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# Verification of Warhead Dismantlement: Challenges, solutions and prospects

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Despite the new sense of dynamism that marks recent debates on nuclear disarmament, verification of nuclear warhead dismantlement remains an understudied topic. This paper presents and elaborates on the findings of VERTIC's report: 'Verifying Warhead Dismantlement: Past, Present, Future.' The study, released in 2010, surveys past exercises and initiatives that investigated various aspects of verifying nuclear warhead dismantlement. The study relied on a wide variety of primary and secondary, government and non-governmental, sources. It also benefited from VERTIC's participation as an observer to the UK Norway Initiative on the verification of warhead dismantlement. This paper, after presenting the main findings of the study, poses the question: 'What role could the IAEA play in future efforts to develop verification methodology for nuclear disarmament?'

In the eighth preambular paragraph of the Nuclear Non-Proliferation Treaty (NPT), state parties have declared their intention to 'undertake effective measures in the direction of nuclear disarmament.' They have also committed, in operative article six of the treaty, to 'pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament.' Effective verification measures are likely to play an important role in ensuring the multilateral achievement of nuclear disarmament. In 2000, the NPT review conference included verification as part of the 13 'practical steps' for the systematic and progressive implementation of Article VI of the treaty. But despite the importance of verification in reaching a world free of nuclear weapons, the topic has not received the attention it deserves.

This paper presents and elaborates on the findings of VERTIC's report: 'Verifying Warhead Dismantlement: Past, Present, Future.' [1] The study was motivated by VERTIC's three-year involvement as an independent observer to the UK-Norway Initiative on the verification of warhead dismantlement. VERTIC's study drew on a wide range of previous warhead verification studies and exercises. It also relied on the organization's first hand participation in the UK-Norway Initiative. In writing the report, a wide variety of primary and secondary, government and non-governmental, sources were consulted. [2] Apart from a few instances of personal communication with involved participants, all sources consulted for the report are freely available in the public domain.

The report's survey of past exercises and initiatives begins in the 1960s when, at the height of the Cold War, the United States undertook a little-publicised verification exercise known as Field Test FT-34. This was in line with US proposals around at the time to transfer up to 60,000 kilograms of weapons-grade uranium-235 to non-weapons uses. The purpose of the study, as outlined in the test's declassified final report, 'was to develop and test inspection procedures to monitor the demonstrated destruction of nuclear weapons.' [3]

The exercise was conducted jointly by the US Department of Defence and the US Arms Control and Disarmament Agency. It emphasized developing metrics for concepts such as verifiability and intrusiveness. With meticulous attention to detail, scientists and military men working across four different US nuclear sites over four months in 1967 charted the likelihood of diversion and of revealing classified information at various levels of inspection intrusiveness.

Some of the project's conclusions, such as the increase in inspector confidence with increasing levels of access, are intuitive and reappear in later studies. Others, such as the almost exponential rise in the number of classified items revealed as access levels increase, can be considered more distinctive. [4] In particular, FT-34 underlined the potential synergy between the use of dedicated dismantlement facilities and the management of on-site inspector access as a means of reaching acceptable confidence levels while guarding potentially proliferative information at the same time. [5] It argued that almost all classified information could be protected in the future through the redesign of facilities and equipment coupled with heavy controls on access.[6]

Purpose-built facilities can have the advantage of using universal tooling and fixtures for weapons and material disassembly, thereby decreasing the complexity of verification in a classified environment. Also, the careful management of inspectors' on-site presence can significantly mitigate proliferation risks. The report also flagged the importance of reconciling the inclination of the host to decrease access with the inspector confidence that high access levels can generate. The report concludes that 'it may be possible to protect most classified information during a demonstration in a specially prepared facility if inspector access is limited to visual inspections of weapons and facilities, if some features of weapons are effectively masked, and if fissionable materials are blended.'[7]

The 'Black Sea Experiments' are another verification exercise worthy of particular note. The experiments were conducted in the late 1980s and involved a group of American scientists, taking part in their own personal capacities, and a host of official Soviet participants. The experiments took place amid US-Soviet differences over the inclusion of long-range nuclear-armed sea-launched cruise missiles (SLCM) in ongoing Strategic Arms Reduction Treaty negotiations. The Soviet Union had a keen interest in applying limitations to this class of weapon system while the United States, which held an advantage in SLCM deployment, argued that limits on nuclear SLCMs could not be adequately verified. [8]

The Black Sea Experiments can be considered a verification anomaly for a number of reasons, not just its unique format. In one of the experiments, US nationals were allowed to obtain direct measurements on an operational, unshielded Soviet nuclear warhead. For all their pioneering advances, later studies tend to assume that such direct measurements will not be tolerated by nuclear-weapon states. From that perspective, the experiments demonstrate how states' tolerance to verification intrusiveness can shift over time. [9] It is difficult to imagine how a similar exercise, involving direct access by foreign scientist to a nuclear warhead, can happen today. The experiments also show the role that civil society can potentially play in creating confidence, and in examining verification methods when the political environment is less permitting. [10]

Another notable study examined was the US Department of Energy's 1996-1997 study into transparency and verification options that could be implemented to monitor warhead dismantlement at DOE facilities. The study anticipated US-Russian deliberations of reductions beyond START I and II that could potentially include warhead dismantlement.

