that states' tolerance to intrusiveness shifts over time.

The 1996-97 Department of Energy Study

Turning to the post-Cold War era, the DOE's mid-1990s report on Transparency and Verification Options that could be applied at US dismantlement facilities was included in our report for the substantial contribution it makes to the broader state of knowledge.

In contrast to FT-34, however, the DOE study was only a theoretical one. But as we have written, while practical exercises have a number of advantages over table-top studies, such theoretical investigations have their merits also. They are (relatively) cheap, (relatively) easy to organise, and can produce valuable results and insights.

Some of the principal conclusions from the DOE's work were:

- That confidence in warhead dismantlement is theoretically possible without the need for an exchange of classified information;
- That chain-of-custody monitoring may need to begin as early as deployment sites if inspectors are to be confident that a real warhead is being dismantled;
- And that, more obviously, inspector confidence correlates closely to the level of access provided.

On that last point, it struck us that in all the exercises we looked at, these kinds of issues of confidence tend to be referenced often but never examined from a more detailed, psychological point of view. It would be interesting to see a study involving a psychologist to measure and analyze the interactions between inspectors and hosts at different stages and in different situations.

Amongst its many recommendations, the DOE suggested (somewhat similarly to FT-34) that an in-depth analysis of the issues and costs involved in the construction of a verification-oriented, dedicated dismantlement facility be conducted in preparation for real-world agreements calling for the verified dismantling of warheads.

The Trilateral Initiative

The Trilateral Initiative from 1996-2002 holds particular relevance for the recently amended Plutonium Management and Disposition Agreement, which is to see the Agency verify the disposition of 68 tons of US and Russian weapons-grade plutonium—equivalent to some 17,000 nuclear weapons—over and above their military needs.[3]

In comparison to some of the other studies that we looked at in researching this report, little is known about the Trilateral Initiative and its comprehensive final report remains 'in confidence' to this day.

A major aspect of the Trilateral Initiative was the development of 'information barrier' technology, designed to allow inspectors to take measurements of nuclear weapon components without gaining access to sensitive design information.

For six years work among the three involved parties continued before the project was wound down under the Bush and Putin administrations' watch. But the legacy and obvious potential of the information barrier lived on, resurfacing again as part of the UK and Norway's joint efforts. In the Trilateral instance the technology developed under the project was never put to the final test of real-life implementation. Significantly, though, all parties concluded that the same technology was robust enough to be used by the IAEA in nuclear facilities, with no danger of proliferative material being revealed in the process.

We included this section mostly because of the information barrier, but also because the project has a good deal of relevance for other work. It is a true shame that the Initiative's findings have

[3] See http://www.america.gov/st/texttrans-english/2010/April/20100413172618xjsnommis0.4895397.html

never been declassified and released, but for those involved in verifying the PMDA they should certainly be revisited.

The UK Study Series, 1998-2005

As the Trilateral Initiative was winding down, British efforts to investigate disarmament verification—a project with its origins in the UK's 1998 Strategic Defence Review planning document—was heating up.

The UK study series has been mostly overlooked and underappreciated since its major work phase was completed in 2005. It made an important contribution to the state of knowledge, but its impact was lost as its findings were not clearly and publicly enough communicated. Which demonstrates the value of civil society involvement—NGOs are can play an important role in getting the message out to a wider audience in the after-action phase of an initiative or study.

The British effort focused on three strands of disarmament verification: authentication, dismantlement, and weapons complexes, with interim reports presented to the NPT PrepCom meetings in 2003 and 2004 and a working paper of consolidated findings presented to the Review Conference in 2005.

As one might expect from a study of this size and depth, Britain's investigations resulted in a number of important conclusions. Among them:

- that the authentication of warheads and warhead components is the most technically challenging verification task (echoes of the DOE report here); and
- that 'managed access', when done properly, with due regard for the full range of risks involved, is able to permit some degree of access for non-security-cleared personnel to facilities of a sensitive nuclear nature.

The UK-Norway Initiative

Research activities under the UK-Norway Initiative proceeded along two interlinking fronts: information barrier technology; and managed access methodologies. During the actual monitoring visit, held in Norway in June 2009, inspectors used the information barrier system developed for the purpose of the Initiative in order to help them verify the dismantlement of a mock nuclear warhead.