By studying the various verification options readily available, the study presented a solid appraisal of relevant verification methods and how they can be integrated into an effective monitoring regime. After which it drew some important conclusions, including that moderate inspector confidence in the dismantlement of a nuclear warhead is achievable without the need for two sides to engage in an exchange of information that is considered classified under US law.[11]

The DOE study raised an interesting problem also: namely, that finding out whether an item presented for dismantlement is a genuine warhead is, on balance, difficult. It recognized the importance of preserving a

robust chain of custody during dismantlement as one way of increasing confidence. [12]It also suggested that the early establishment of chain of custody measures, perhaps even as early as deployment sites, could help to reduce uncertainties associated with the identification of nuclear warheads before dismantlement takes place.

The joint Trilateral Initiative between the US, Russia and the International Atomic Energy Agency (IAEA) started around the same time as the DOE's study. This initiative examined the legal, technical and financial aspects of IAEA verification of fissile material deemed to be in excess of US and Russian military needs. [13] Significantly, the Initiative developed 'information barrier' technology designed to allow inspectors to take measurements on nuclear weapon components without gaining access to classified design information.

Information barrier technology was designed to provide simple 'pass/fail' readings based on a set of unclassified, pre-agreed attributes of an item under inspection. For six years work among the three involved parties continued before the project ended in 2002. Documents were produced 'in confidence', with distribution strictly limited to the parties involved. [14] To this day, precious little information on the initiative has been released into the public domain. And much of what has emerged has been related to the technical side of the initiative, which included work in three areas: authentication; inventory monitoring systems; and the verification of the conversion of classified fissile material to unclassified forms.

The last exercise examined in our survey is the UK-Norway Initiative on verifying warhead dismantlement. In 2007, the UK and Norway came together, with the assistance of VERTIC, to establish a joint research programme looking into the technical requirements of warhead dismantlement verification in the unique context of nuclear-weapon state (NWS) and non-nuclear-weapon state (NNWS) cooperation.

Research under the initiative advanced along two strands: one on information barrier technology, building on research undertaken during the Trilateral years; and one on on-site inspection methodology. [15] The aim was to prove the applicability of certain verification concepts to the verification of warhead dismantlement and particularly in a context involving both a NWS and a NNWS. An important feature of the methodology used was its reliance on applied exercises to test verification methods and techniques in a setting designed to simulate real-life constraints and conditions. [16] In organizing the initiative along the two aforementioned strands and in following a simulation methodology, it sought to tease out lessons from the interaction of NWS and NNWS on the verification of warhead dismantlement and identify areas where further research might be required.

And as the first example of collaboration between a nuclear and a non-nuclear-weapon state on the verification of warhead dismantlement, the UK-Norway Initiative broke important new ground. The results were encouraging, suggesting that NWS-NNWS cooperation in this specific area of nuclear arms control is not only possible but useful also. [17] Moreover, nothing in the initiative led to a conclusion that the verified dismantlement of nuclear warheads is not a technically feasible goal, able to be conducted within acceptable levels of confidence. [18]

The initiative has confirmed earlier findings about the crucial importance of maintaining a robust chain of custody during the dismantlement process and the challenges associated with verifying that the item presented for dismantlement is truly a nuclear warhead and not some other item with similar properties. [19] But perhaps more significantly, it has demonstrated that the involvement of a NNWS, despite the challenges it presents, is achievable. [20] Nothing would suggest that involvement of a NNWS in the verification of warhead dismantlement is impossible.

The different studies examined in the report might seem unconnected and, indeed, each had its own peculiar context and motivations. These studies provide a solid foundation for exploring the array of verification challenges and solutions associated with nuclear disarmament. Such studies show remarkable seriousness, focus and solid methodology. However, reaching an effective nuclear weapons dismantlement regime will require dedicated and concerted efforts to further examine and develop international capabilities and expertise in the field. Wider participation and contributions from states and international organizations in examining verification solutions and methods will be vital to advance the state of knowledge and develop

the kinds of best practices necessary for any such verification missions.

So what part could the International Atomic Energy Agency play in future efforts to develop verification methodology for nuclear disarmament?

It is important to recall that the Agency's role in the disarmament effort is, undeniably, supported by international treaties. The 1996 African Nuclear Weapon-Free Zone Treaty, for instance, clearly envisions a role for the IAEA in verifying the processes of dismantling and destroying nuclear explosive devices. [21] The Agency was closely involved in drafting this treaty, and had the endorsement of its policy making organs when doing so. In fact, in the words of Ms Jan Priest: 'The Agency's statutory mandate to apply safeguards leaves considerable room for flexibility to accommodate fresh tasks and challenges.' [22] This statement was made in her official IAEA capacity.

The African Nuclear Weapon-Free Zone Treaty entered into force in July 2009. There are no present indications of any nuclear weapons programme in Africa. But the question should be asked: if another programme emerges, and the IAEA is called to do its treaty-mandated work, could it perform?

Not only is the IAEA treaty mandated to carry out this kind of work. Its role in nuclear disarmament was clearly foreseen by its founders. Article III.B.1 of the IAEA Statute clearly stipulates that the Agency should 'conduct its activities in...conformity with policies of the United Nations furthering the establishment of safeguarded worldwide disarmament and in conformity with any international agreements entered into pursuant to such policies'. It should be recalled, further, that when the Statute was drafted, there was no clear understanding of what 'safeguarded' meant. It is therefore misleading to follow a narrow interpretation of the phrase 'safeguarded disarmament' in light of the present safeguards system.

The IAEA clearly has the expertise to become involved in efforts of this kind. It was active in disarmament verification in Iraq, Libya and South Africa. It was also an active participant of the Trilateral Initiative. The relevant question is not if the IAEA should get involved in the future. It is, rather, how it should get involved. There are no immediate or easy answers to this question. Therefore, further research is required to explore the IAEA's verification role within the context of disarmament.


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[2] D. Cliff, H. Elbahtimy and A. Persbo, "Verifying Warhead Dismantlement", VERTIC Research Reports 09 (2010), 10, 96-99.

[3] Weapons Evaluation and Control Bureau, "Demonstrated Destruction of Nuclear Weapons," Washington DC: US Arms Control and Disarmament Bureau, (1969), 31

[4] Weapons Evaluation and Control Bureau, "Demonstrated Destruction of Nuclear Weapons," Washington DC: US Arms Control and Disarmament Bureau, (1969), 11.

[5] Weapons Evaluation and Control Bureau, "Demonstrated Destruction of Nuclear Weapons," Washington DC: US Arms Control and Disarmament Bureau, (1969), Annex F, p. 6.

[6] Weapons Evaluation and Control Bureau, "Demonstrated Destruction of Nuclear Weapons," Washington DC: US Arms Control and Disarmament Bureau, (1969), 117

[7] Weapons Evaluation and Control Bureau, "Demonstrated Destruction of Nuclear Weapons," Washington DC: US Arms Control and Disarmament Bureau, (1969), 11.

[8] G. N. Lewis, S. Ride and J. Townsend, 'Dispelling Myths about Verification of Sea-Launched Cruise Missiles', Science, Vol. 246, No. 4931 (1989), 765

[9] D. Cliff, H. Elbahtimy and A. Persbo, "Verifying Warhead Dismantlement", VERTIC Research Reports

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[14] D. Cliff, H. Elbahtimy and A. Persbo, "Verifying Warhead Dismantlement", VERTIC Research Reports 09 (2010), p.49

[15] Norway and United Kingdom, 2010, pp. 3-5.

[16] D. Cliff, H. Elbahtimy and A. Persbo, "Verifying Warhead Dismantlement", VERTIC Research Reports 09 (2010), 67

[17] D. Cliff, H. Elbahtimy and A. Persbo, "Verifying Warhead Dismantlement", VERTIC Research Reports 09 (2010), 82-84

[18] Norway and United Kingdom, "The United Kingdom-Norway initiative: research into the verification of nuclear warhead dismantlement". Working paper, New York , (2010), 15-16

[19] Norway and United Kingdom, "The United Kingdom-Norway initiative: research into the verification of nuclear warhead dismantlement". Working paper, New York , (2010), 15

[20] D. Cliff, H. Elbahtimy and A. Persbo, "Verifying Warhead Dismantlement", VERTIC Research Reports 09 (2010), 82-84

[21] African Nuclear-Weapon-Free Zone Treaty, April 11, 1996, 35 I.L.M. 698

[22] Jan Priest, "Efforts to Establish Other Nuclear Weapons Free Zones: Africa, Middle East. Sourth Asia and South East Asia," http://www.opanal.org/Articles/Jamaica/jam-Priest.htm, accessed on 30 November 2010.