Alongside the information barrier, the managed access research strand explored the human factors involved in dismantlement verification—fundamentally, ways to manage the presence of foreign inspectors in highly sensitive nuclear weapons complexes.

The main exercise phase of the Initiative involved two inspection visits: one in December 2008 to negotiate a verification plan and the abovementioned visit to June 2009 to then carry out those agreed activities. Both exercises were held in Norway, partly in order to minimize proliferation risks. Full details of both are contained in our report.

Despite criticism that it would add nothing of value, the Initiative has made a worthwhile contribution to the state of dismantlement verification knowledge—and it has done so in a unique

manner, by investigating the verification of nuclear warhead dismantlement within the pioneering context of NWS-NNWS collaboration.

There remain, however, several unanswered questions highlighted by the Initiative's work:

- how to make the best use of the array of verification tools and techniques available to inspectors;
- how to authenticate an item as an actual warhead or component warhead; and
- how to verify a state's initial declaration of its nuclear weapon and material holdings.

Overall, then, there still exists considerable scope for further work addressing the verification of nuclear warhead dismantlement. And while the work of the UK-Norway Initiative has made a number of significant contributions, sustained state efforts—whether they come from individual states, or under the umbrella of international governmental organizations, or from joint 'coalitions of the willing'—are essential in order to resolve the various issues that still require further research and development.

Conclusions

All that said, at VERTIC it is our overriding conclusion, drawn both from our experiences as part of the UK-Norway Initiative and our subsequent research into similar and related efforts, that verified warhead dismantlement is technically feasible. Furthermore, we believe that it is possible to keep dismantlement verification within acceptable levels of tolerance—both in terms of intrusiveness and reliability.

That said, however, a number of caveats require a mention also.

1. Confirming that an item is a warhead or a component from a warhead has been shown time and again to represent one of the most technically challenging aspects of disarmament verification. The information barrier is one way of potentially overcoming this difficulty; beginning chain-of-custody tracking at warhead deployment sites is another. Any dismantlement verification regime is likely to receive a significant confidence boost if inspectors are allowed to witness the actual de-mating of a warhead from its delivery platform.
2. Establishing a robust chain-of-custody of a warhead undergoing dismantlement is a challenging, but by no means an insoluble, problem. More research in this area can be directed a wide range of verification techniques and technologies, not just the information barrier.
3. Finding and maintaining a mutually acceptable balance between confidentiality (on the part of a host) and confidence (on the part of an inspector) is not easy, but absolutely critical to the success of a verified dismantlement process.
4. No exercise has ever sought to explore where the inspector's demand for information optimally intersects with what the inspected host party is willing to supply, for instance. What level of access best reconciles the competing priorities of inspector and host? Can such an intersection ever be found even, given variable classification requirements and shifting tolerances?

Future research into issues such as these could look beyond the purely technical realm too. Away from the nuts and bolts of verification activities, the human factor remains a largely unexplored avenue of arms control monitoring. As we note in the conclusion to the report: 'Human beings have a tremendous ability to observe, deduce and imagine from limited data-sets, yet most verification exercises almost see the human inspector as a pawn to be moved around on a facility chess-board.'

As a result, there is room for more psychologically-oriented studies into dismantlement to be undertaken in the future. After all, trust and confidence between an inspector and an inspected party is a matter of vital importance. Neither can be taken for granted, both need to be built from the ground up and nurtured over time. If broken, they may stay that way for a long time. Thirdly, a common finding of most major studies of dismantlement verification is that verification activities carried out in existing facilities can be disruptive and fraught with potential monitoring complications.

By contrast, a dedicated dismantlement facility designed and built with monitoring in mind would ease the verification process considerably—to the considerable benefit of both sides. As a final note, as we look now to the future, it almost goes without saying that we at VERTIC wholeheartedly support efforts to advance the state of dismantlement verification knowledge as far as possible, whether those efforts be ongoing or yet to be set in motion.

And it is our opinion that the best way to build on the momentum created by the UK-Norway Initiative is to continue to involve more actors in the process—whether they be from the nuclear or non-nuclear weapons side of the NPT divide—in the months and years ahead.

While we don't say so explicitly in our report, this is about ownership of the process. All stakeholders, nuclear and non-nuclear, need to feel that their input is welcome and valued; that their ideas will be listened to, considered and, if appropriate, acted upon.

Thank you for your attention.